CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES

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Initial Scientific Notebook Entry for Corrosion Resistant Material Potentiostatic and Potentiodynamic Tests.

Title: Potentiaostatic tests, polarization tests, crevice repassivation tests, passive current density tests, critical pitting temperature tests, critical repassivation temperature tests.

Test Performed by: Kuang-Tsan Kenneth Chiang , Darrell Dunn , Brian k. Derby

Objective: Study the effect of Nitrate [NO_3^-] to Chloride [Cl^-] concentration ratio on corrosion resistance of candidate materials.

Equipment: EG&G Versastat Serial Number 20104. EG&G Model 352 corrosion software. NEC 586 computer. Keithley Electrometer Model 614 SN 55538 or equivalent. ASTM G-5 Polarization Cell. Large 2 L glass cells with Teflon tops. Electrochemical Impedance Spectroscopy system including Solaritron 1260 FRA and Solaritron 1287 Potentiostat. ESC 440 multichannel potentiostats with National Instruments Labview data acquisition software or Strawberry Tree data acqusition software.

Materials: Alloy C-22

Specimen Specifications: Cylindrical CPP specimens 1.195"x.250" and Crevice repassivation specimens with Teflon crevice washers attached to surface.

Measurement Parameters: Current and Potential as described in TOP-008. Temperature of solution ±2°C.

Required Level of Accuracy: Potentials ±5mV. Current less than 0.1 microamp.

Uncertainty and Source of Error: Current density calculated as current divided by sample area. Actual current density of corroding areas is not determined. Resolution limit of data acquisition systems may limit accuracy of passive current density measurements.

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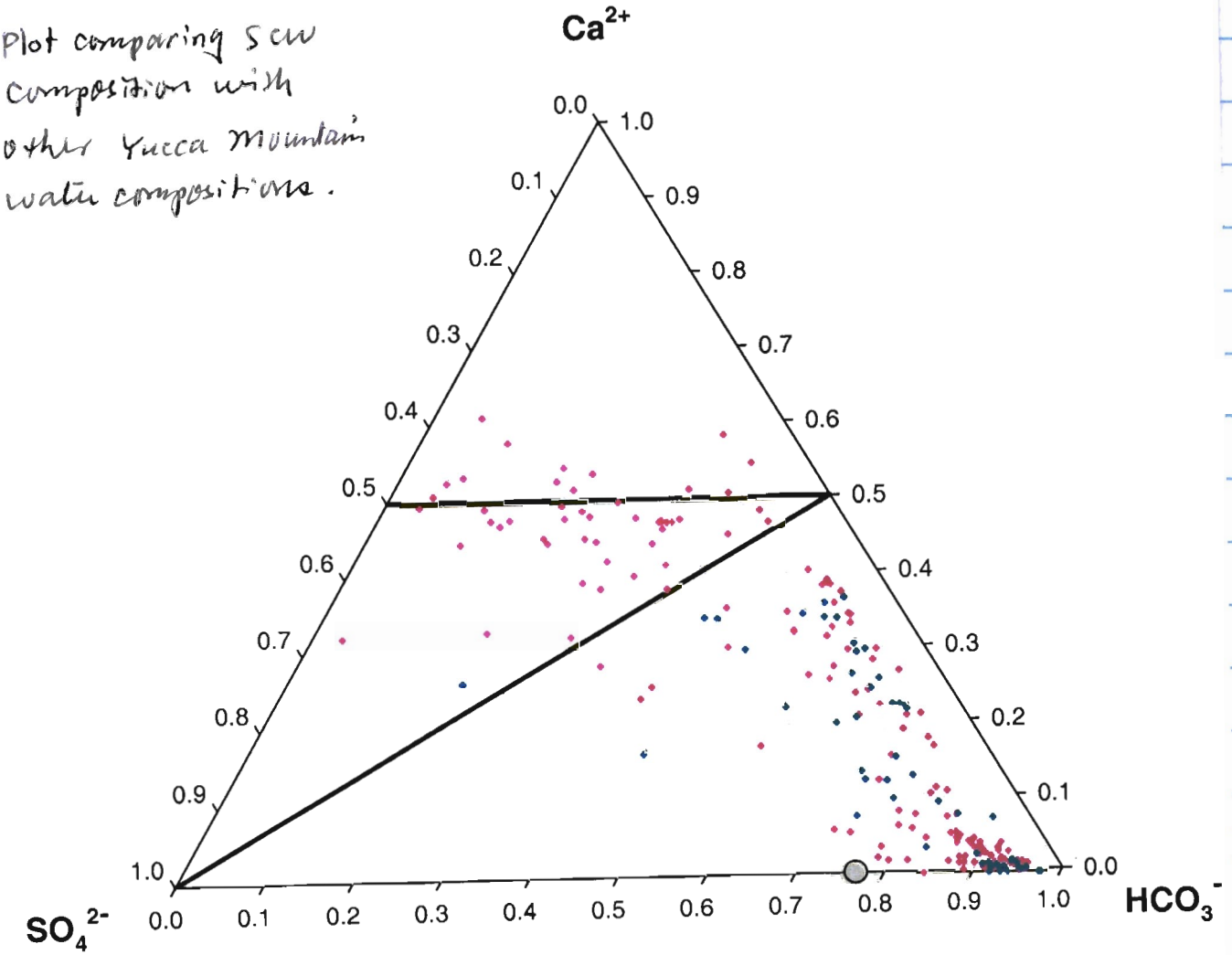
Plot comparing SCW composition with other Yucca Mountain water compositions.



Pink – Yucca Mountain unsaturated zone porewater compositions
Green – Yucca Mountain perched and saturated zone water compositions
Grey circle – Simulated Concentrated Water (DOE corrosion experiments)

Source: Robert Fabelan

Reference UCRL-ID-132286

Formulation and Make-Up of Simulated Concentrated Water, High Ionic Content Aqueous Solution

Greg Gdowski, April 4, 1997

K.T. Chiang
11-2-03

1.0 PURPOSE

This procedure describes the formulation and make-up of Simulated Concentrated Water (SCW), a high-ionic-content water to be used for Activity E-20-50 "Long-Term Corrosion Studies." This water has an ionic content which is nominally a factor of a thousand higher than that of "representative" waters at or near Yucca Mountain. "Representative" waters were chosen as J-13 well water [Harrar, 1990] and "perched" water at Yucca Mountain [Glassley, 1996] (see Table 1). J-13 well water is obtained from ground water that is in contact with the Topopah Spring tuff, which is the repository horizon rock. The "perched" water is located in the Topopah Spring tuff, but below the repository horizon and above the water table. A nominal thousand times higher ionic content was chosen to simulate the water that would result from the wetting of salts which have been previously deposited on a container surface.

The expected composition of the SCW is given in Table 1. It is anticipated that the actual composition of test solutions will be within ± 20% of these values. The changes in the corrosive properties of the test solutions will be acceptable within these values. In addition similar type materials are tested in the same test vessel, so minor vessel to vessel variation of solution composition is of limited significance.

Both of the "representative" waters have similar corrosive characteristics. The solution pH's and the concentrations of the aggressive anions (Cl^-, F^-, and SO_4^{2-}) are essentially equivalent from a corrosion stand point.

This aqueous solution is one of the four aqueous test solutions to be used in the activity. The other aqueous solutions included a Simulated Dilute Water (SDW), a simulated acidic concentrated water (SAW), and a simulated basic concentrated water (SBW).

This TIP documents the chemical reagents, reactant air, and the procedures used to make-up the aqueous solution for Activity E-20-50. More than 12,000 liters (3,170 gallons) of Simulated Concentrated Water solution are required for the test vessels for implementation of the full test matrix of the activity plan.

2.0 SCOPE

This procedure applies to the Simulated Concentrated Water solution, one of the aqueous solutions that are to be used in the test vessels for Activity E-20-50 "Long-Term Corrosion Studies."

3.0 RESPONSIBILITIES

The Principal Investigator (PI) or designee is responsible for:

- the conduct of the activities and methods described in this procedure, and
- maintaining laboratory scientific notebooks.

The Task Area Leader (TAL) is responsible for:

- ensuring that the requirements of this procedure are implemented,
- ensuring that personnel conducting the work are qualified and are trained to this procedure,
- verifying that this procedure meets the objectives of the Scientific Investigation Plan (SIP) "Metal Barrier Selection and Testing" (SIP-CM-01, Rev.3, WBS # 1.2.2.5.1) and Activity E-20-50 "Long-Term Corrosion Studies", and
- ensuring approval of this procedure.

The YMP Quality Assurance Manager (QA Manager) is responsible for:

- monitoring the work to assure proper implementation of this procedure, and
- assuring its continued effectiveness.

Simulated Concentrated Water (SCW)

Simulated Dilute Water (SDW)

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SCW Composition

4.0 COMPOSITION OF SCW AND REACTANT AIR

4.1 Aqueous Solution Composition

The Simulated Concentrated Water (SCW) has a ionic composition that is nominally a factor of a thousand higher than that of "representative" water of Yucca Mountain. "Representative" waters were chosen J-13 well water [Harrar, 1990] and "perched" water at Yucca Mountain [Glassley, 1996]. J-13 well water is obtained from ground water that is in contact with the Topopah Spring tuff, which is the repository horizon rock. The "perched" water is located in the Topopah Spring tuff, but below the repository horizon and above the water table. The thousand times higher ionic content was chosen to simulate the water that may result from wetting of salts and minerals that have been deposited on the container surfaces.

The composition of J-13 well water and the "perched" water are given in Table 1. Only ions with concentration greater than 0.5 ppm are included in this table. Minor constituents have been detected in J-13 well water; these include Li, B, Al, Mn, Fe, Sr, and PO_4^{3-} ions. These constituents have been reported in the 10-100 µg/liter concentration. The most consistently determined minor constituents are Li and B at mean (several studies) concentrations of 48 and 134 µg/liter, respectively. The minor constituents are not explicitly included in the SCW. However, the reagent chemicals have some impurites, which may include the above noted impurities. **The minor constituents at the reported concentrations are not expected to significantly effect the corrosion of the test specimens.**

It is worth noting the differences in the "representative" waters. In terms of the calcium and bicarbonate concentrations, the "perched" water is higher in both of these constituents, and has a higher pH; these both are probably due to contact with calcium carbonate ($CaCO_3$) minerals. The concentrations of Na^+, K^+, F^-, and NO_3^- are slightly higher in J-13 well water.

Table 1. Compositions of "representative" Yucca Mountain waters J-13 well water and "perched" water, and the estimated composition of the simulated concentrated water.

Constituent	J-13 (mg/l) (mg/l)	"Perched" (mg/l)	Simulated Concentrated Water (estimated)
Na	45.80	36	40,900
Si	28.5	37	27 (60C); 49 (90C)
Ca	13.0	25	< 1
K	5.04	1.7	3,400
Mg	2.01	2.2	< 1
F^-	2.18	0.7	1,400
Cl^-	7.14	6.3	6,700
NO_3^-	8.78	4	6,400
SO_4^{2-}	18.4	15	16,700
HCO_3^-	128.9	147	70,000
$CaCO_3$	—	—	47,500 (precipitate)
$MgCO_3$			7,300 (precipitate)
pH	7.41	8.1	

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The following paragraphs explain the reasoning used to arrive at the composition and formulation of the SCW. The silica content is based on solubility of α- cristobalite which is believed to be the dominant soluble silica phase of Yucca Mountain rock at 60 and 90°C [Wolery, 1983; Knauss, 1987]. Silica may be added to the solution by dissolution of sodium silicate. The salts, in general, are concentrated by a factor of a thousand over an "average" of the "representative" Yucca Mountain waters. The exceptions are calcium (Ca^{2+}), magnesium (Mg^{2+}), and bicarbonate (HCO_3^-), which are all at lower concentration.

Previous studies have indicated that extensive concentrating of water with relative ionic concentrations like those of the "representative" water (high bicarbonate) results in the precipitation of calcium and magnesium carbonates and silica-base minerals [Drever, 1982]. Calcite ($CaCO_3$) will precipitate first, with some magnesite ($MgCO_3$) co-precipitating in the calcite. The remaining magnesium will precipitate in silica-based minerals.

Simulations of concentrating the "representative" waters were run using the computer program "Geochemist's Workbend, Release 2.2" [Bethke, 1994]. The results generated were in agreement with the qualitative predictions based on the general solution composition. All of the calcium and magnesium was effectively precipitated during concentrating of the solution; a few ppm of each remained in solution.

The estimated composition of the SCW is given in Table 1. It is expected that the actual composition of test solutions will be within ± 20% of these values. The changes in the corrosive properties of the test solutions within these values will not be significant. In addition similar type materials are tested in the same test vessel, so minor vessel-to-vessel variation of solution composition is of limited significance.

4.2 Reactant Air

Reactant air is compressed building air which has been purified to remove hydrocarbons and water. Air will be purified by flowing through a Whatman Zero Air Generator (see Section 6.0). Nominal flow rates through each test vessel will be 200 ml/min. Air will exit through a condenser to remove water; this greatly reduces the amount of water loss from the test vessels.

Reactant air serves two purposes: 1) it keeps the oxygen content of the vessels constant, and 2) the slightly pressurized test vessel will keep the potentially contaminated room air out of the test vessels.

5.0 REAGENTS AND FORMULATION

5.1 Reagent Chemicals

In order to obtain the solution composition given in Table 1, various combinations of chemicals can be used. A spreadsheet has been developed which calculates the composition of a solution based on the added chemicals. **Copies** of typical outputs of the spreadsheets **are** shown in Appendix A **for 60 and 90°C solutions; the amount of silica changes with temperature.** Many of the chemicals listed in the spreadsheet are not used in this particular example. The inclusion of numerous chemicals in the spreadsheet allows the user the freedom to choose the needed chemicals based on availability, cost, and personal preference.

The algorithm to arrive at reagent concentrations was a trial and error method. The quantities of reagents required was estimated, and the spreadsheet calculated the total ionic content of the theoretical solution. Iteration was continued until an acceptable match was achieved.

A few guidelines were used in choosing the reagents. The choices for bicarbonate ions **were** $NaHCO_3$ **or** $KHCO_3$, since **these are** the common commercial source of bicarbonate. The use of potentially hazardous materials such as HF, MgF_2, and CaF_2 was avoided. The more soluble salts (minerals) were chosen, for example, magnesium sulfate was chosen over the less soluble carbonate and nitrate salts.

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Also solution silica will be obtained by the addition of sodium silicate. (Calculations showed that dissolution of solid silica phases would take extended periods of time (>1000 days) in order for sufficient amounts of silica to dissolve.) Note using sodium silicate will result in slightly elevated sodium concentrations.

Using sodium silicate will result in the formation of hydroxyls equal to the number of moles of sodium atoms added. **In order to neutralize the hydroxyls, an equal number of moles of acid (hydrochloric, nitric, or sulfuric) will be added.**

Since a large percentage of both the calcium and magnesium will form carbonate precipitates, it was not necessary to add soluble salts of these ions to the level of the concentrating. However excess of these ions will be added such that precipitates of calcite and magnesite will form.

A word of caution in using the spreadsheet: the calculations assume that the chemicals dissolve completely and may therefore over estimate the composition of some species. The user must therefore be aware of potential solubility problems. A listing of the solubilities of various chemical is shown in Appendix B.

A typical example of chemicals used to make-up of the aqueous solution are listed in Table 2 along with the quantities required per 1000 l of solution.

Table 2. An example of the reagents and quantites required per 1000 liters of simulated aqueous solution.

Reagent	Quantity @ 60°C (gms / 1000 liters)	**Qualtity @ 90°C (gms / 1000 liters)**
$NaHCO_3$	**128,450.0**	**128,297.0**
NaF	**3,182.6**	**3,182.6**
Na_2SO_4	**12,236.4**	**12,254.5**
$Na_2SiO_3 \cdot 5H_2O$	**204.0**	**370.0**
$MgSO_4 \cdot 7H_2O$	**21,392.0**	**21,392.0**
$CaCl_2 \cdot 2H_2O$	**7,598.0**	**7,598.0**
$Ca(NO_3)_2 \cdot 4H_2O$	**12,168.5**	**12,168.5**
HCl	**3.73**	**70.1**
KCl	**6,417.8**	**6,282.0**
$KHCO_3$	**10.4**	**192.5**
$CaCO_3$	**37,117.3**	**37,117.3**
H_2SO_4	**89.3**	**76.79**

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The chemicals and the quantities used in making up the test solutions will be listed in the Scientific Notebook or electronic media.

5.2 Purified Water

The make up of the test solutions requires large quantities of low ionic content water is required. The use of LLNL de-ionized water is acceptable. This water has an ionic content typically less than 1 ppm. This is less than 0.001% of the ionic content due to the added chemicals. The source of the water used in testing will be recorded in the scientific notebook.

5.3 Reactant Gas

The reactant air will be purified before entering the test vessels.

6.0 EQUIPMENT

A balance that can measure to 0.1 grams is acceptable for make-up of the test solutions. An acceptable balance is:

Mettler Balance Model # AT200
Serial Number 1114463500

Mettler Balance Model # PC16
Serial Number A51361

An air purifier for cleaning the building compressed air is required. The following unit or equivalent is acceptable:

Whatmann Type 76-818NA Zero Air Generator
Unit Serial Number 768180065B
Tower Module Serial Number 76811-10116B

This air purifier removes hydrocarbon to 0.1 ppm.

7.0 PROCEDURE

The following procedure will be followed in making-up of the Simulated Concentrated Water solutions for the test vessels:

1) Purified water is emplaced in the cleaned vessel; the liquid level is slightly less than the required depth for testing. (Need to account for rise in water level due to the specimens and racks, and the density decrease due to raising the water temperature to the test temperature.)

2) The amount of purified water added to the test vessels is estimated.

3) The required amounts of reagent chemicals is determined and entered in the scientific notebook or electronic media.

4) The purified water is heated to a nominal temperature of 40°C. This will accelerate reactions that occur in solution.

5) The water will be stirred. The stirrer mounted on the vessel is sufficient.

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6) **Add chemicals to water. No particular order is required for chemical additions except that sulfuric acid will be the last chemical added to the test vessel.**

7) **Concentrated sulfuric acid shall be diluted 500-1000 times the required volume using deionized water and then added to the test vessel.**

8) **The vessel is sealed and brought to testing temperature for at least 24 hours.**

9) **The specimen racks are inserted into test vessel.**

10) **A sample of the test solution is withdrawn for analysis approximately a day after the level of water reaches the normal operation set point.**

Note: The liquid level in the test vessels will self-adjust to the required level. If the liquid level is low, the liquid level control system will add purified water. If the liquid level is high, water removal by the air purge will occur; this may be slow but it will occur. It is preferred to add water rather than to remove water, since the control system shuts down the heaters when the liquid level is above a certain height.

8.0 QA RECORDS

Any data that is pertinent to this TIP shall be entered into the Scientific Notebook or electronic media for Activity E-20-50. This shall include, but is not be limited to the chemical used lot # manufacturer supplied analysis, and actual reagent chemical amounts used for make-up.

9.0 REFERENCES

C.M. Bethke, The Geochemist's Workbench, Version 2.0; A Users Guide to Rxn, Tact, React, and Gtplot, Hydrogeology Program, University of Illinois, 1994.

J.I. Drever, The Geochemistry of Natural Waters, Prentice-Hall, Inc., Englewood Cliffs, NJ, 1982.

W. Glassley, private communication, 1996.

J.E. Harrar, J.F. Carley, W.F. Isherwood, and E. Raber, "Report of the Committee to review the Use of J-13 Well Water in Nevada Nuclear Waste Storage Investigations," Lawrence Livermore National Laboratory report UCID-21867, Livermore California, January 1990.

K.G. Knauss, W.J. Beiriger, D.W. Peifer, "Hydrothermal Interaction of Solic Wafers of Topopah Spring Tuff with J-13 Water at 90 and 150°C Using Dickson-Type, Gold-Bag Rocking Autoclaves: Long-Term Experiments," Lawrence Livermore National Laboratory Report UCRL-53722, May 1987.

T.J. Wolery, Memo GCC-83-3/1773w, "Summary of Silica Solubilty Data for Acid-to-Neutral pH Conditions," 16 Nov. 1983.

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Compound	Mol Wt.	gms/ 1000 l	K	Na	Mg	Ca	Cl	F	HCO3	CO3	SO4	NO3	SiO3	H
NaCl	58.44	0.0		0.0			0.0							
NaOH	40.00	0.0		0.0										
NaHCO3	84.01	128450.0		35152.3					93297.7					
Na2CO3	105.99	0.0		0.0						0.0				
Na2SO4	142.04	12236.4		3961.0							8275.4			
NaNO3	84.99	0.0		0.0								0.0		
Na2CO3	105.99	0.0		0.0						0.0				
NaF	41.99	3182.6		1742.6				1440.0						
Na2SiO3•9H2O	284.20	0.0		0.0									0.0	
Na2SiO3•5H2O	212.14	204.0		44.2									73.2	
MgCl2•6H2O	203.31	0.0			0.0		0.0							
MgF2	62.31	0.0			0.0			0.0						
MgSO4	120.37	0.0			0.0						0.0			
MgSO4•7H2O	246.48	21392.0			2110.0						8337.2			
Mg(NO3)2•6H2O	256.41	0.0			0.0							0.0		
CaCl2	110.99	0.0				0.0	0.0							
CaCl2•2H2O	147.02	7598.0				2071.4	3664.5							
CaF2	78.08	0.0				0.0		0.0						
CaCO3	100.09	37117.3				14863.3				22254.0				
CaSO4	136.14	0.0				0.0					0.0			
CaSO4•2H2O	172.17	0.0				0.0					0.0			
Ca(NO3)2•4H2O	236.15	12168.5				2065.3						6390.0		
CaCO3MgCO3	184.41	0.0			0.0	0.0				0.0				
H2SO4	98.08	89.3000									87.5			1.8355
HCl	36.46	3.7280					3.6							0.1031
HNO3	63.01	0.0										0.0		0.0000
KF•2H2O	94.13	0.0	0.0					0.0						
KCl	74.56	6417.8	3366.0				3051.8							
K2SO4	174.27	0.0	0.0								0.0			
KNO3	101.11	0.0	0.0									0.0		
KHCO3	100.12	10.4	4.1						6.3					
K2CO3	138.21	0.0	0.0							0.0				
KOH	56.11	0.0	0.0											
													73.2	
Totals			3370.0	40900.0	2110.0	19000.0	6720.0	1440.0	93304.1	44507.9	16700.0	6390.0	27.0	1.9386
Target			3370.0	40900.0	2110.0	19000.0	6720.0	1440.0	137950.0		16700.0	6390.0	27 (Si)	1.9386
										137812				
						[HCO3] + [CO3] + [OH] = 1379.5								

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Compound	Mol Wt.	gms/ 1000 l	K	Na	Mg	Ca	Cl	F	HCO3	CO3	SO4	NO3	SiO3	H
NaCl	58.44	0.0		0.0			0.0							
NaOH	40.00	0.0		0.0										
NaHCO3	84.01	128297.0		35110.4					93186.6					
Na2CO3	105.99	0.0		0.0						0.0				
Na2SO4	142.04	12254.5		3966.9							8287.6			
NaNO3	84.99	0.0		0.0								0.0		
Na2CO3	105.99	0.0		0.0						0.0				
NaF	41.99	3182.6		1742.6				1440.0						
Na2SiO3•9H2O	284.20	0.0		0.0									0.0	
Na2SiO3•5H2O	212.14	370.0		80.2									132.7	
MgCl2•6H2O	203.31	0.0			0.0		0.0							
MgF2	62.31	0.0			0.0			0.0						
(MgCO3)4•Mg(	485.69	0.0			0.0					0.0				
MgSO4	120.37	0.0			0.0						0.0			
MgSO4•7H2O	246.48	21392.0			2110.0						8337.2			
Mg(NO3)2•6H2	256.41	0.0			0.0							0.0		
CaCl2	110.99	0.0				0.0	0.0							
CaCl2•2H2O	147.02	7598.0				2071.4	3664.5							
CaF2	78.08	0.0				0.0		0.0						
CaCO3	100.09	37117.3				14863.3				22254.0				
CaSO4	136.14	0.0				0.0					0.0			
CaSO4•2H2O	172.17	0.0				0.0					0.0			
Ca(NO3)2•4H2(	236.15	12168.5				2065.3						6390.0		
CaCO3MgCO3	184.41	0.0			0.0	0.0				0.0				
H2SO4	98.08	76.790									75.2			1.578
HCl	36.46	70.100					68.2							1.938
HNO3	63.01	0.0										0.0		0.000
KF•2H2O	94.13	0.0	0.0					0.0						
KCl	74.56	6282.2	3294.8				2987.4							
K2SO4	174.27	0.0	0.0								0.0			
KNO3	101.11	0.0	0.0									0.0		
KHCO3	100.12	192.5	75.2						117.3					
K2CO3	138.21	0.0	0.0							0.0				
KOH	56.11	0.0	0.0											
													132.7	
Totals			3370.0	40900.0	2110.0	19000.0	6720.0	1440.0	93303.9	44507.9	16700.0	6390.0	49.0	3.516
Target			3370.0	40900.0	2110.0	19000.0	6720.0	1440.0	137950.0		16700.0	6390.0	49 (Si)	3.516
										137812				
						[HCO3] + [CO3] + [OH] = 1379.5								

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Appendix B. Solubilites in Water

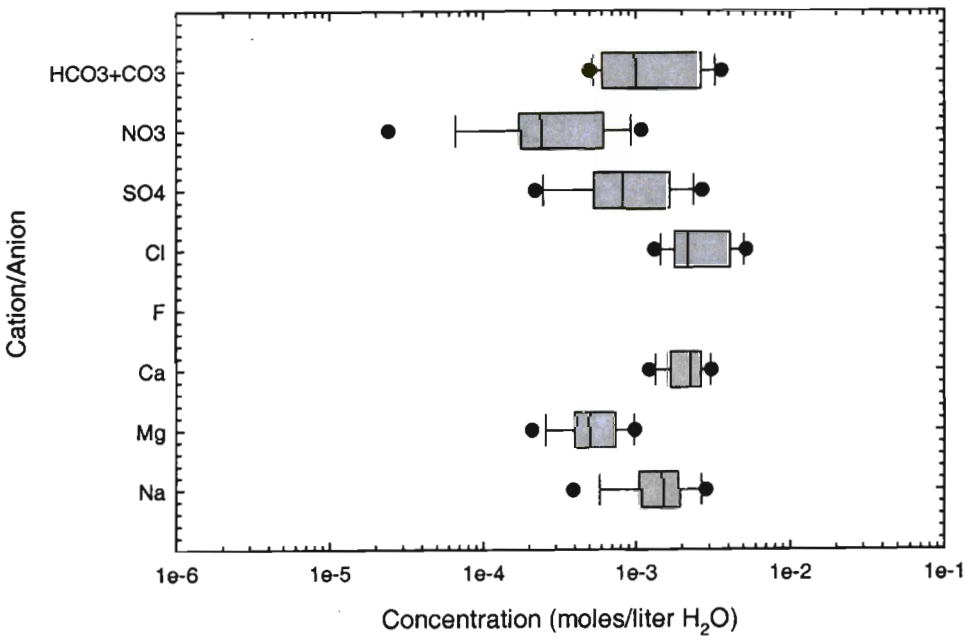
Compound	Formula		Mol Wt.	Solubility	Solubiliy	T(°C)	Solubility	Solubiliy	T(°C)
				gms/100cc	mg / l		gms/100cc	mg/l	
Calcium sulfate	CaSO4	nat anhydrite	136.14	0.2090	2090	30	0.1619	1619	100
Calsium sulfate dihydrate	CaSO4•H20	nat gypsum	172.17	0.2410	2410		0.222	2220	100
Calcium nitrate	Ca(NO3)2		164.09	121.2000	1E+06	18	376	3760000	100
Calcium Chloride	CaCl2		110.99	74.5000	745000	20	159	1590000	100
Calcium Flouride	CaF2	nat flouride	78.08	0.0016	16	18	0.0017	17	26
Calcium Carbonate	CaCO3	calcite	100.09	0.0014	14	25	0.0018	18	75
Calcium hydroxide	Ca(OH)2		74.09	0.1850	1850	0	0.077	770	100
Sodium sulfate	Na2SO4	nat thenardite	142.04	4.7600	47600	0	42.7	427000	100
Sodium nitrate	NaNO3	soda niter	84.99	92.1000	921000	25	180	1800000	100
Sodium Chloride	NaCl	halite	58.44	35.7000	357000	0	39.12	391200	100
Sodium Flouride	NaF	nat villiaumite	41.99	4.2200	42200	18		0	
Sodium carbonate	Na2CO3		105.99	7.1000	71000	0	45.5	455000	100
Sodium Bicarbonate	NaHCO3		84	6.9000	69000	0	16.4	164000	60
Sodium hydroxide	NaOH		40	42.0000	420000	0	347	3470000	100
Sodium Silicate	Na2SiO3	metasilicate	122.06	soluble		-	soluble; dissolves		-
Magnesium sulfate	MgSO4		120.37	26.0000	260000	0	73.8	738000	100
Magnesium nitrate	Mg(NO3)2•6H2O		256.41	124.0000	-1E+06		vs		
Magnesium chloride	MgCl2		95.22	54.2500	542500	20	72.7	727000	100
Magnesium flouride	MgF2	nat sellaite	62.31	0.0076	76	18	i		
Magnesium carbonate	MgCO3	nat magnesite	84.32	0.0106	106			0	
Magnesium carbonate trihydrate	3MgCO3•Mg(OH)	nat hydromag	365.34	0.0400	400		0.011	110	
Magnesium carbonate basic	MgCO3•3H2O	nat nesqueho	138.37	0.179	1790	16	d		
Magnesium hydroxide	Mg(OH)2	nat brucite	58.33	0.0009	9	18	0.004	40	100
Potassium sulfate	K2SO4	nat arcanite	174.27	12	120000	25	24.1	241000	100
Potassium sulfate, hydrogen	KHSO4	nat mercallite	136.17	36.3	363000	0	121.6	1216000	100
Potassium nitrate	KNO3	saltpeter	101.11	13.3	133000	0	247	2470000	100
Potassium chloride	KCl	nat sylvite	74.56	23.8	238000	20	56.7	567000	100
Potassium flouride	KF		58.1	92.3	923000	18	vs		
Potassium carbonate	K2CO3		138.21	112	1E+06	20	156	1560000	100
Potassium Carbonate, hydrogen	KHCO3		100.12	22.4	224000		60	600000	60
Potasssium Hydroxide	KOH		56.11	107	1E+06	15	178	1780000	100

Source: CRC Handbook of Chemistry and Physics, R.C. Weast, M.J. Astle, eds., CRC Press, Inc., Boca Raton, FL, 1981.

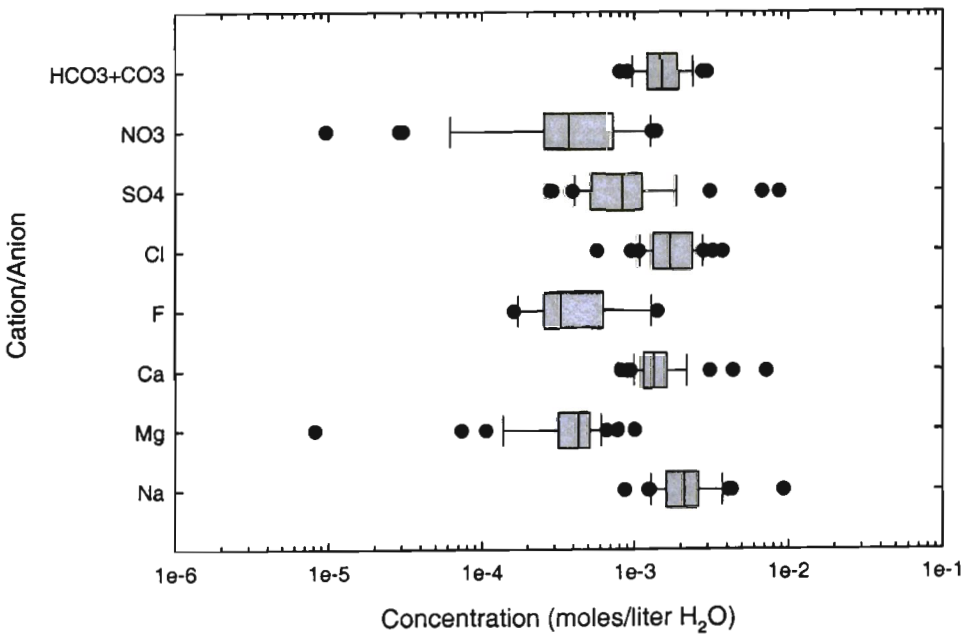
K.T. Cheng 11-02-03

Discussions: Darrel Dunn, Bobby Pabalan. Ken Chiang Tues 10/28/03 1pm

Yucca Mountain Ca-Cl-Type Unsaturated Zone Waters
(Yang et al., 1996, 1998, 2003)



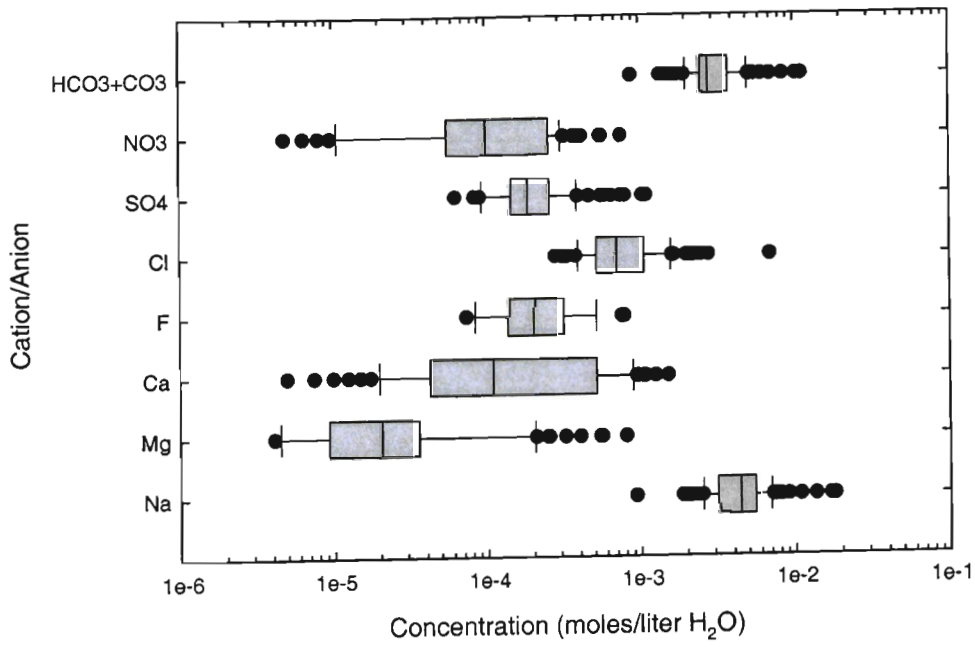
Yucca Mountain Neutral-Type Unsaturated Zone Waters
(Yang et al., 1996, 1998, 2003)

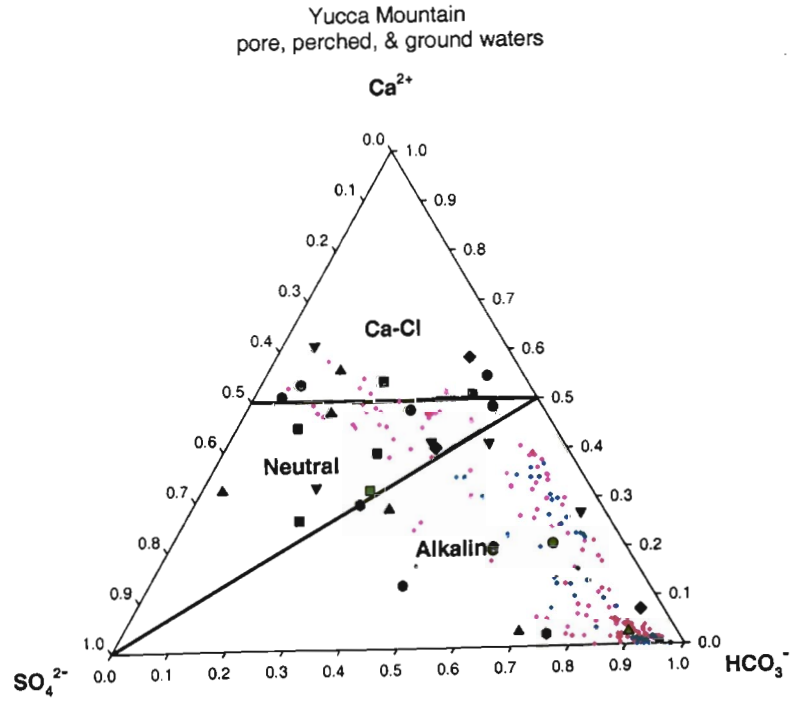


K. J. Chiang
11/2/03

Discussion D. Dunn, R. Pabalan, Ken Chiang 10/28/03 1pm-3pm

Yucca Mountain Alkaline-Type Unsaturated Zone Waters
(Yang et al., 1996, 1998, 2003)





unsaturated zone porewater (pink)
perched and saturated zone water (dark green)
compositions used in evaporation simulation (light green)

K. J. Chiang
11-2-03

24 Cylindrical Specimens machined to the following drawing dimensions.

78668

Darrell S. Dunn
SwRI-CNWRA
Phone: (210) 522-6090
Fax: (210) 522-5184

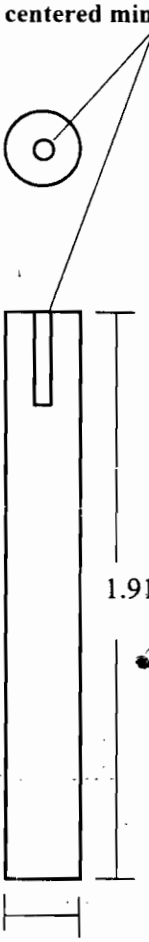
N-T-C

92 R-3

Cylindrical Test Specimen

CNWRA Drawing 20.01402.571.019

#5-40 thread centered minimum 0.250" deep



1.915" ± 0.005"

0.250" ± 0.003"

This information is to be completed at time of fabrication

Material: C-22 Alloy

Heat #: 2277-3-3266

Specimen Orientation: Specimens Need To Be perpendicular To Roll

Other: Quanity = 24 Specimens

Procedure IQS-WI-827.3

Project #

LOCATION CC3

TOTAL PCS. INSPECTED 6 of 24 J.C. # 78668

TOTAL PCS. ACCEPTED 6

TOTAL PCS. REJECTED 0

"NR #" IF REJECTS NA

EQUIPMENT Mic 2191790 Cal 30 Dec-3 Thd Gage

INSPECTOR

DATE NOV -3 2003

Darrell S. Dunn 10/15/01
Initiated by. D. Dunn Date

Mark R. Shaw for 10/15/01
QA Approval B. Mabrito Date

10/15/01
Reviewed by V. Jain Date

K.T. Chiang 11/10/03

Kuang-Tsan Ken Chiang

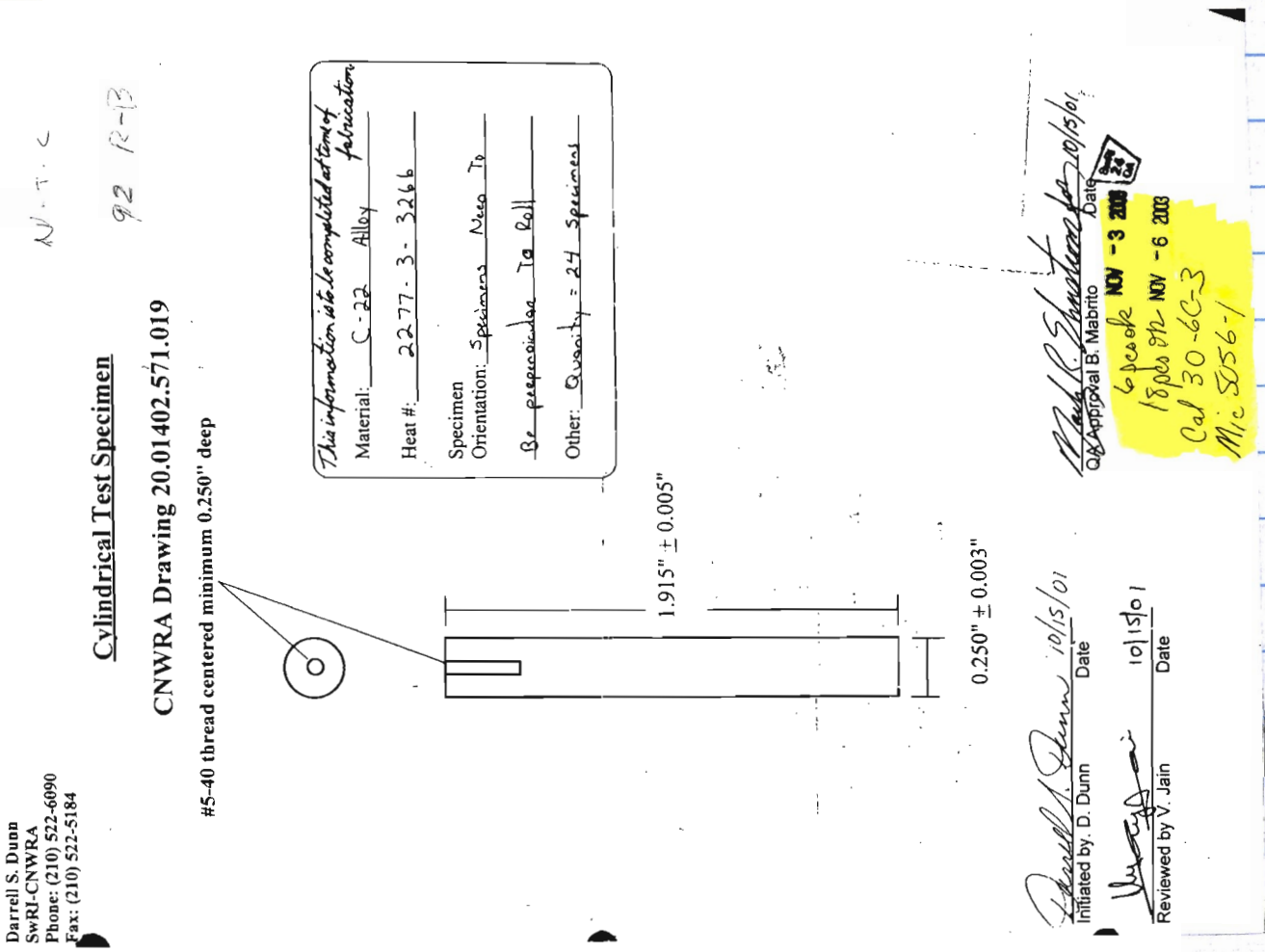
From: Walter Smithson [walter.smithson@swri.org]
Sent: Monday, November 03, 2003 1:26 PM
To: Kuang-Tsan K Chiang; Darrell S Dunn
Cc: Brian K Derby
Subject: CYL. TEST SPECIMENS C-22 ALLOY

6PCS. OF 24PCS. COMPLETE

Kuang-Tsan Ken Chiang

From: Walter Smithson [walter.smithson@swri.org]
Sent: Thursday, November 06, 2003 11:27 AM
To: Kuang-Tsan K Chiang; Darrell S Dunn
Cc: Brian K Derby
Subject: cyl. test specimen

final 18pcs. of 24 complete at ms



K.T. Chiang 11/10/03 KTC 11/10/03

POTENTIODYNAMIC TEST

Objective: see page #5

Specimen: C22 Cylinder Heat# ~~2277-8-3266~~ 2277-3-3266 BMO 4/27/06 **CNWRA Drawing 20.01402.571.019 polished to a 600 grit finish**

Initial Weight:	12.54034g	**Model:** Sartorius Genius	**SN:** 12809099
Final Weight:	12.53842g	**Cal:** 5/15/03	**Due:** 11/15/03

SOLUTION: Simulated Concentrated H_2O

12.966g	KCl	Lot# 006242	Na_2SO_4	41.41g	Lot# 025157
10.870g	NaCl	Lot# 034103	$NaHCO_3$	192.79g	Lot# 025418
17.503g	$NaNO_3$	Lot# 020809	NaF	6.153g	Lot# 99055

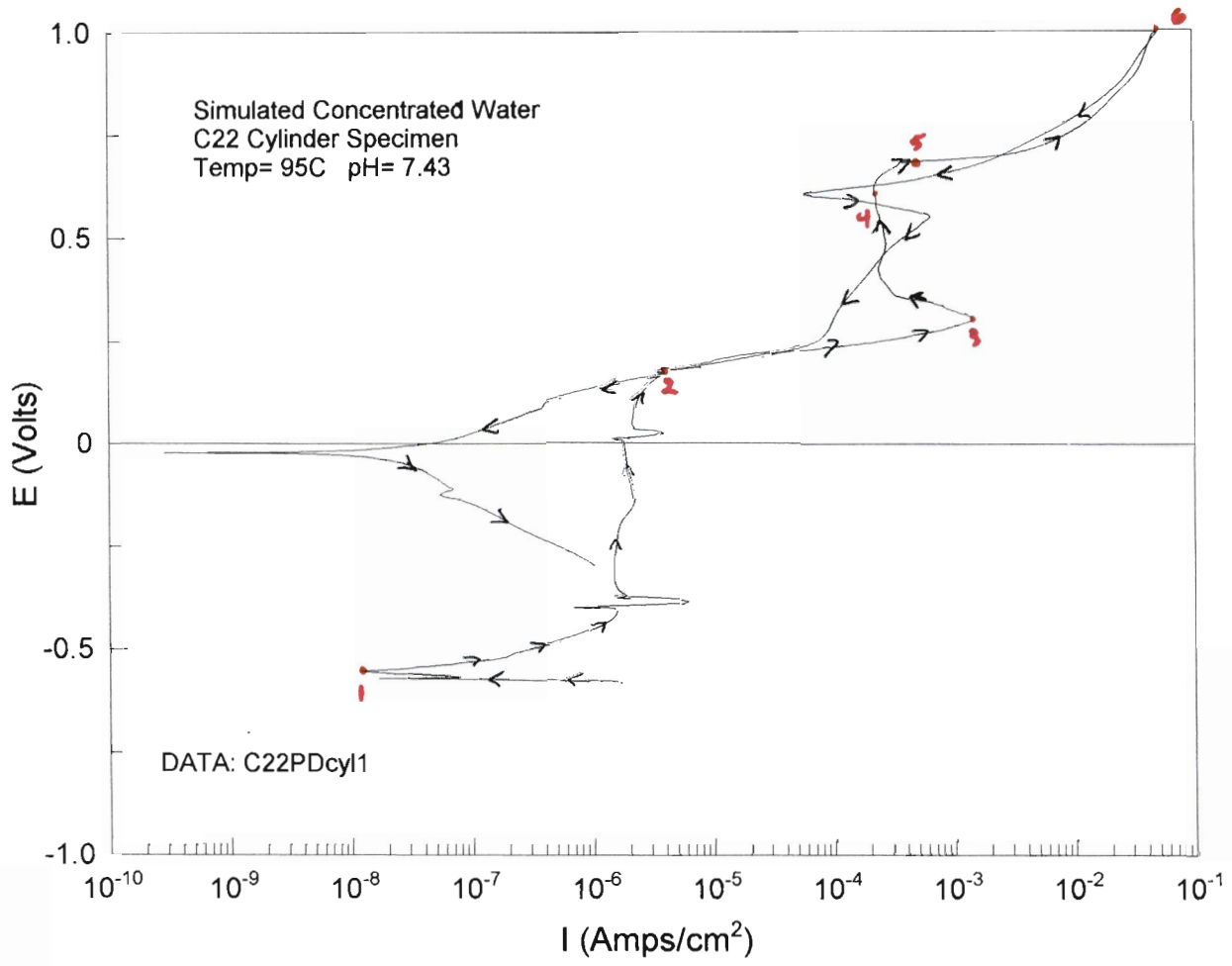
+ DI water To 2000mls

Reagents measured with	**Model:** OHAUS	**SN:** 2883	9/11/03
	Cal: 7/29/03	**Due:** 1/29/~~03~~ 04	
Initial pH: 7.43	**Model:** Fisher Accumet 950 Meter	**SN:** 3340	
Final pH: 8.89	**Cal:** 8/11/03	**Due:** 8/11/04	
	pH Probe: #13-620-296	**SN:** 2291257P6	
TEST TEMPERATURE: 95°C	**Measured with Hg Thermometer SN:**	C96-377	
	Cal: 7/15/03	**Due:** 1/15/04	
Counter Electrode: Platinum Flag			
Reference Electrode: Fisher SCE	13-620-52	**SN:** 0251439	
Gas: 99.999% Nitrogen			
Ecorr: -468 mv	**Model:** Keithley 614	**SN:** 0704934	
Ept: -221 mv	**Cal:** 6/09/03	**Due:** 6/09/04	
Eapplied (vs SCE): none			
Potentiostat: Solartron 1480	**SN#** 00240551		

Specimen Examination: No visual sign of Corrosion or Pitting Surface Has Dull tint staining - Except Area In Vapor phase of cell

Data: C22PDcyl1

11/11/03



	Potential	Current
1	-0.551	1.2187×10^{-8}
2	0.159	3.3373×10^{-6}
3	0.297	0.0013905
4	0.626	0.00022667
5	0.683	0.0047025
6	0.995	0.0487

11/12/03

POTENTIODYNAMIC TEST

Objective: see page #5

Specimen: C22 Cylinder Heat# ~~2277-8-3266~~ 2277-3-3266 CNWRA Drawing 20.01402.571.019 polished to a 600 grit finish 6/27/04

Initial Weight: 12.17976g **Final Weight:** 12.17927g
Model: Sartorius Genius **Cal:** 5/15/03 **SN:** 12809099 **Due:** 11/15/03

SOLUTION: Simulated Concentrated H_2O minus NO_3

12.970g KCl Lot# 086242
10.894g NaCl Lot# 034103
41.40g Na_2SO_4 Lot# 025157
192.83g $NaHCO_3$ Lot# 025478
6.196g NaF Lot# 991559

Reagents measured with **Model:** OHAUS **Cal:** 7/29/03 **SN:** 2883 **Due:** 1/29/~~03~~ 04 1/12/04

Initial pH: 7.78 **Final pH:** 9.01
Model: Fisher Accumet 950 Meter **Cal:** 8/11/03 **pH Probe:** #13-620-296 **SN:** 3340 **Due:** 8/11/04 **SN:** 2291257P6

TEST TEMPERATURE: 95°C **Measured with Hg Thermometer SN:** C96-377 **Cal:** 7/15/03 **Due:** 1/15/04

Counter Electrode: Platinum Flag

Reference Electrode: Fisher SCE 13-620-52 **SN:** 0251439

Gas: 99.999% Nitrogen

Ecorr: -673mv **Ept:** -227mv
Model: Keithley 614 **Cal:** 6/09/03 **SN:** 0704934 **Due:** 6/09/04

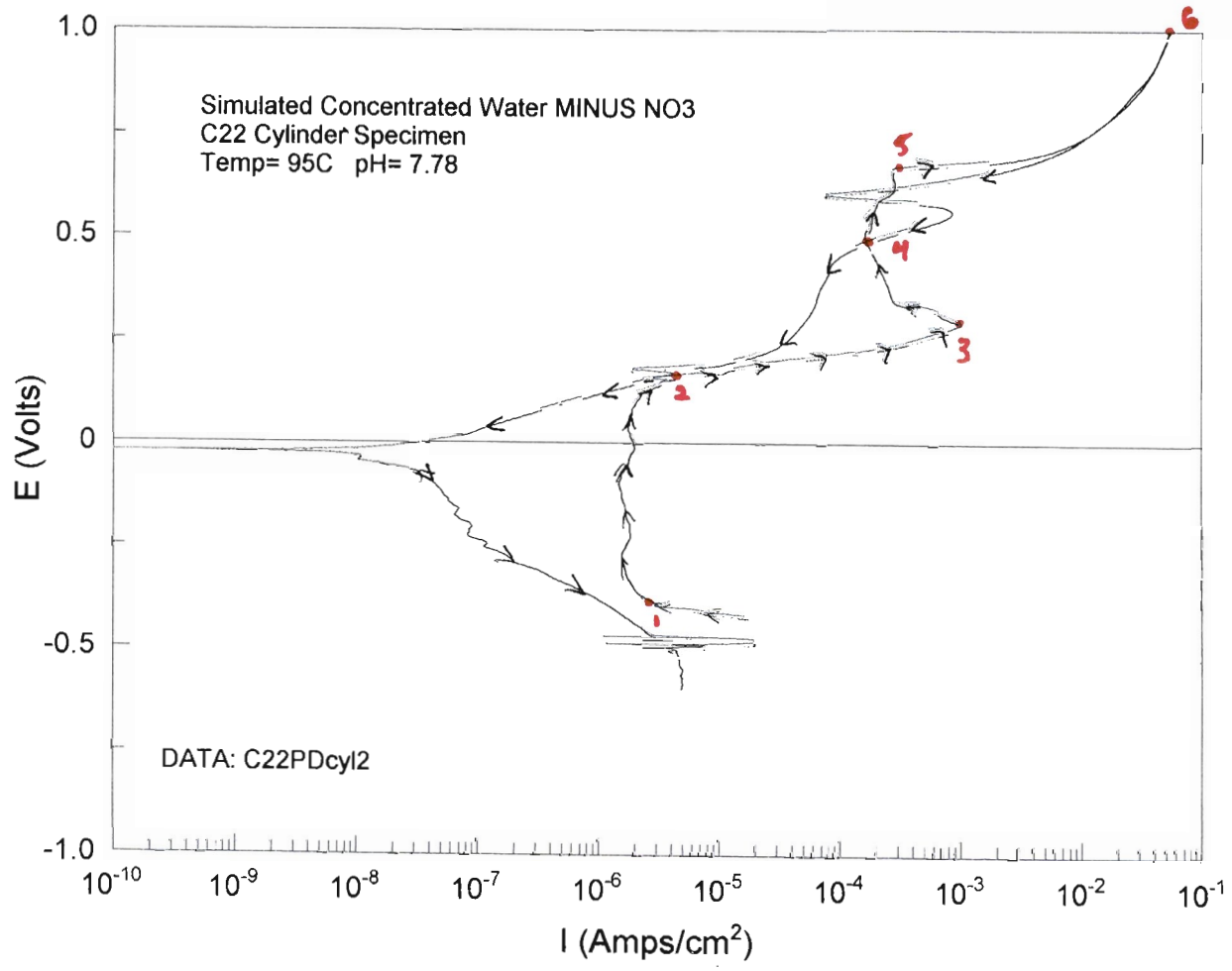
Eapplied (vs SCE): none

Potentiostat: Solartron 1480 **SN#** 00240551

Specimen Examination: No visual signs of Corrosion/Pitting Surface Has A Dull Tint staining - Area In Vapor phase of Cell look great No staining

* Note: Simulated Concentrated H_2O was minus NO_3

Data C22PD04/2 11/12/03



	Potential	Current
1	-0.400	3.1727×10^{-6}
2	0.166	8.971×10^{-6}
3	0.280	0.00098319
4	0.488	0.0001651
5	0.662	0.00030346
6	0.995	0.052418

11/6/03

POTENTIODYNAMIC TEST

Objective: see page #5

Specimen: C22 Cylinder Heat# ~~2277-8-3266~~ 2277-3-3266 BJD 6/27/01 **CNWRA Drawing 20.01402.571.019 polished to a 600 grit finish**

Initial Weight: 12.29263g **Model:** Sartorius Genius **SN:** 12809099
Final Weight: 12.29102g **Cal:** 5/15/03 **Due:** 11/15/03

SOLUTION: Simulated Concentrated Water minus Na_2SO_4
12.962g KCl Lot # 006242 192.73 g $NaHCO_3$ Lot # 024924
10.872g NaCl Lot # 034103 6.20g NaF Lot # 991559
17.507g $NaNO_3$ Lot # 020809
+ DI water To 2000 mls

Reagents measured with **Model:** OHAUS **SN:** 2883
Cal: 7/29/03 **Due:** 1/29/~~03~~04 BKP 11/14/03

Initial pH: 7.76 **Model:** Fisher Accumet 950 Meter **SN:** 3340
Final pH: 9.16 **Cal:** 8/11/03 **Due:** 8/11/04
pH Probe: #13-620-296 **SN:** 2291257P6

TEST TEMPERATURE: 95°C **Measured with Hg Thermometer SN:** C96-377
Cal: 7/15/03 **Due:** 1/15/04

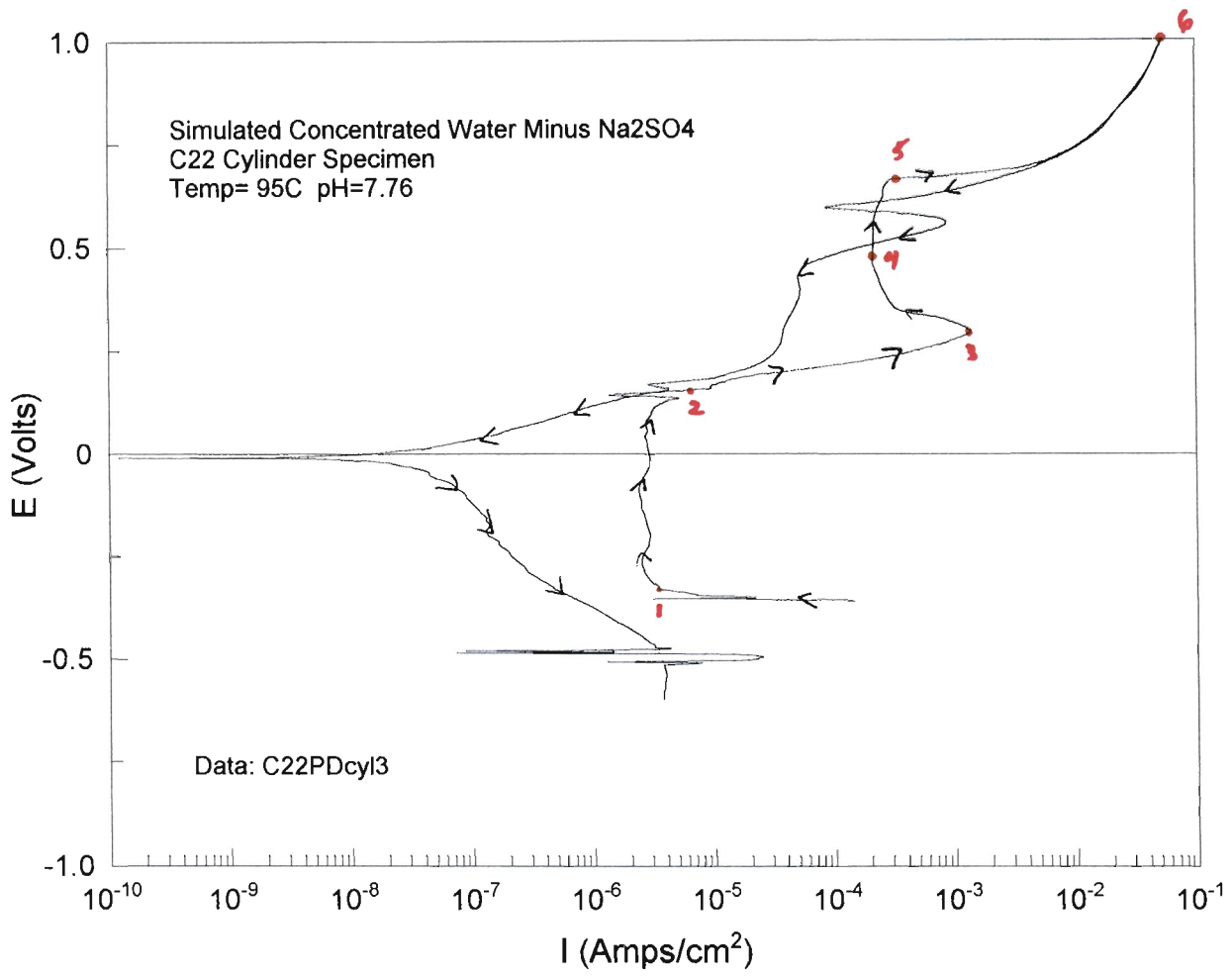
Counter Electrode: Platinum Flag
Reference Electrode: Fisher SCE 13-620-52 **SN:** 0251439

Gas: 99.999% Nitrogen
Ecorr: -620 mv **Model:** Keithley 614 **SN:** 0704934
Ept: -244 mv **Cal:** 6/09/03 **Due:** 6/09/04
Eapplied (vs SCE): none

Potentiostat: Solartron 1480 **SN#** 0024 0551

Specimen Examination: No Sign of Corrosion/Pitting on Any Surface of Specimen; Surface has Dull tint staining

Data: C22PD6/13 11/14/03



	Potential	Current
1	-0.333	3.5079×10^{-6}
2	0.159	9.3344×10^{-6}
3	0.292	0.0013224
4	0.453	0.00020772
5	0.654	0.00028103
6	0.996	0.051672

11/19/03

POTENTIODYNAMIC TEST

Objective: see page #5

Specimen: C22 Cylinder Heat# ~~2277-8-3266~~ 2277-3-3266 CNWRA Drawing 20.01402.571.019 polished to a 600 grit finish 6/27/06

Initial Weight: 12.40368g **Model:** Sartorius Genius **SN:** 12809099 12/10/03
Final Weight: 12.40041g **Cal:** 11/14/03 **Due:** 5/14/~~03~~ 04

SOLUTION: Simulated Concentrated water Minus NaF

12.968g KCl Lot# 006242 192.7g $NaHCO_3$ Lot# 028924
10.869g NaCl Lot# 034103 + DI water To 2000mL
17.505g $NaNO_3$ Lot# 020809
41.39g Na_2SO_4 Lot# 025157

Reagents measured with **Model:** OHAUS **SN:** 2883
Cal: 7/29/03 **Due:** 1/29/~~03~~ 04 11/17/03

Initial pH: 7.84 **Model:** Fisher Accumet 950 Meter **SN:** 3340
Final pH: 9.16 **Cal:** 8/11/03 **Due:** 8/11/04
pH Probe: #13-620-296 **SN:** 2291257P6

TEST TEMPERATURE: 95°C **Measured with Hg Thermometer SN:** C96-377
Cal: 7/15/03 **Due:** 1/15/04

Counter Electrode: Platinum Flag

Reference Electrode: Fisher SCE 13-620-52 **SN:** 0251439

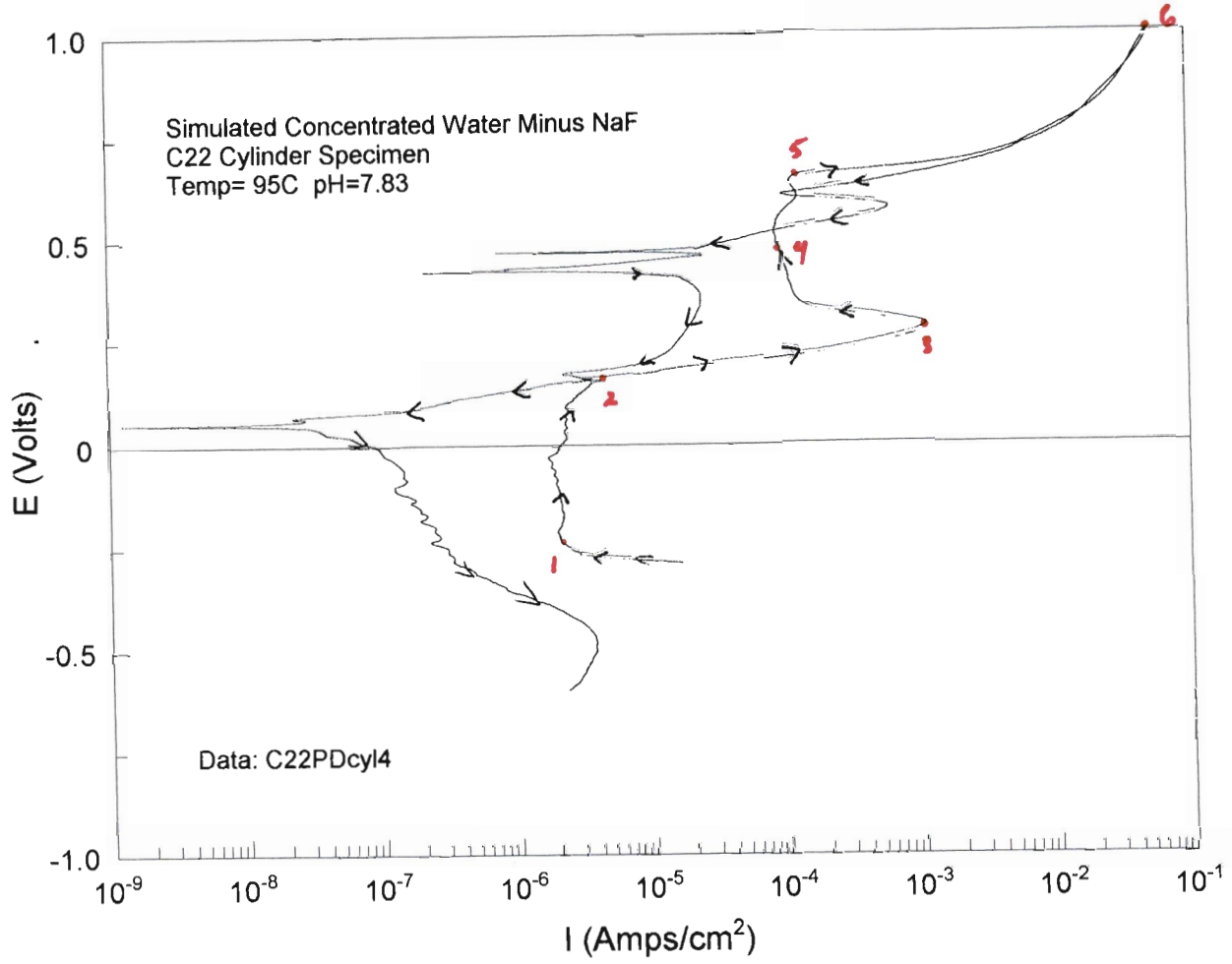
Gas: 99.999% Nitrogen

Ecorr: -561mV **Model:** Keithley 614 **SN:** 0704934
Ept: -307mV **Cal:** 6/09/03 **Due:** 6/09/04
Eapplied (vs SCE): none

Potentiostat: Solartron 1480 **SN#** 00240551

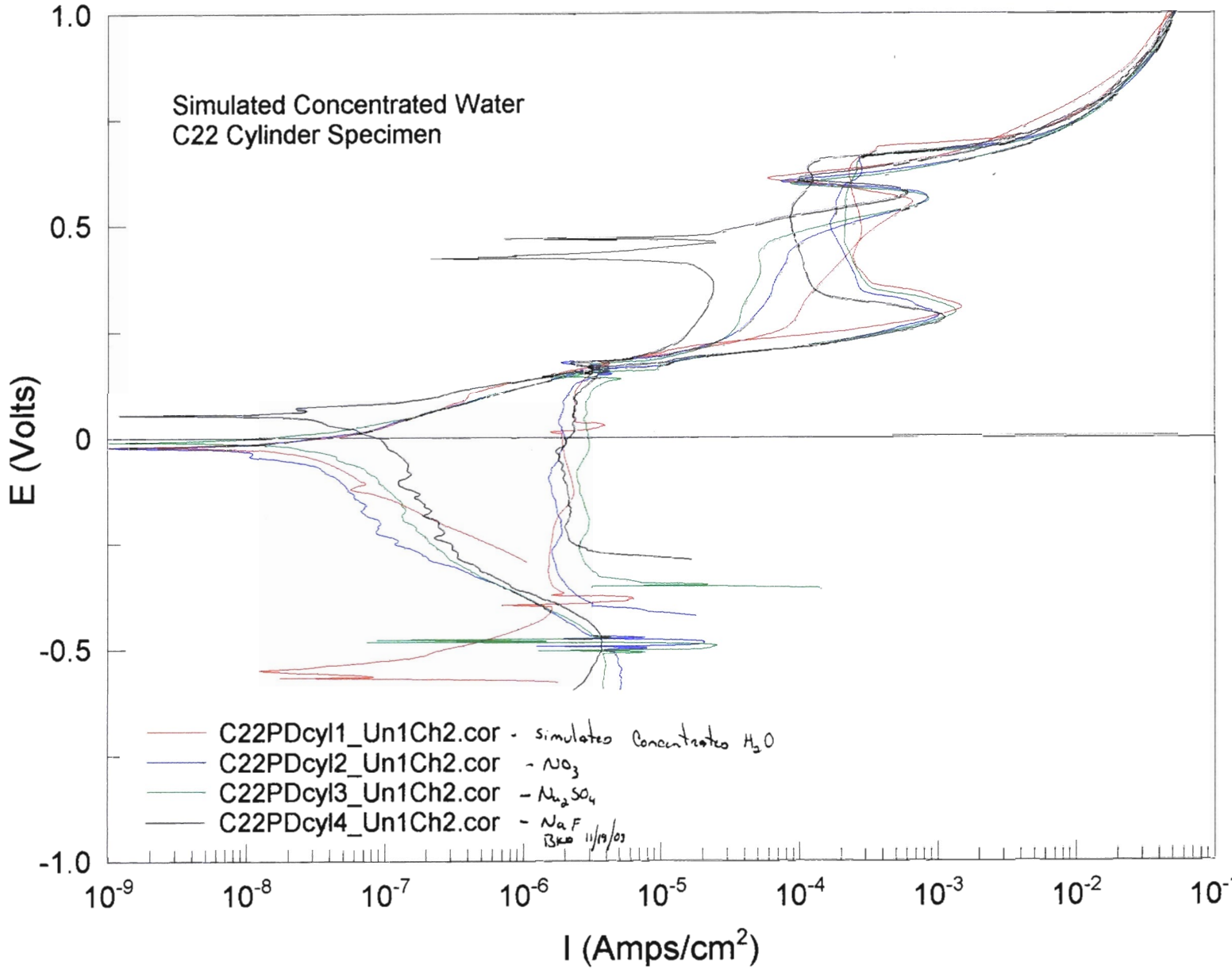
Specimen Examination: No Visual Signs of Corrosion / Pitting on surface. Dull tint staining on All surfaces of Specimen

Data C22PD04 [signature] 11/12/03



	Potential	Current
1	-0.255	2.4917×10^{-6}
2	0.171	6.7851×10^{-6}
3	0.276	0.0011077
4	0.526	8.7174×10^{-5}
5	0.656	0.00016785
6	0.997	0.052362

B. F. 11/18/03


Simulated Concentrated Water
C22 Cylinder Specimen
1.0
0.5
0
-0.5
-1.0
E (Volts)
10-9
10-8
10-7
10-6
10-5
10-4
10-3
10-2
10-1
I (Amps/cm2)
C22PDcyl1_Un1Ch2.cor - simulated Concentrated H2O
C22PDcyl2_Un1Ch2.cor - NO3
C22PDcyl3_Un1Ch2.cor - Na2SO4
C22PDcyl4_Un1Ch2.cor - NaF
BKD 11/19/03

11/19/03

New Test Matrix:

Continue with C-22 Cylinders Ht # 2277-3:3266

Solution will be Simulated Concentrated Water
But Instead of Removal of $NaF - Na_2SO_4$
And $NaNO_3$ will Decrease Molarity of Solution
* Note: will Reduce Molarity of Each Reagent $NaF - Na_2SO_4$
And $NaNO_3$ In Simulated Concentrated Water
See Each Individual Test for Concentrations

Temp: will Remain 95°C

All other test parameters will Remain the same

All other Equipment will Remain the Same through out
Testing In Simulated Concentrated Water

11/20/03

POTENTIODYNAMIC TEST

Objective: see page #5

Specimen: C22 Cylinder Heat# ~~2277-8-3266~~ 2277-3-3266 CNWRA Drawing 20.01402.571.019 polished to a 600 grit finish BKO 6/27/06

Initial Weight: 12.45528g **Model:** Sartorius Genius **SN:** 12809099 BKO 10/12/03
Final Weight: 12.45489g **Cal:** 11/14/03 **Due:** 5/14/~~03~~ 04

SOLUTION: Simulated Concentrated water Decreased NaF

12.964g KCl Lot# 006242 — 41.40g Na_2SO_4 Lot# 025157
10.869g NaCl Lot# 034103 — 192.71g $NaHCO_3$ Lot# 028924
17.051g $NaNO_3$ Lot# 020809 — 3.093g NaF Lot# 991559
+ DI water to 2000 mls

Reagents measured with **Model:** OHAUS **SN:** 2883
Cal: 7/29/03 **Due:** 1/29/~~03~~ 04 BKO 10/13/03

Initial pH: 7.76 **Model:** orion **SN:** S001A
Final pH: 9.21 **CAL:** 1/9/03 **DUE:** 1/9/04
pH Probe: #13-620-296 **SN:** 2291257P6

TEST TEMPERATURE: 95°C **Measured with Hg Thermometer SN:** C96-377
Cal: 7/15/03 **Due:** 1/15/04

Counter Electrode: Platinum Flag

Reference Electrode: Fisher SCE 13-620-52 **SN:** 0251434

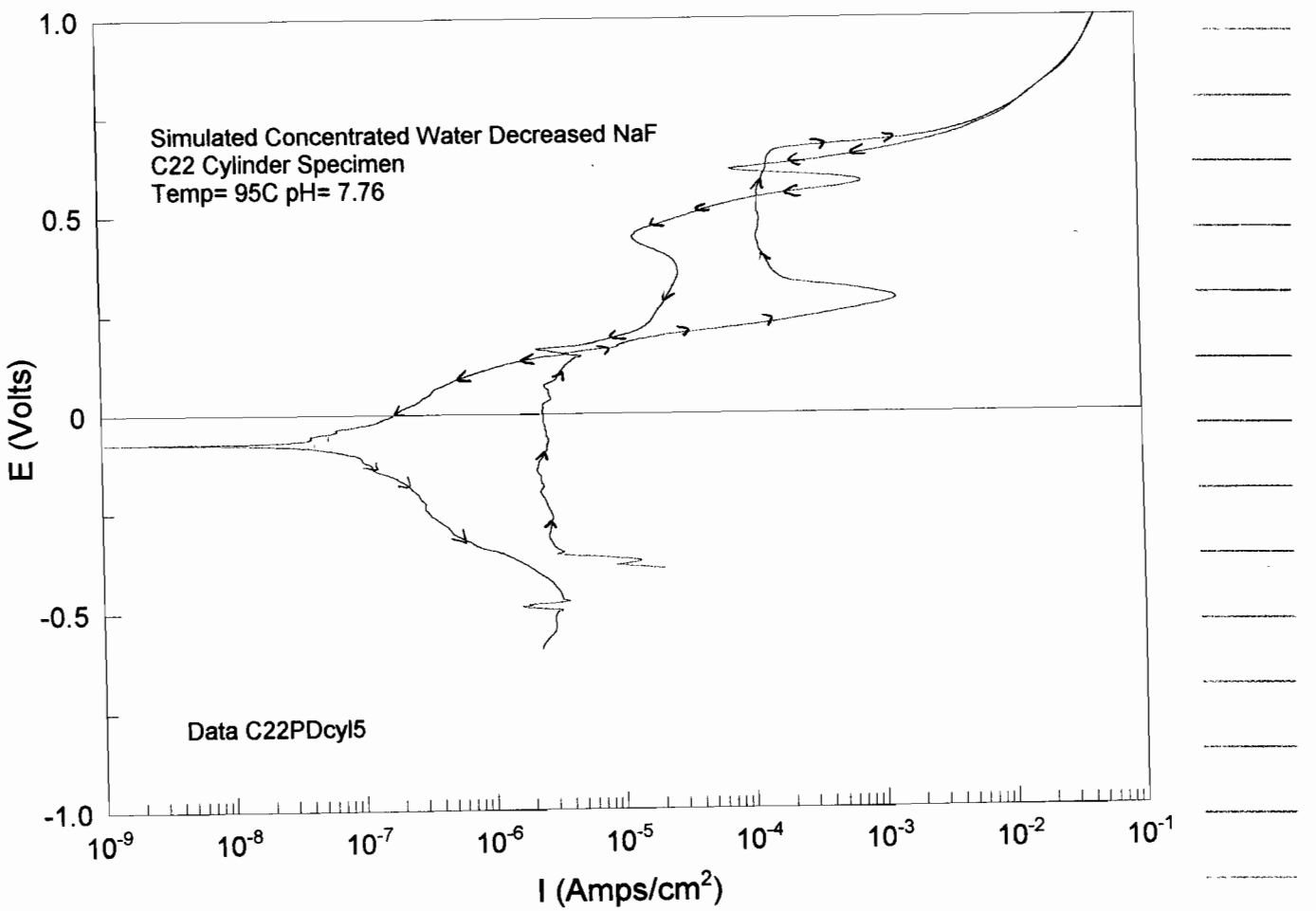
Gas: 99.999% Nitrogen
Ecorr: -649 mv **Model:** Keithley 614 **SN:** 0704934
Ept: -305 mv **Cal:** 6/09/03 **Due:** 6/09/04
Eapplied (vs SCE): —

Potentiostat: Solartron 1480 **SN#** 00240551

Specimen Examination: No visual sign of corrosion / pitting on specimen. Dull tint staining on All surfaces

Data C22PD 04/5

11/21/03


Simulated Concentrated Water Decreased NaF
C22 Cylinder Specimen
Temp= 95C pH= 7.76
Data C22PDcyl5
E (Volts)
1.0
0.5
0
-0.5
-1.0
10-9
10-8
10-7
10-6
10-5
10-4
10-3
10-2
10-1
I (Amps/cm2)

11/2/02

POTENTIODYNAMIC TEST

Objective: see page #5

Specimen: C22 Cylinder Heat# ~~2277-8-3266~~ 2277-3-3266 CNWRA Drawing 20.01402.571.019 polished to a 600 grit finish BJY 6/27/06

Initial Weight: 12.33499g **Model:** Sartorius Genius **SN:** 12809099 BJY 12/12/03
Final Weight: 12.33465g **Cal:** 11/14/03 **Due:** 5/14/~~03~~ 04

SOLUTION: Simulated Concentrated water Decreases $NaNO_3$

12.961g KCl	Lot # 066242	41.39g Na_2SO_4	Lot # 035451
10.861g NaCl	Lot # 034103	192.70g $NaHCO_3$	Lot # 028924
8.773g $NaNO_3$	Lot # 026809	6.190g NaF	Lot # 991555

+ DI water to 2000mls

Reagents measured with **Model:** OHAUS **SN:** 2883
Cal: 7/29/03 **Due:** 1/29/~~03~~ BJY 12/12/03

Initial pH: 7.71 **Model:** orion **SN:**S001A
Final pH: 9.34 **CAL:** 1/9/03 **DUE:** 1/9/04
pH Probe: #13-620-296 **SN:** 2291257P6

TEST TEMPERATURE: 95°C **Measured with Hg Thermometer SN:** C96-377
Cal: 7/15/03 **Due:** 1/15/04

Counter Electrode: Platinum Flag
Reference Electrode: Fisher SCE 13-620-52 **SN:** 0251439

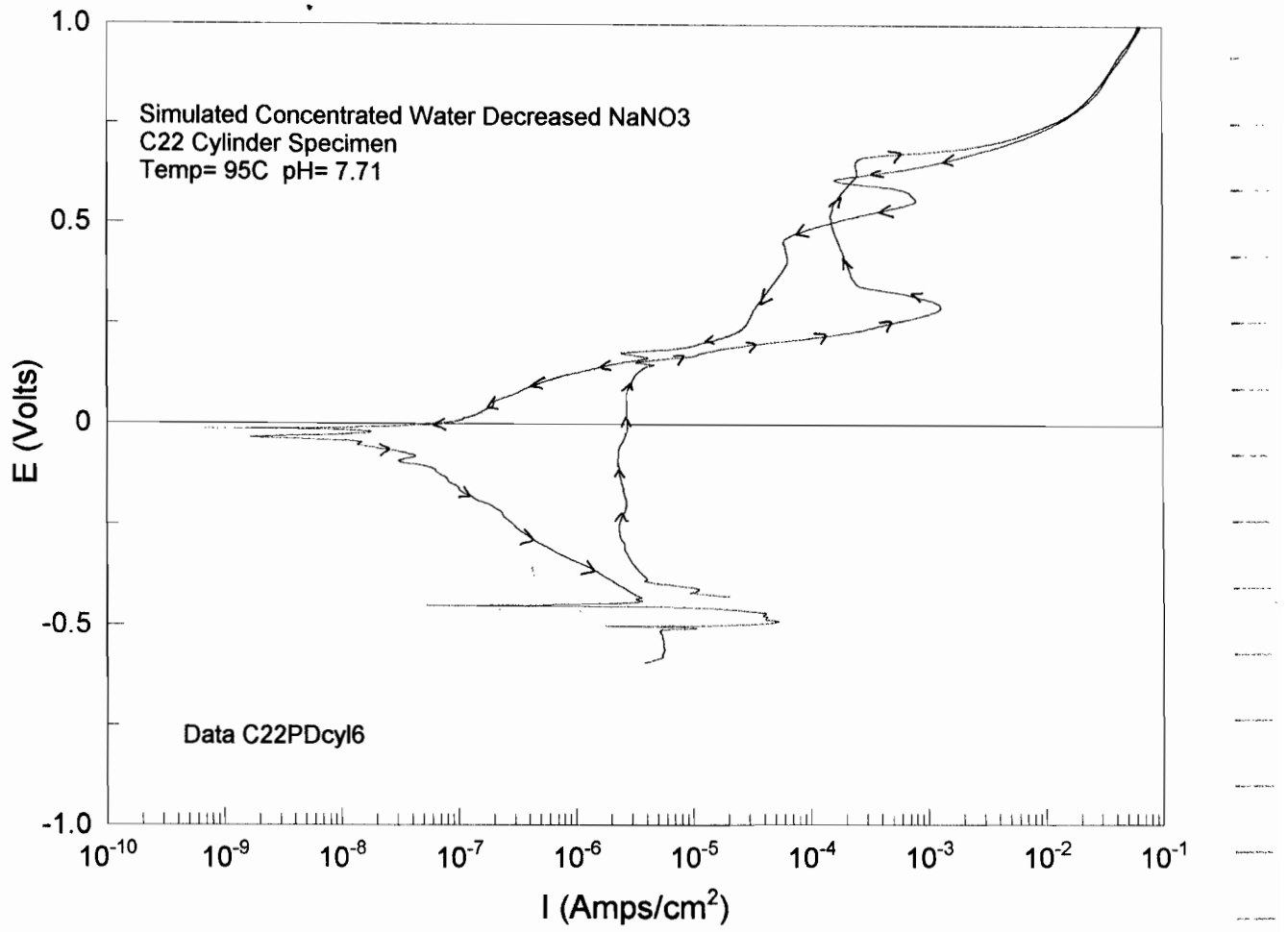
Gas: 99.999% Nitrogen
Ecorr: -636mv **Model:** Keithley 614 **SN:** 0704934
Ept: -249mv **Cal:** 6/09/03 **Due:** 6/09/04
Eapplied (vs SCE): —

Potentiostat: Solartron 1480 **SN#** 00240551

Specimen Examination: No Visual Signs of Corrosion / P.H.z on Specimen - Dull Tint Staining on Surface

Data C22 PD Cyl 6

BJY 11/24/03


Simulated Concentrated Water Decreased NaNO3
C22 Cylinder Specimen
Temp= 95C pH= 7.71
Data C22PDcyl6
E (Volts)
I (Amps/cm2)
1.0
0.5
0
-0.5
-1.0
10-10
10-9
10-8
10-7
10-6
10-5
10-4
10-3
10-2
10-1

11/24/03

POTENTIODYNAMIC TEST

Objective: see page #5

Specimen: C22 Cylinder Heat# ~~2277-8-3266~~ 2277-3-3266 CNWRA Drawing 20.01402.571.019 polished to a 600 grit finish DLO 6/27/06

Initial Weight: 12.43485g **Model:** Sartorius Genius **SN:** 12809099 AM 12/10/03
Final Weight: 12.43395g **Cal:** 11/14/03 **Due:** 5/14/~~03~~ 04

SOLUTION: Simulated Concentrated water Decreased Na_2SO_4

12.966g KCl Lot# 006242 — 20.691g Na_2SO_4 Lot# 035451
16.864g NaCl Lot# 034103 — 192.75g $NaHCO_3$ Lot# 028924
17.521g $NaNO_3$ Lot# 020809 — 6.192g NaF Lot# 991559
+ DI water To 2000 ml's

Reagents measured with **Model:** OHAUS **SN:** 2883
Cal: 7/29/03 **Due:** 1/29/~~03~~ 04 BMC 12/10/03

Initial pH: 7.74 **Model:** orion **SN:** S001A
Final pH: 9.21 **CAL:** 1/9/03 **DUE:** 1/9/04
pH Probe: #13-620-296 **SN:** 2291257P6

TEST TEMPERATURE: 95°C **Measured with Hg Thermometer SN:** C96-377
Cal: 7/15/03 **Due:** 1/15/04

Counter Electrode: Platinum Flag

Reference Electrode: Fisher SCE 13-620-52 **SN:** 0251439

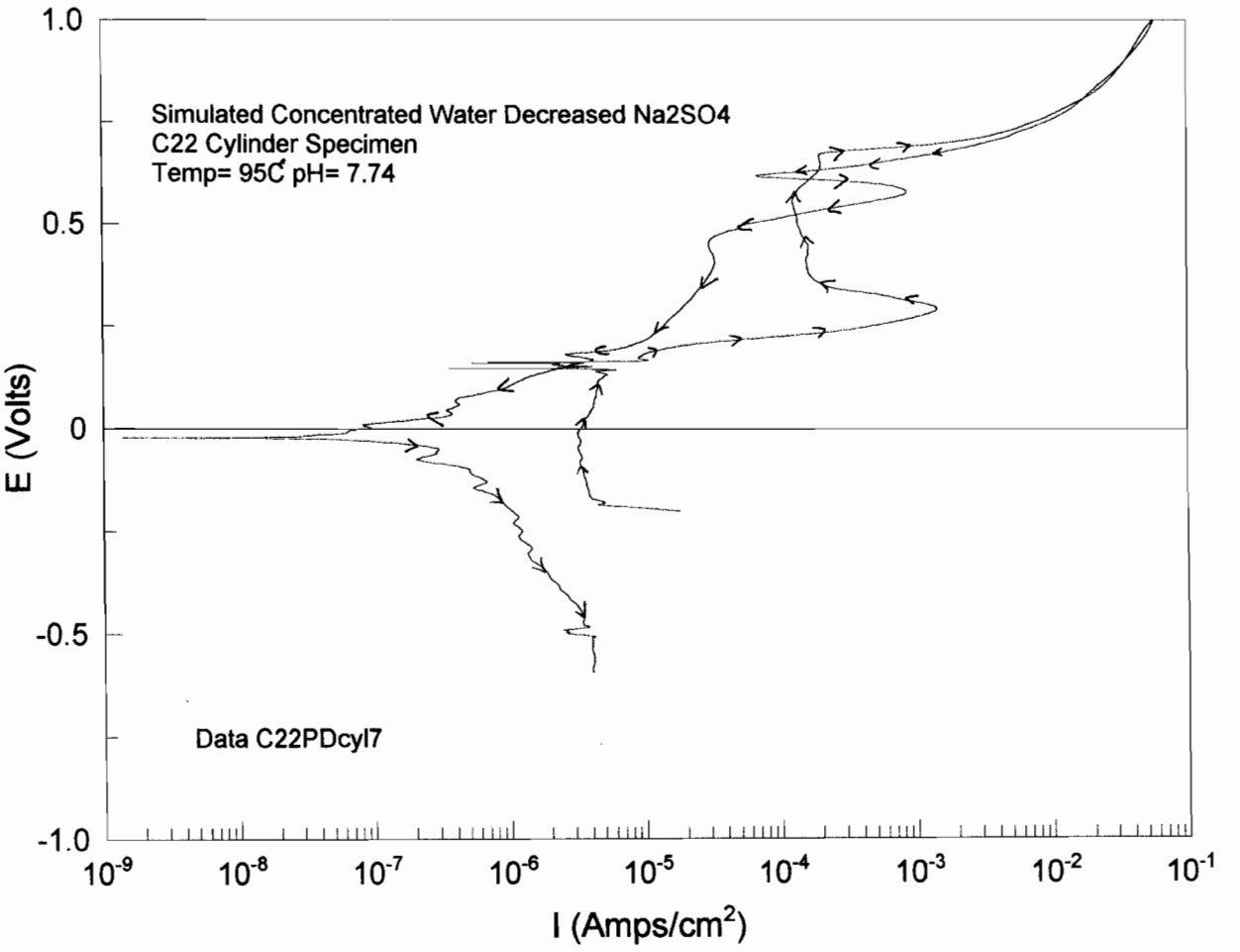
Gas: 99.999% Nitrogen
Ecorr: -445mv **Model:** Keithley 614 **SN:** 0704934
Ept: -233 mv **Cal:** 6/09/03 **Due:** 6/09/04
Eapplied (vs SCE): -

Potentiostat: Solartron 1480 **SN#** 00240551

Specimen Examination: No Sign of Corrosion/Pitting
Staining on All Surfaces of specimen (Dull Tint)

Data C22P0Cy17

B. Ford 11/24/03



See pg 41 for Graph of Test Data C2200 cyl #5 - #7 · Comparision Graph

11/25/03

36

1/2 pore water calculation from Bobby Pabalan

Kuang-Tsan Ken Chiang

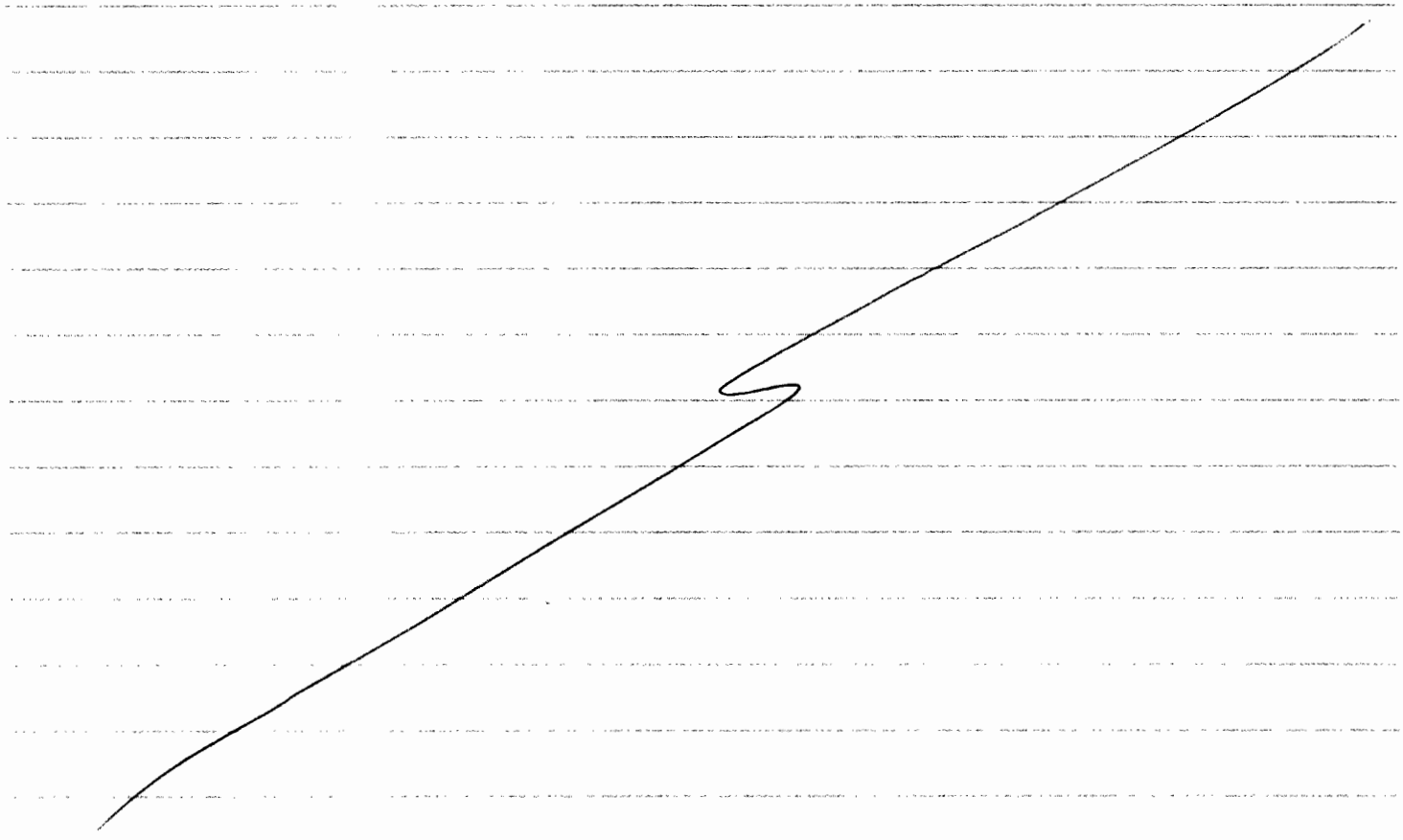
From: R Pabalan [rpabalan@cnwra.swri.edu]
Sent: Wednesday, December 03, 2003 1:33 PM
To: Darrell Dunn; Ken Chiang
Subject: UZ porewater evaporation results

Synth UZ rewater Evap at 95-

Darell, Ken,

Attached is a Word file with plots of pH, ionic strength, and aqueous species concentration as a function of concentration factor and temperature (95, 110, 125, and 140 C) for UZ porewater. The porewater composition was taken from Rosenberg et al. (2001).

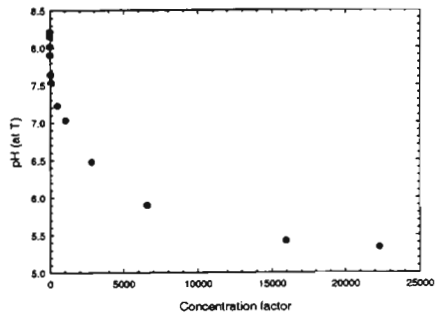
bobby



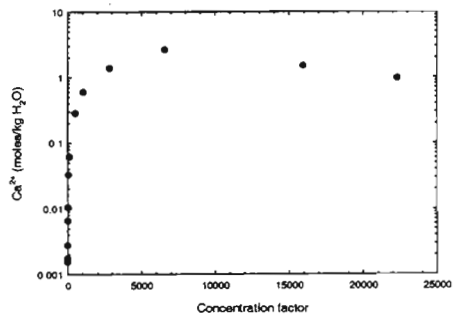
K. J. Chiang 12/4/03

Synthetic UZ porewater evaporation at T=95 °C

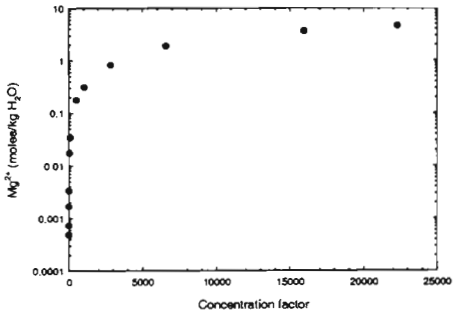
pH vs conc. factor



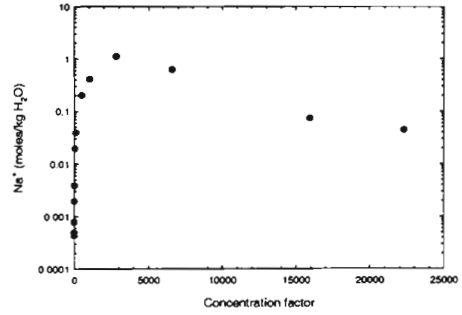
[Ca^{2+}] vs conc. factor



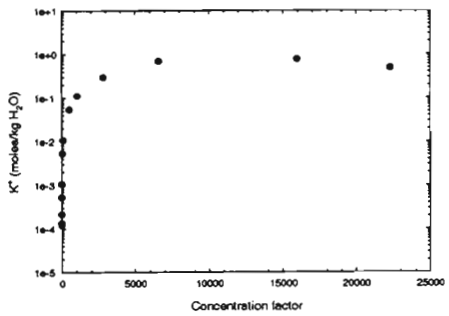
[Mg^{2+}] vs conc. factor



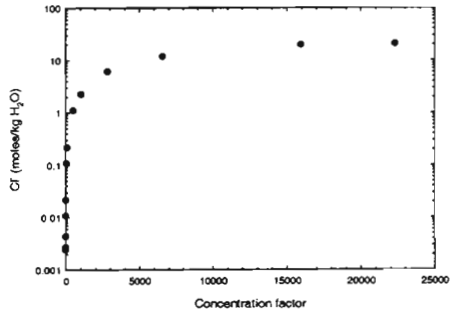
[Na^{+}] vs conc. factor



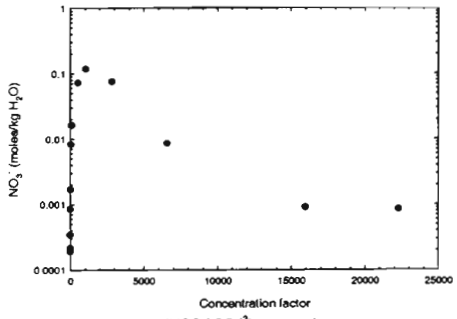
[K^{+}] vs conc. factor



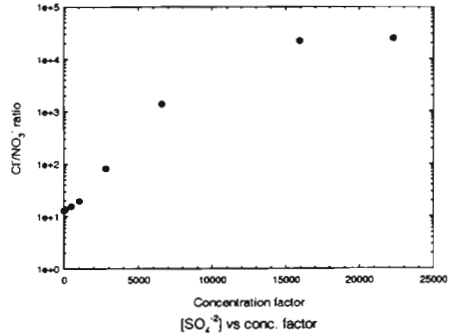
[Cl^{-}] vs conc. factor



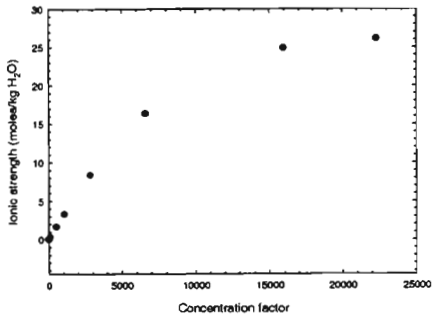
[NO_3^{-}] vs conc. factor



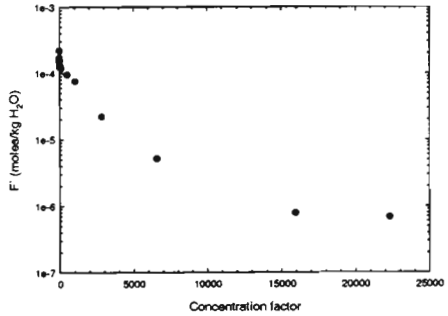
[Cl^{-}/NO_3^{-}] vs conc. factor



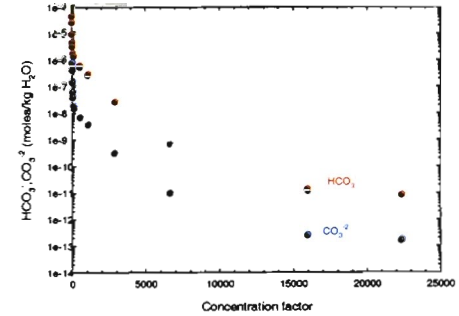
Ionic strength vs conc. factor



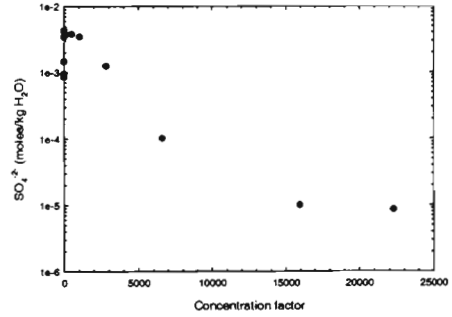
[F^{-}] vs conc. factor



[HCO_3^{-},CO_3^{-2}] vs conc. factor



[SO_4^{-2}] vs conc. factor



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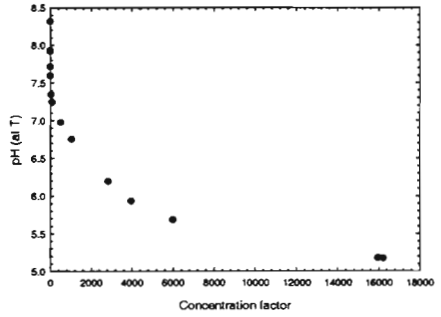
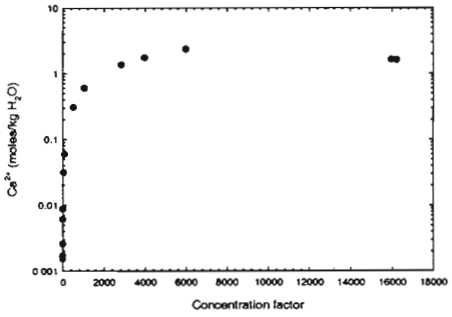
Synthetic UZ porewater evaporation at T=110 °C

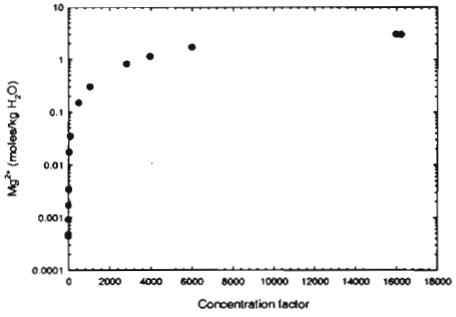
pH vs conc. factor



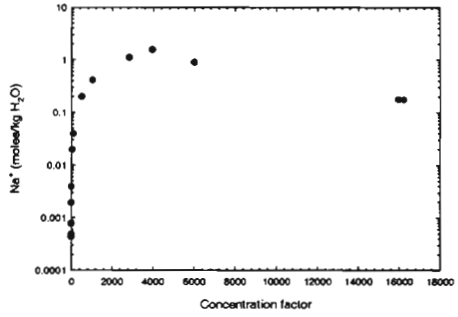
[Ca^{2+}] vs conc. factor



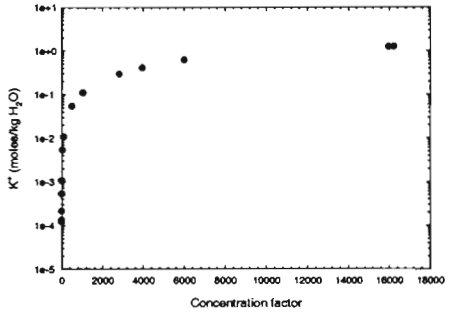
[Mg^{2+}] vs conc. factor



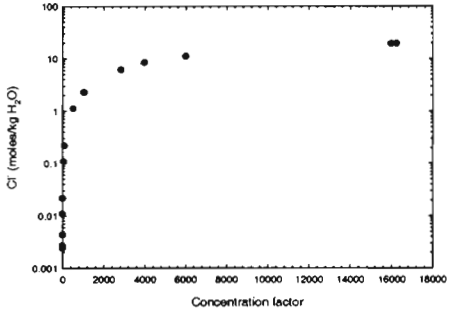
[Na^{+}] vs conc. factor



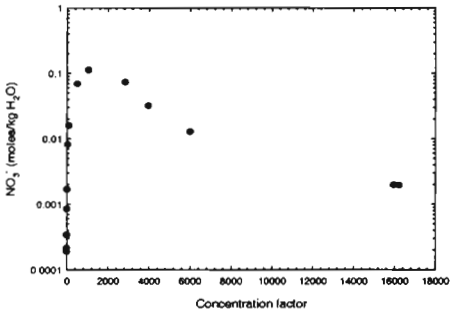
[K^{+}] vs conc. factor



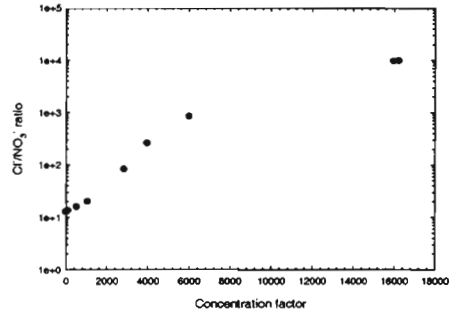
[Cl^{-}] vs conc. factor



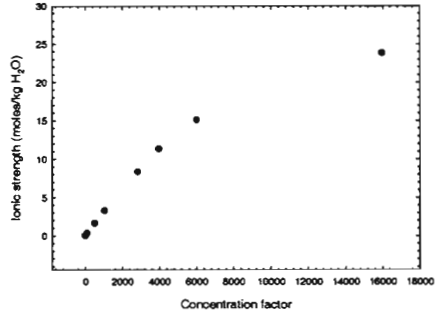
[NO_3^{-}] vs conc. factor



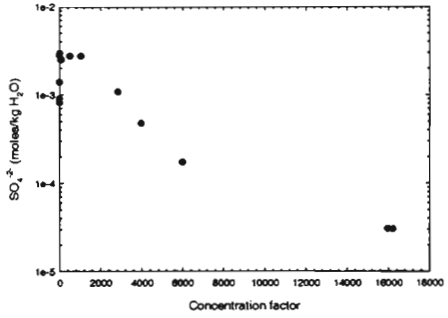
[Cl^{-}/NO_3^{-}] vs conc. factor



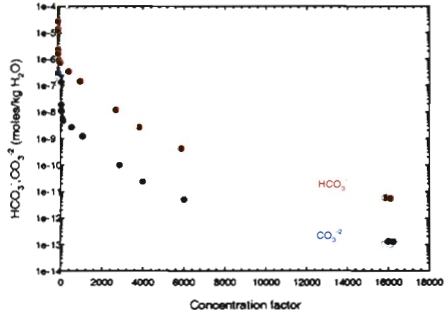
Ionic strength vs conc. factor



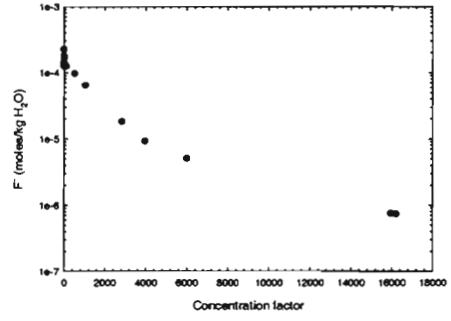
[SO_4^{-2}] vs conc. factor



[HCO_3^{-},CO_3^{-2}] vs conc. factor



[F] vs conc. factor



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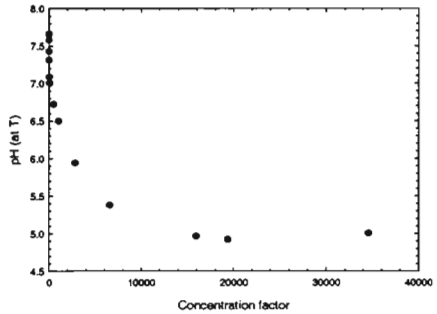
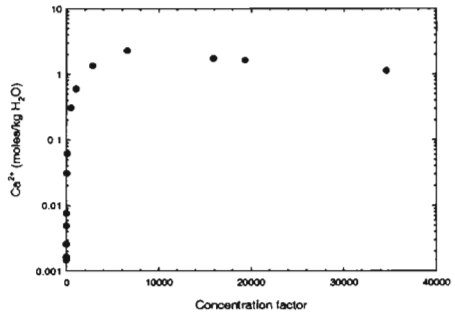
Synthetic UZ porewater evaporation at T=125 °C

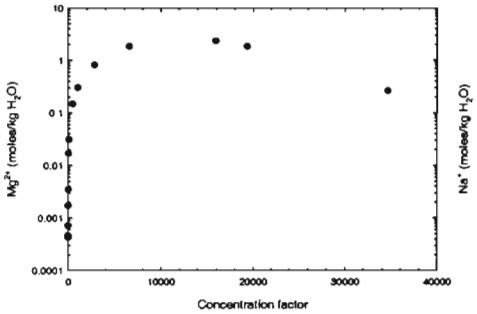
pH vs conc. factor



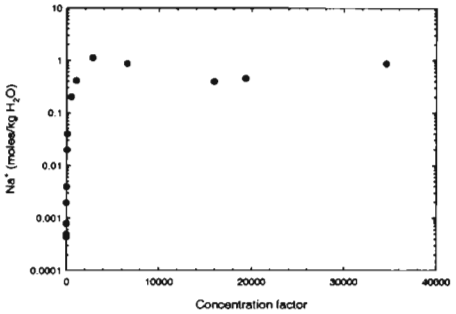
[Ca^{2+}] vs conc. factor



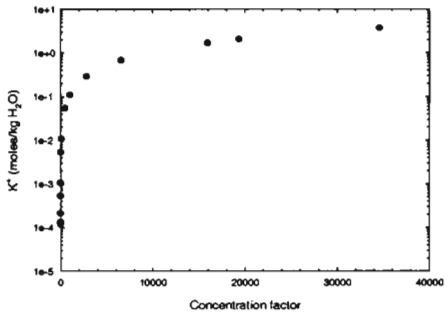
[Mg^{2+}] vs conc. factor



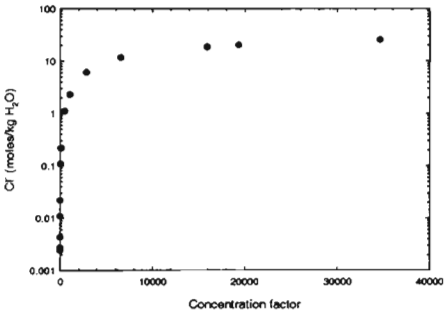
[Na^{+}] vs conc. factor



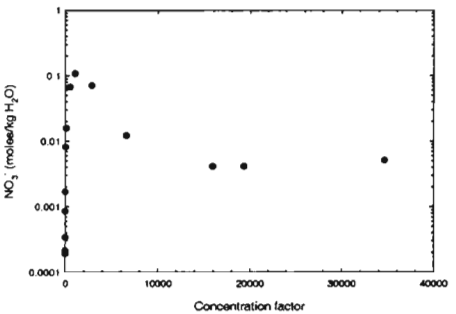
[K^{+}] vs conc. factor



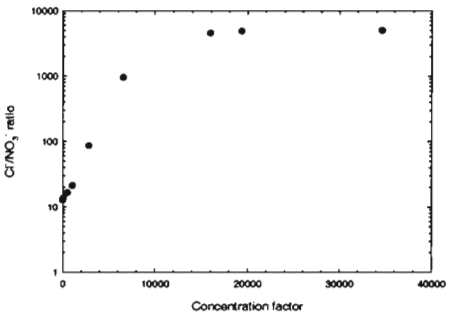
[Cl^{-}] vs conc. factor



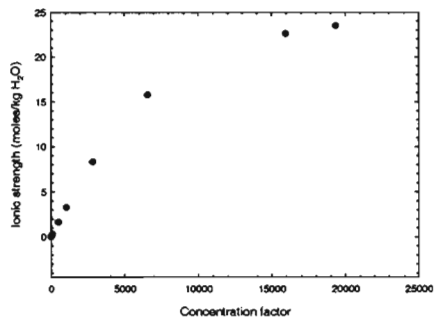
[NO_3^{-}] vs conc. factor



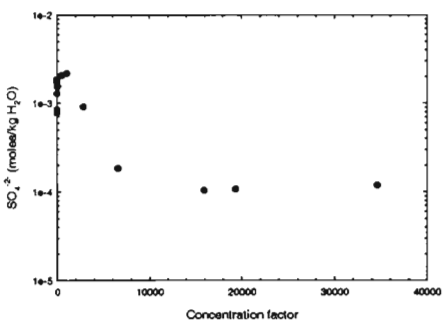
[Cl^{-}/NO_3^{-}] vs conc. factor



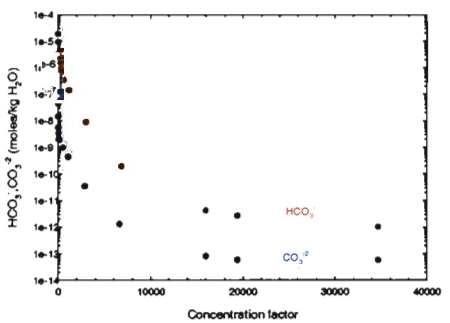
Ionic strength vs conc. factor



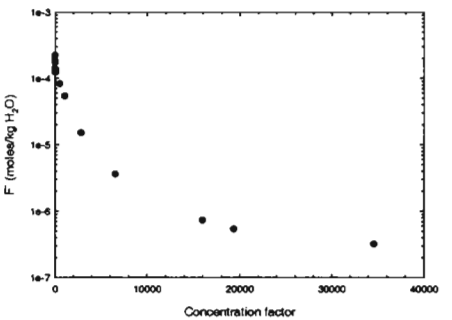
[SO_4^{-2}] vs conc. factor



[HCO_3^{-},CO_3^{-2}] vs conc. factor

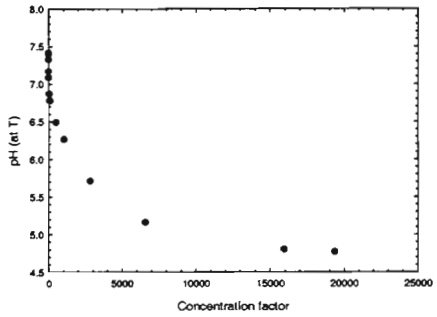


[F^{-}] vs conc. factor

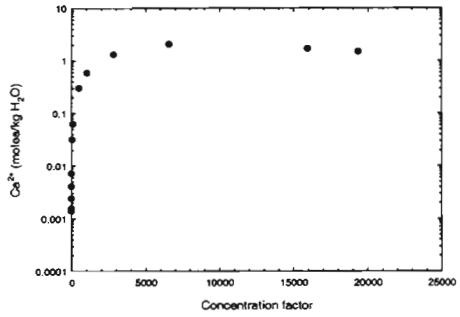


Synthetic UZ porewater evaporation at T=140 °C

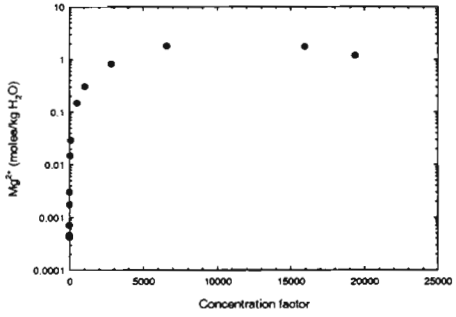
pH vs conc. factor



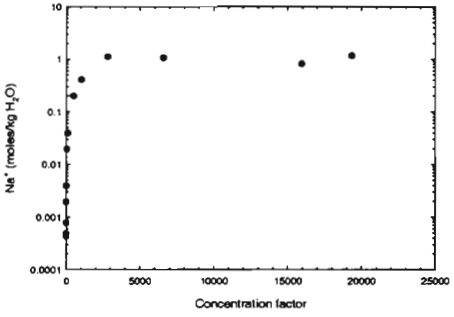
[Ca^{2+}] vs conc. factor



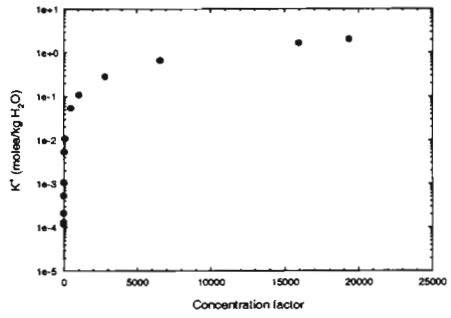
[Mg^{2+}] vs conc. factor



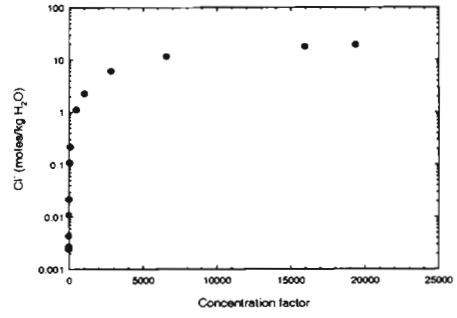
[Na^{+}] vs conc. factor



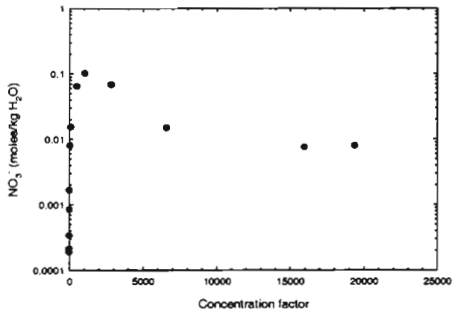
[K^{+}] vs conc. factor



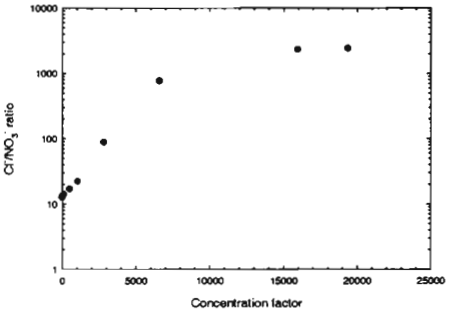
[Cl^{-}] vs conc. factor



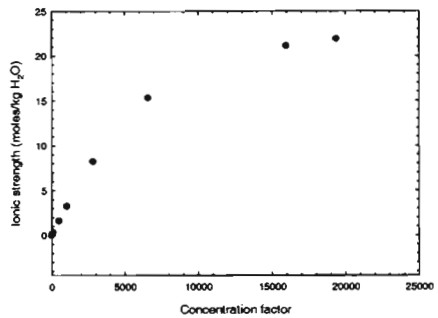
[NO_3^{-}] vs conc. factor



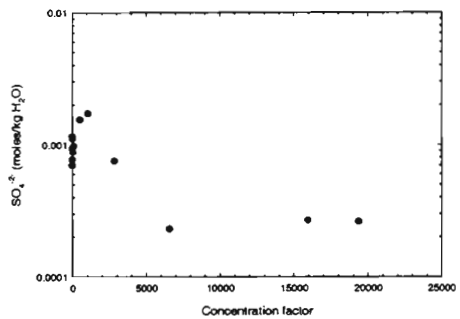
[Cl^{-}/NO_3^{-}] vs conc. factor



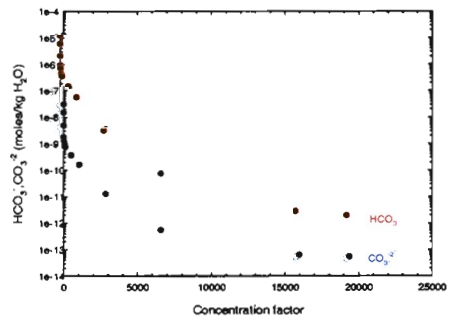
Ionic strength vs conc. factor



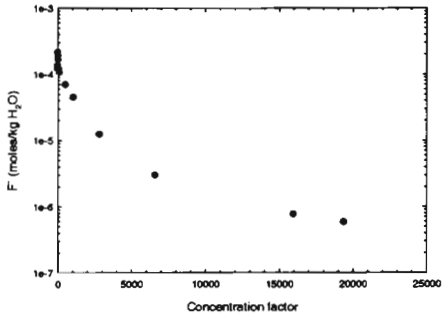
[SO_4^{-2}] vs conc. factor



[HCO_3^{-},CO_3^{-2}] vs conc. factor



[F^{-}] vs conc. factor



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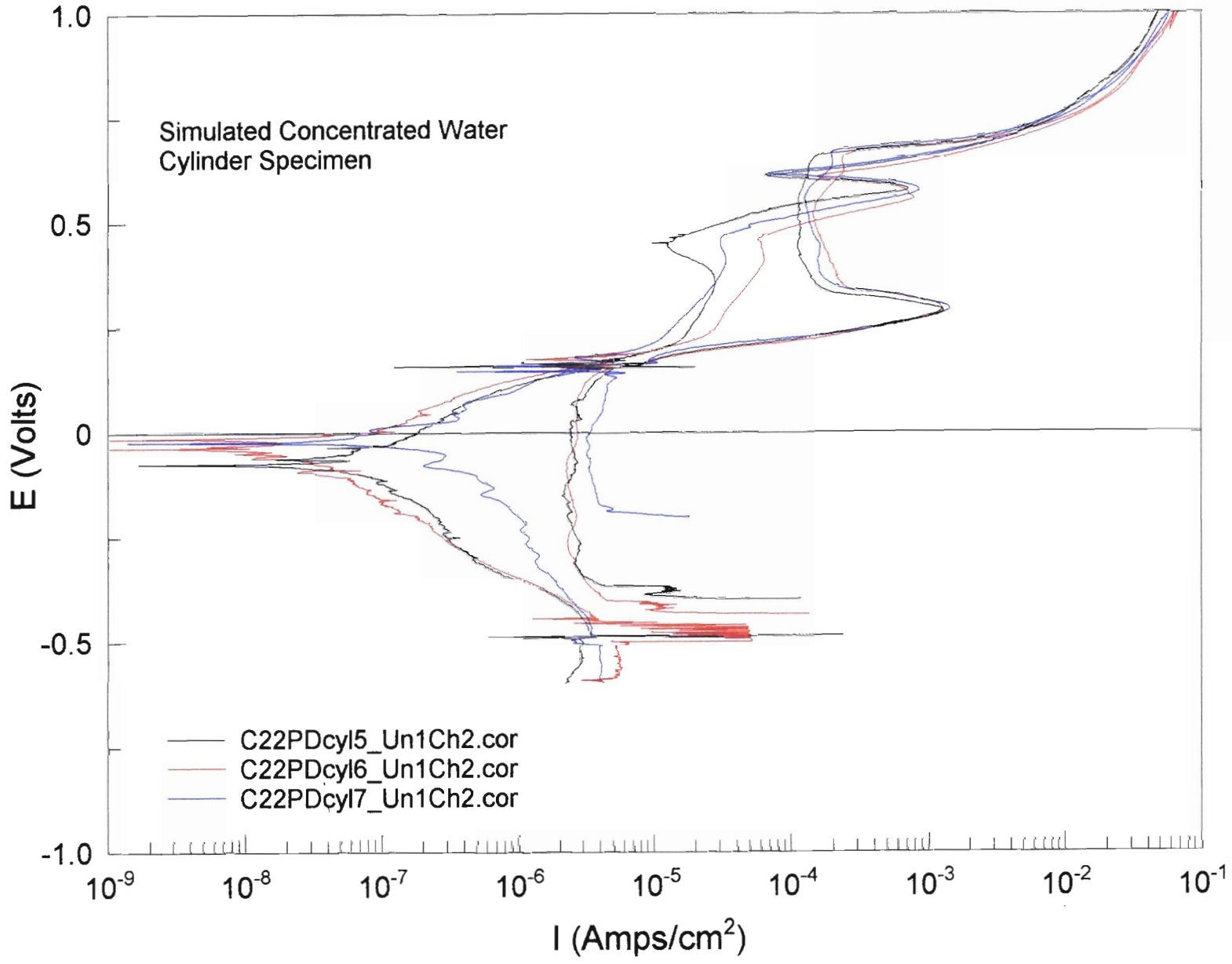
Simulated Concentrated Water
Cylinder Specimen
E (Volts)
1.0
0.5
0
-0.5
-1.0
10^{-9}
10^{-8}
10^{-7}
10^{-6}
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
I (Amps/cm^2)
C22PDcyl5_Un1Ch2.cor
C22PDcyl6_Un1Ch2.cor
C22PDcyl7_Un1Ch2.cor

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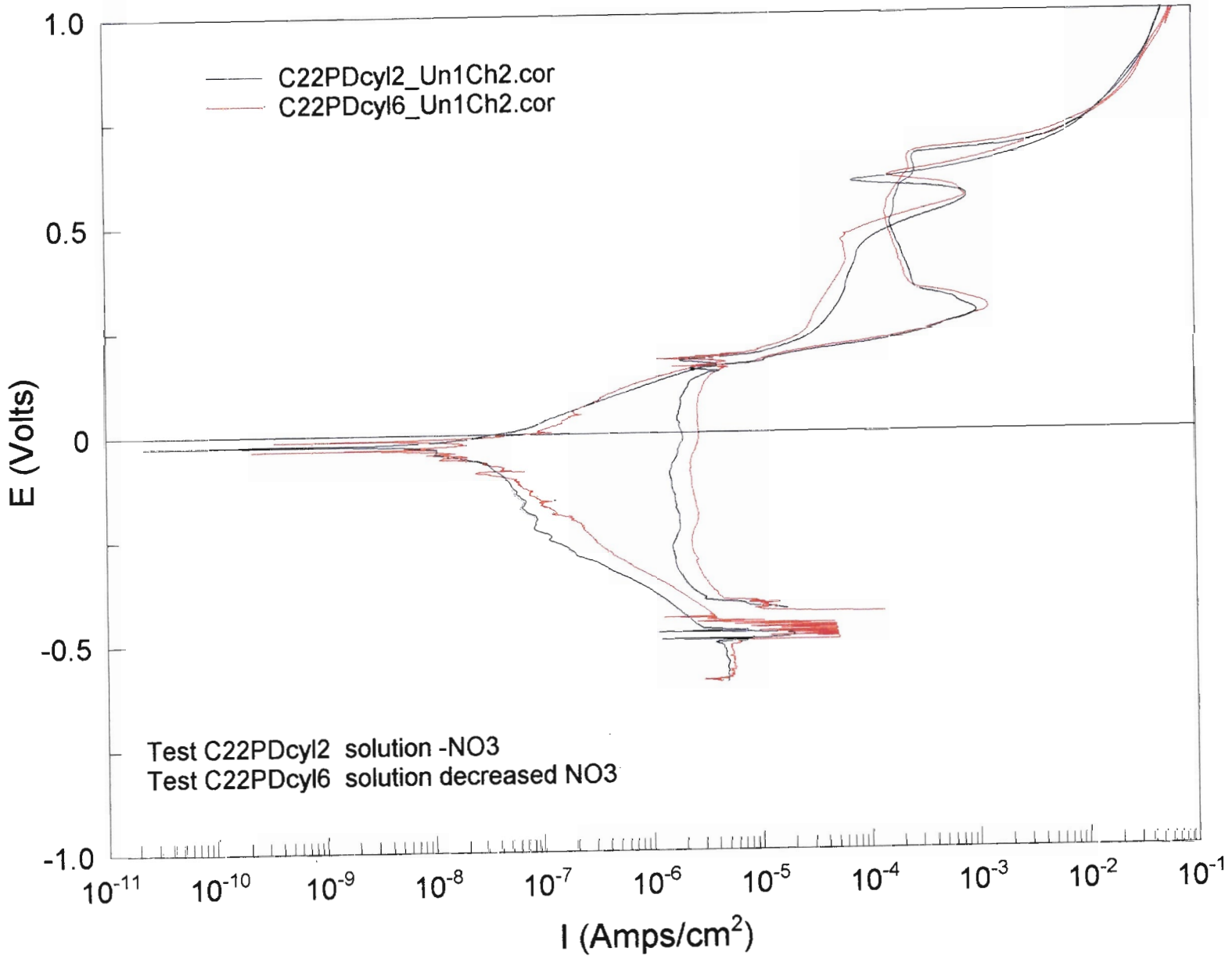
C22PDcyl2_Un1Ch2.cor
C22PDcyl6_Un1Ch2.cor
Test C22PDcyl2 solution -NO3
Test C22PDcyl6 solution decreased NO3
E (Volts)
1.0
0.5
0
-0.5
-1.0
10-11
10-10
10-9
10-8
10-7
10-6
10-5
10-4
10-3
10-2
10-1
I (Amps/cm2)

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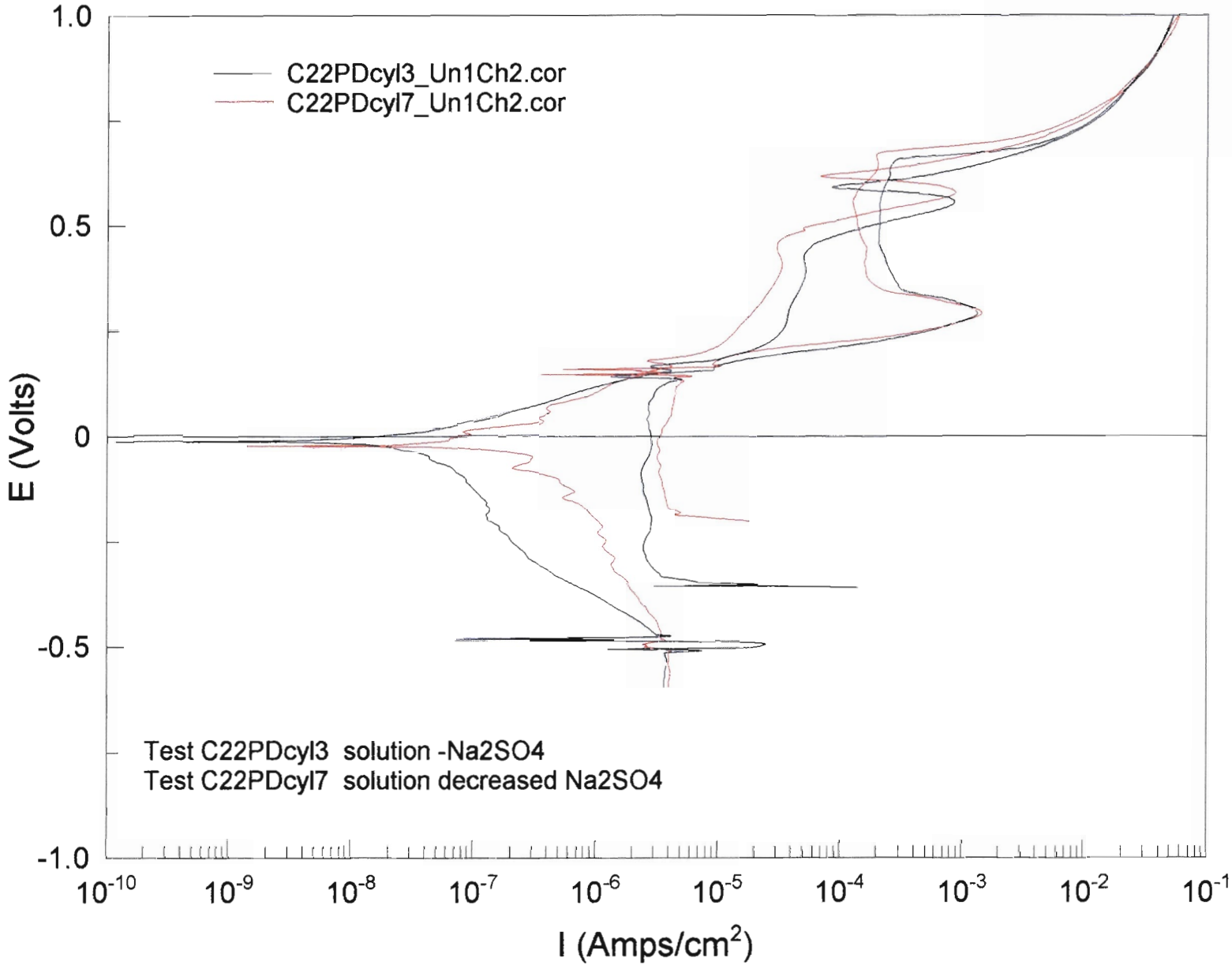
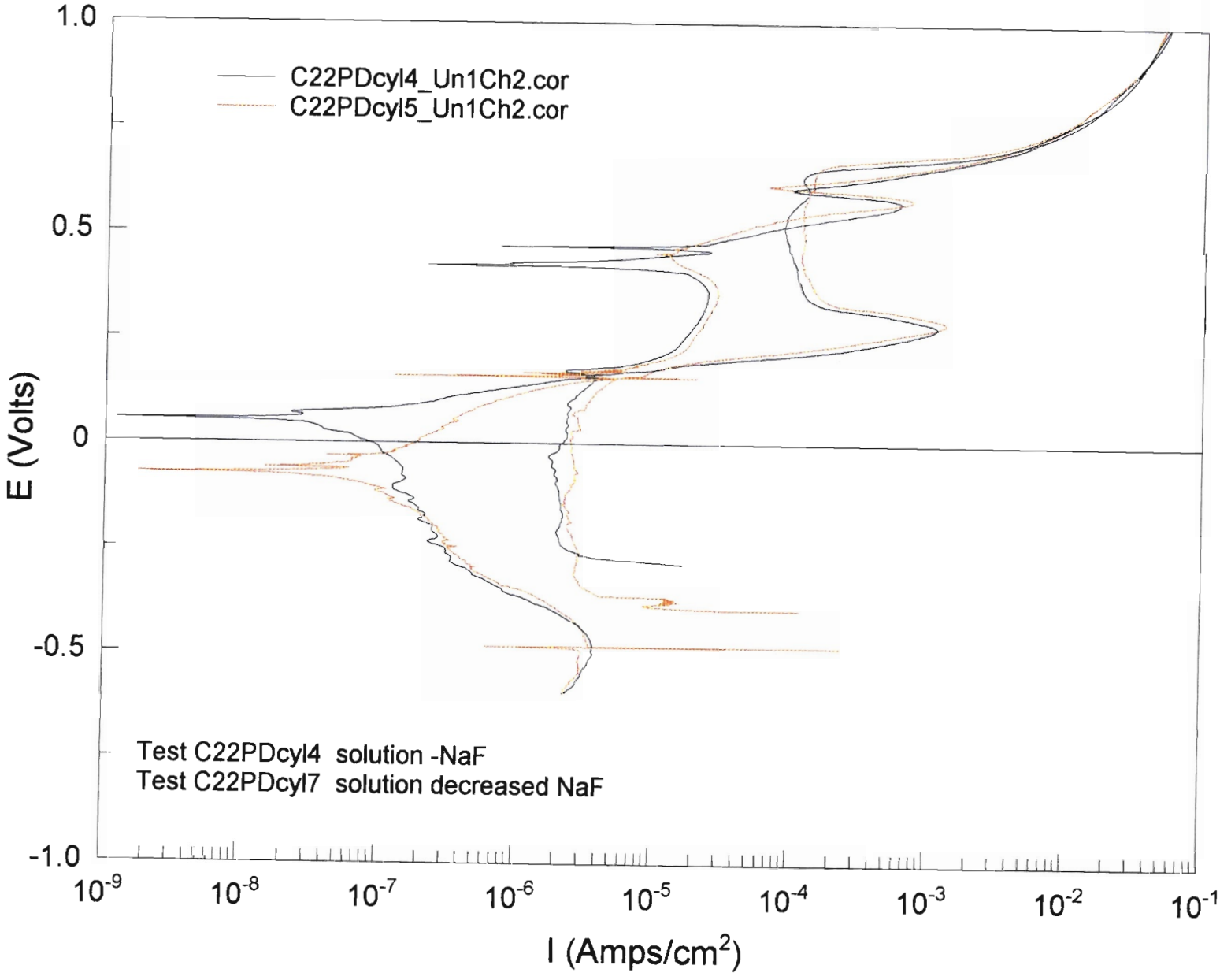

C22PDcyl3_Un1Ch2.cor
C22PDcyl7_Un1Ch2.cor
Test C22PDcyl3 solution -Na2SO4
Test C22PDcyl7 solution decreased Na2SO4
E (Volts)
1.0
0.5
0
-0.5
-1.0
10-10
10-9
10-8
10-7
10-6
10-5
10-4
10-3
10-2
10-1
I (Amps/cm2)

12/5/03


C22PDcyl4_Un1Ch2.cor
C22PDcyl5_Un1Ch2.cor
Test C22PDcyl4 solution -NaF
Test C22PDcyl7 solution decreased NaF
E (Volts)
1.0
0.5
0
-0.5
-1.0
10-9
10-8
10-7
10-6
10-5
10-4
10-3
10-2
10-1
I (Amps/cm2)

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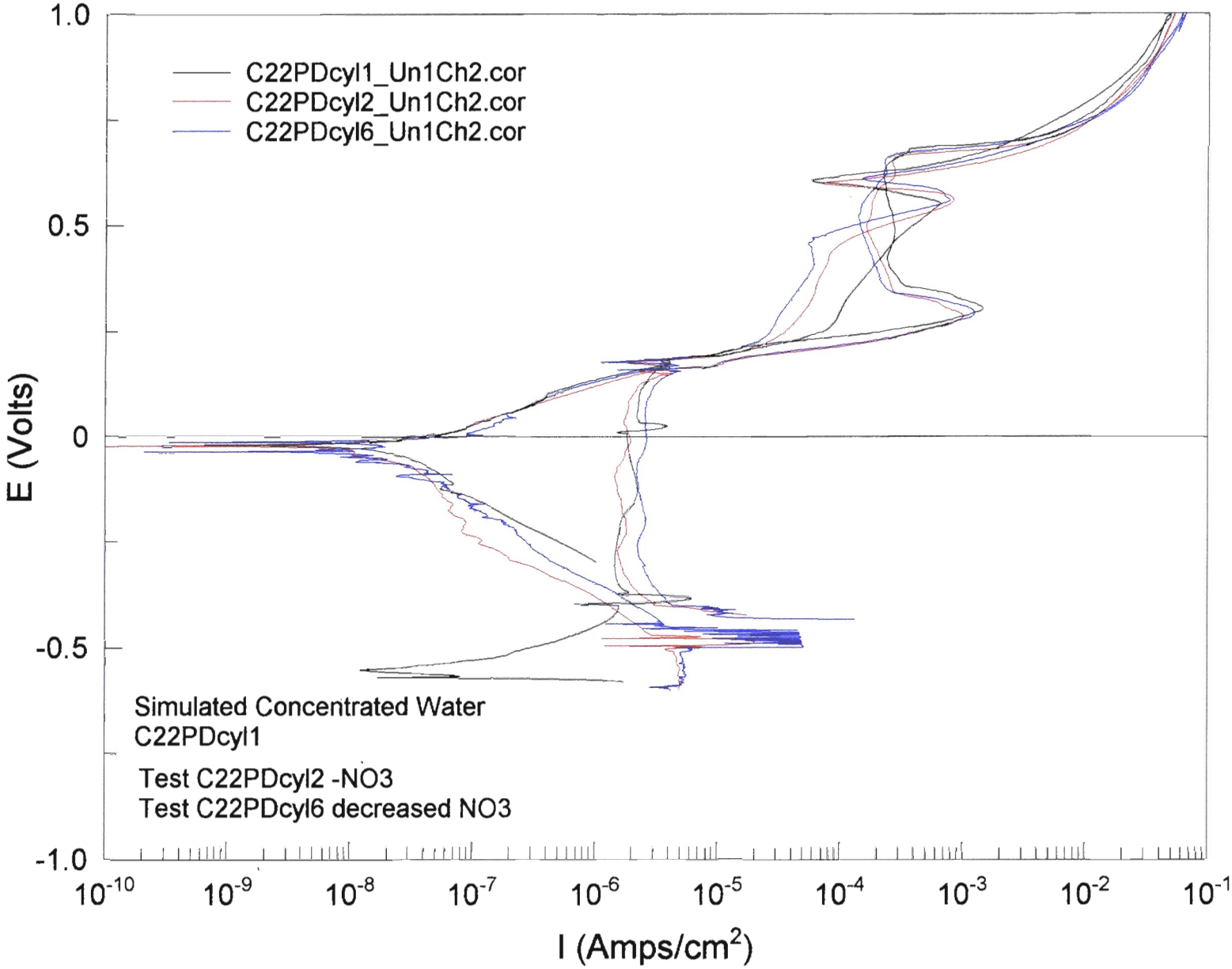
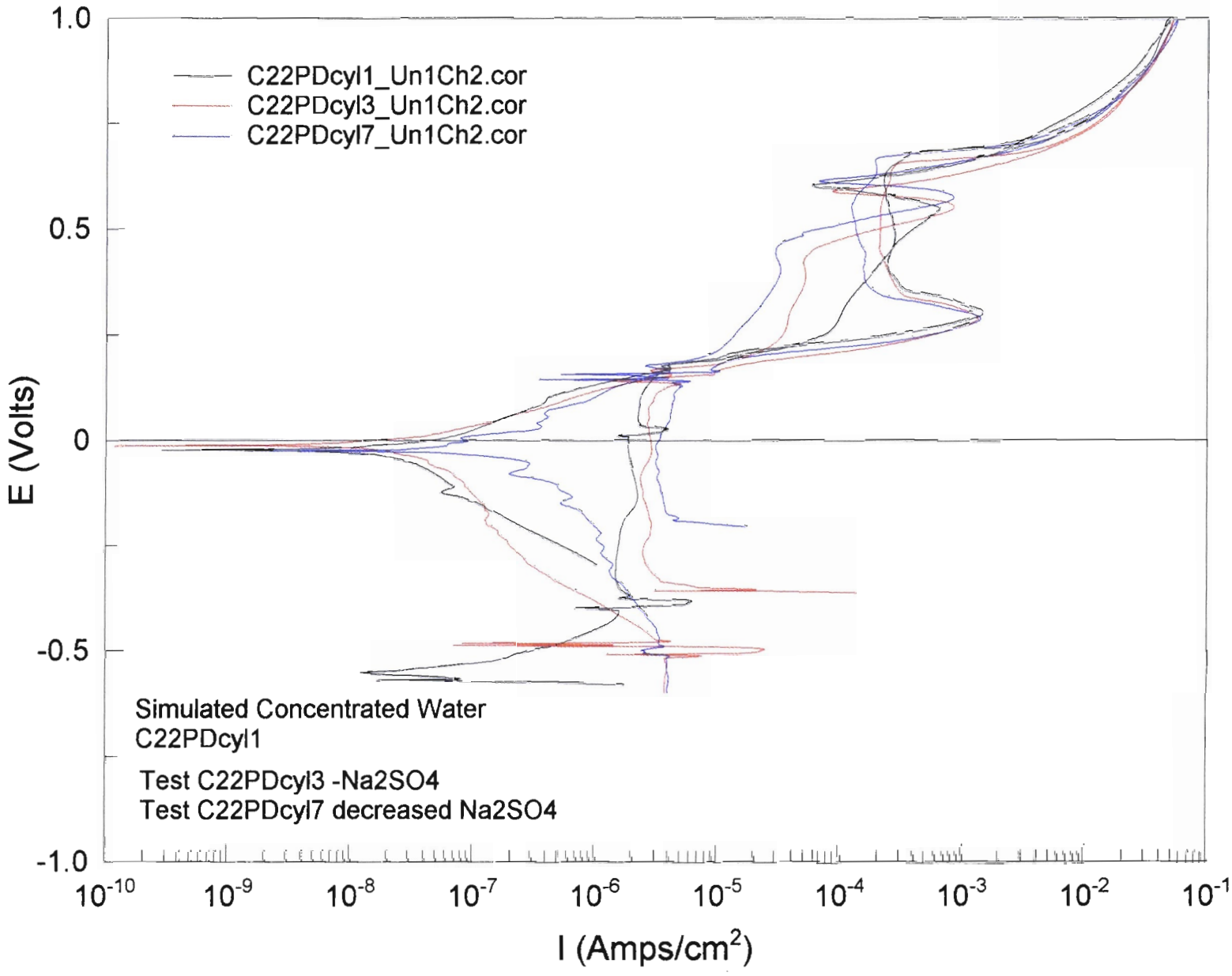
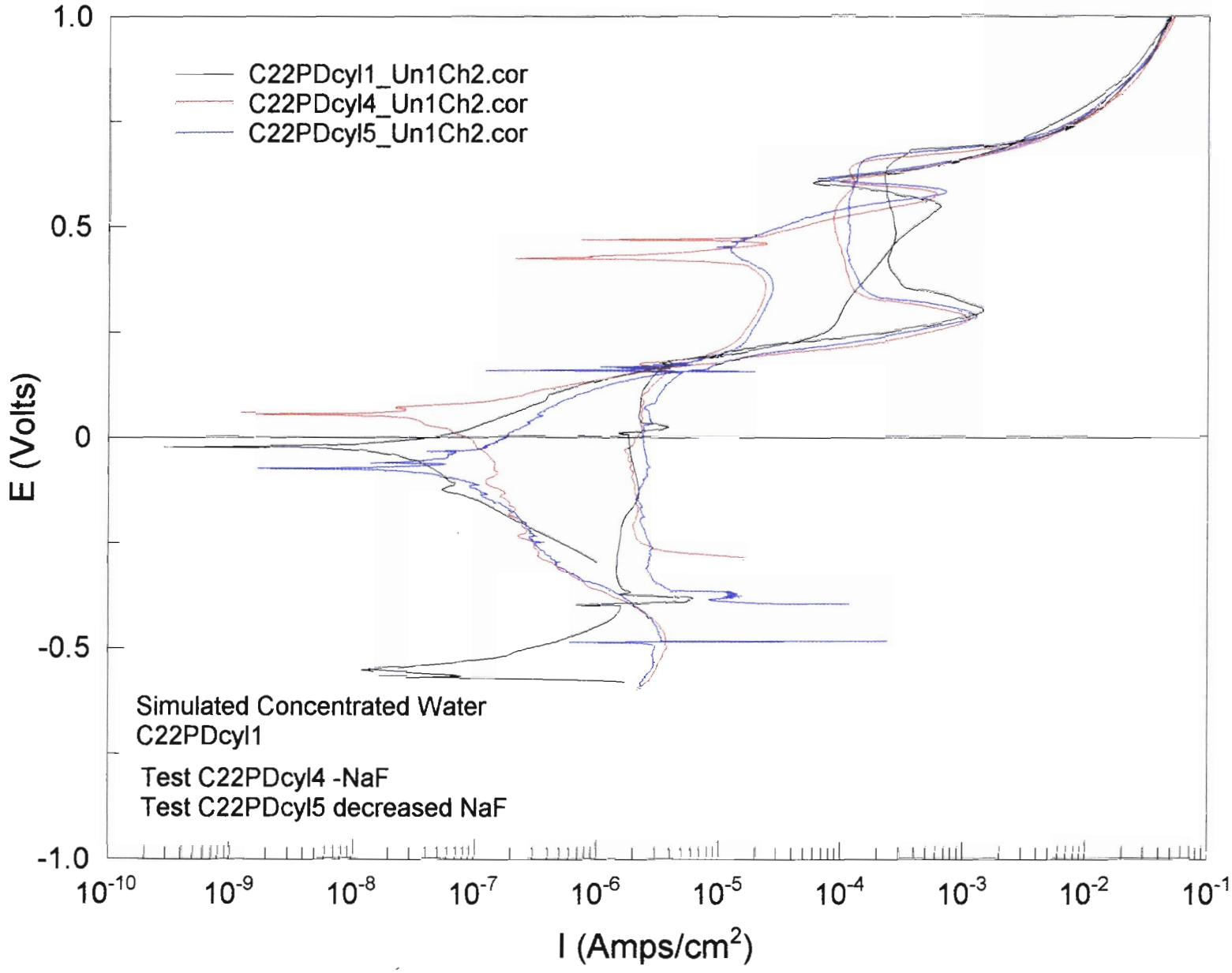
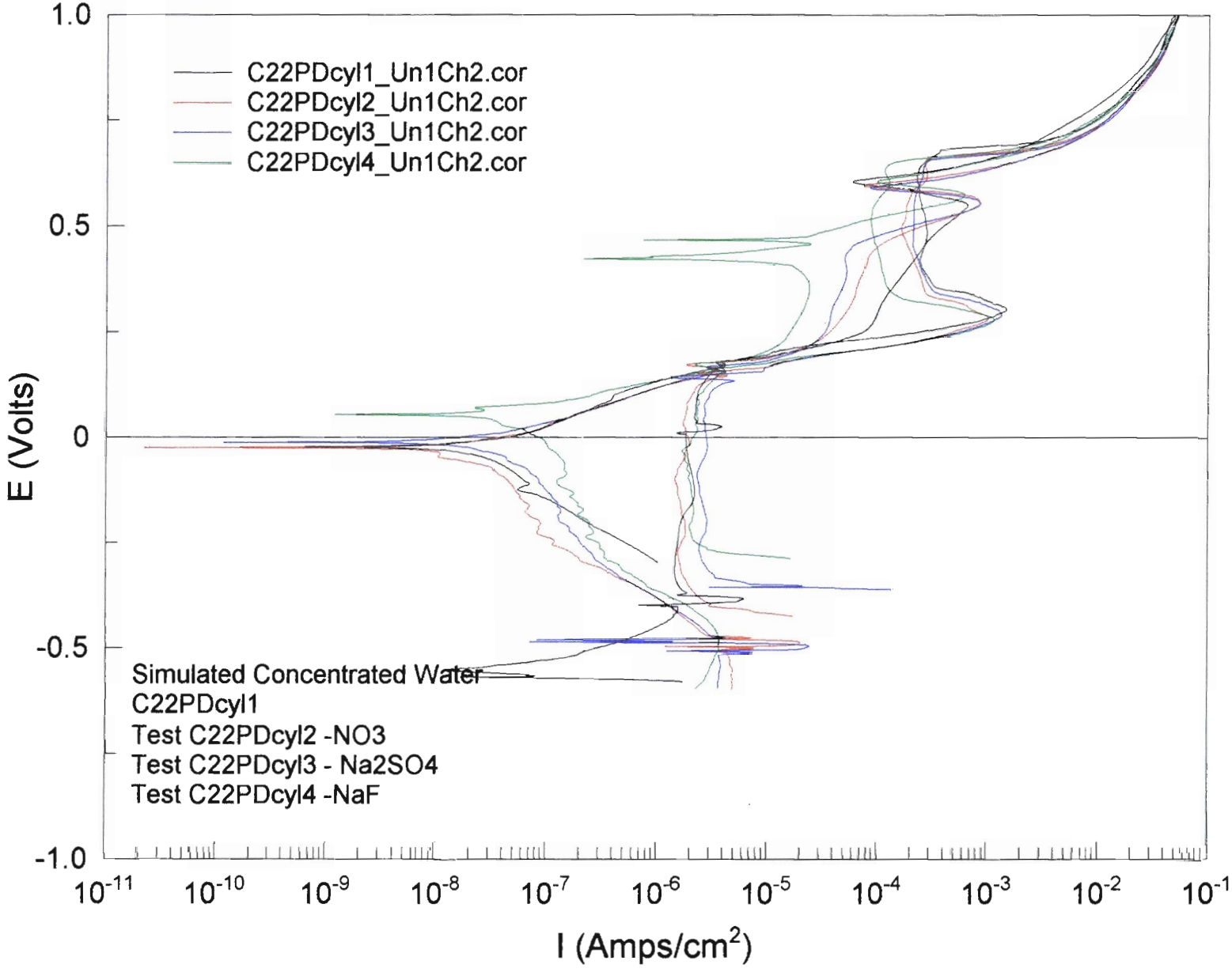

C22PDcyl1_Un1Ch2.cor
C22PDcyl2_Un1Ch2.cor
C22PDcyl6_Un1Ch2.cor
1.0
0.5
0
-0.5
-1.0
E (Volts)
Simulated Concentrated Water
C22PDcyl1
Test C22PDcyl2 -NO3
Test C22PDcyl6 decreased NO3
10-10
10-9
10-8
10-7
10-6
10-5
10-4
10-3
10-2
10-1
I (Amps/cm2)


C22PDcyl1_Un1Ch2.cor
C22PDcyl3_Un1Ch2.cor
C22PDcyl7_Un1Ch2.cor
1.0
0.5
0
-0.5
-1.0
E (Volts)
Simulated Concentrated Water
C22PDcyl1
Test C22PDcyl3 -Na2SO4
Test C22PDcyl7 decreased Na2SO4
10-10
10-9
10-8
10-7
10-6
10-5
10-4
10-3
10-2
10-1
I (Amps/cm2)


C22PDcyl1_Un1Ch2.cor
C22PDcyl4_Un1Ch2.cor
C22PDcyl5_Un1Ch2.cor
1.0
0.5
0
-0.5
-1.0
E (Volts)
Simulated Concentrated Water
C22PDcyl1
Test C22PDcyl4 -NaF
Test C22PDcyl5 decreased NaF
10-10
10-9
10-8
10-7
10-6
10-5
10-4
10-3
10-2
10-1
I (Amps/cm2)



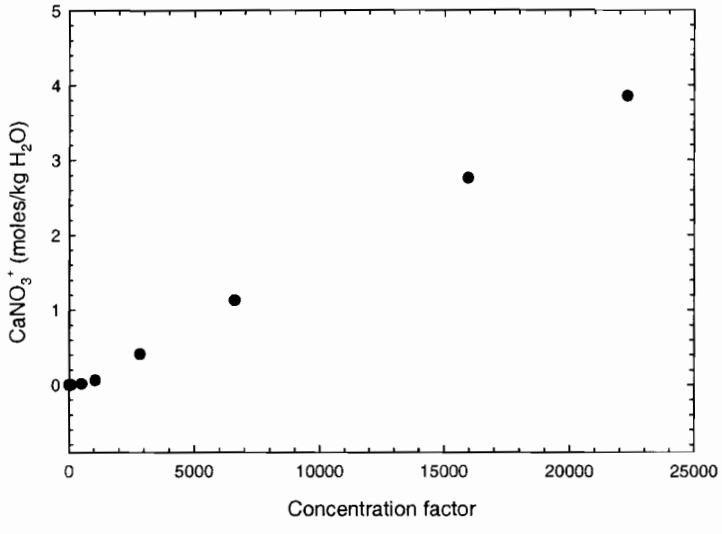
Note: same graph as on pg #38

12/8/03

Synthetic UZ Porewater

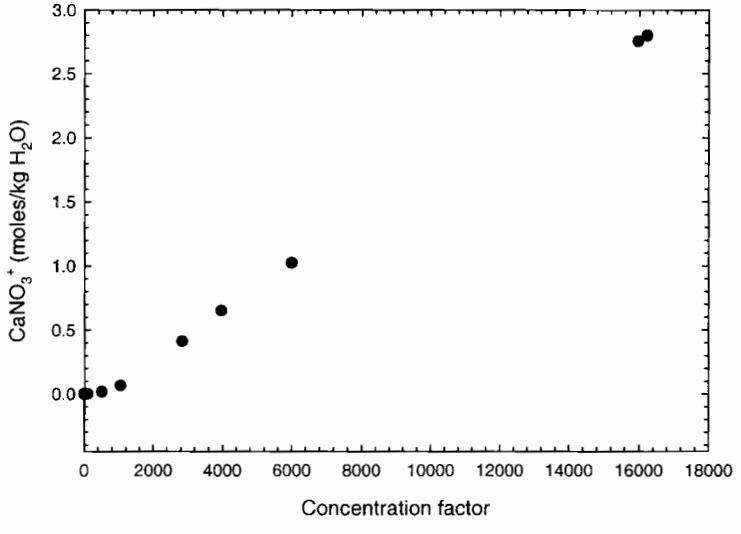
[$CaNO_3^+$] vs conc. factor

Temp = 95 °C



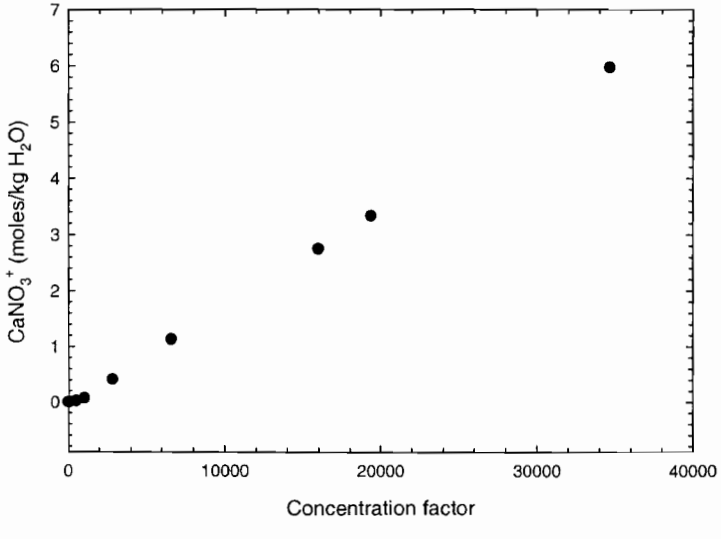
[$CaNO_3^+$] vs conc. factor

Temp = 110 °C



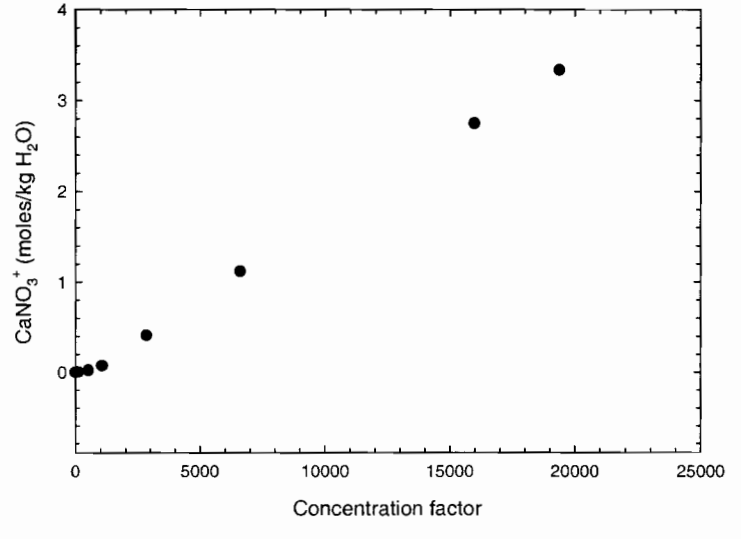
[$CaNO_3^+$] vs conc. factor

Temp = 125 °C



[$CaNO_3^+$] vs conc. factor

Temp = 140 °C



12/4/96

POTENTIODYNAMIC TEST

Objective: see page #5

Specimen: C22 Cylinder Heat# ~~2277-8-3288~~ 2277-3-3266 **CNWRA Drawing 20.01402.571.019 polished to a 600 grit finish** 8/7 6/27/04

Initial Weight: 12.41790g **Model:** Sartorius Genius **SN:** 12809099
Final Weight: 12.41468g **Cal:**11/14/03 **Due:**5/14/04

SOLUTION: simulated concentrated water - KCl

10.873g NaCl cat# 034103 — 192.73g $NaHCO_3$ cat# 028424
17.540g $NaNO_3$ cat# 020809 — 6.198g NaF cat# 991559
41.61g Na_2SO_4 cat# 039451
+DI water to 2000mls

Reagents measured with **Model:** OHAUS **SN:** 2883
Cal: 7/29/03 **Due:** 1/29/~~03~~ 8/100 12/15/03

Initial pH: 8.17 **Model:** orion **SN:**S001A
Final pH: 9.24 **CAL:** 1/9/03 **DUE:** 1/9/04
pH Probe: #13-620-296 **SN:** 2291257P6

TEST TEMPERATURE: 95°C **Measured with Hg Thermometer SN:** C96 377
Cal: 7/15/03 **Due:** 1/15/04

Counter Electrode: Platinum Flag

Reference Electrode: Fisher SCE 13-620-52 **SN:** 025439

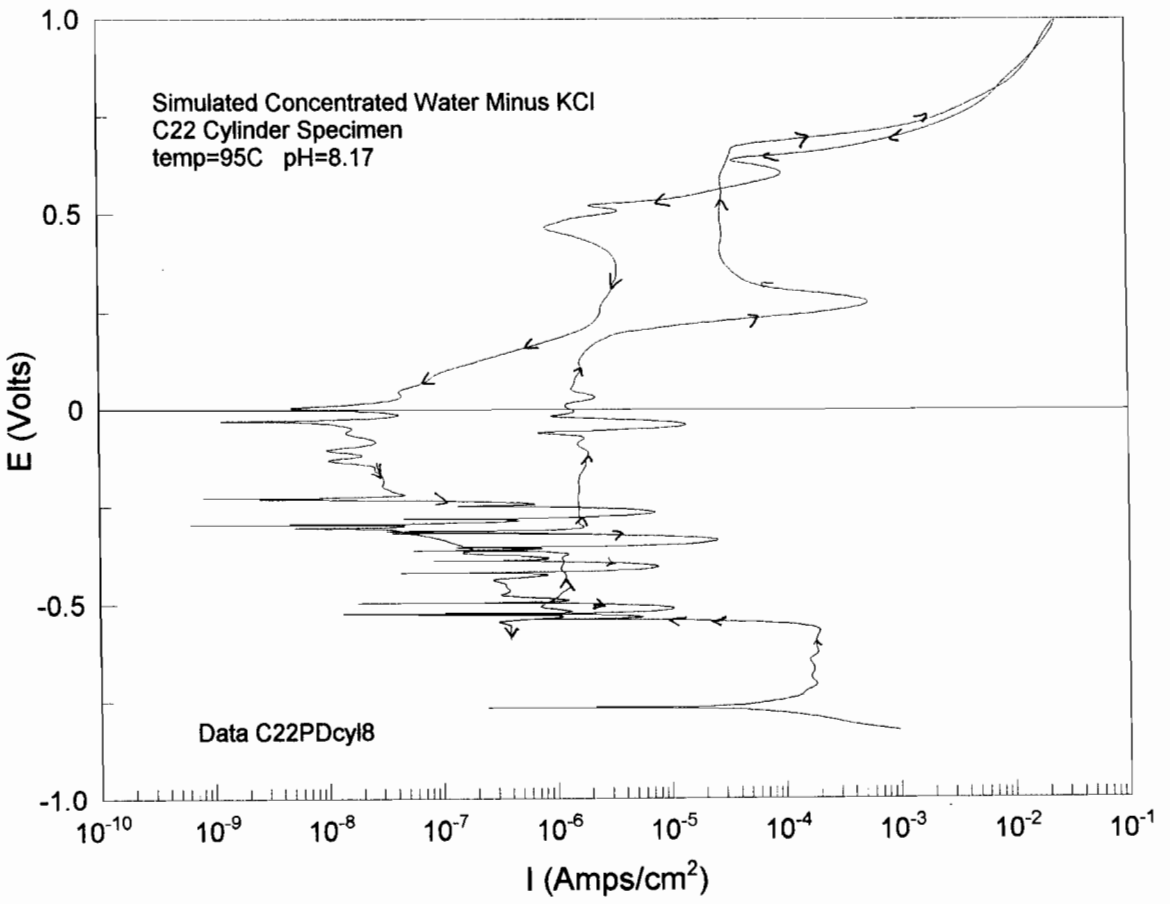
Gas: 99.999% Nitrogen

Ecorr: ~624 mV **Model:** Keithley 614 **SN:** 0704934
Ept: ~464 mV **Cal:** 6/09/03 **Due:** 6/09/04
Eapplied (vs SCE): —

Potentiostat: Solartron 1480 **SN#** 0624055

Specimen Examination: No visual signs of corrosion/pitting surface has dull tint staining

Date C22PDCyl8 12/9/03


Simulated Concentrated Water Minus KCl
C22 Cylinder Specimen
temp=95C pH=8.17
Data C22PDcyl8
E (Volts)
1.0
0.5
0
-0.5
-1.0
10-10
10-9
10-8
10-7
10-6
10-5
10-4
10-3
10-2
10-1
I (Amps/cm2)

12/16/03

POTENTIODYNAMIC TEST

Objective: see page #5

Specimen: C22 Cylinder Heat# ~~2277-6-3266~~ CNWRA Drawing 20.01402.571.019 polished to a 600 grit finish 2277-3-7266 plus 6/27/06

Initial Weight: 12.41745 **Model:** Sartorius Genius **SN:** 12809099
Final Weight: 12.41745 **Cal:** 11/14/03 **Due:** 5/14/04

SOLUTION: Simulated Concentrated water Minus NaCl

12.983g KCl Lot #006247 192.76g $NaNO_3$ Lot #028924
17.581g $NaNO_3$ Lot # 020809 6.201g NaF Lot # 991559
41.63g Na_2SO_4 Lot # 035451
+ DI water To 2000ml

Reagents measured with **Model:** OHAUS **SN:** 2883
Cal: 7/29/03 **Due:** 1/29/~~03~~ 04 also 12/20/03

Initial pH: 7.87 **Model:** orion **SN:** S001A
Final pH: 9.37 **CAL:** 1/9/03 **DUE:** 1/9/04
pH Probe: #13-620-296 **SN:** 2291257P6

TEST TEMPERATURE: 95°C **Measured with Hg Thermometer SN:** C96-377
Cal: 7/15/03 **Due:** 1/15/04

Counter Electrode: Platinum Flag

Reference Electrode: Fisher SCE 13-620-52 **SN:** 0251439

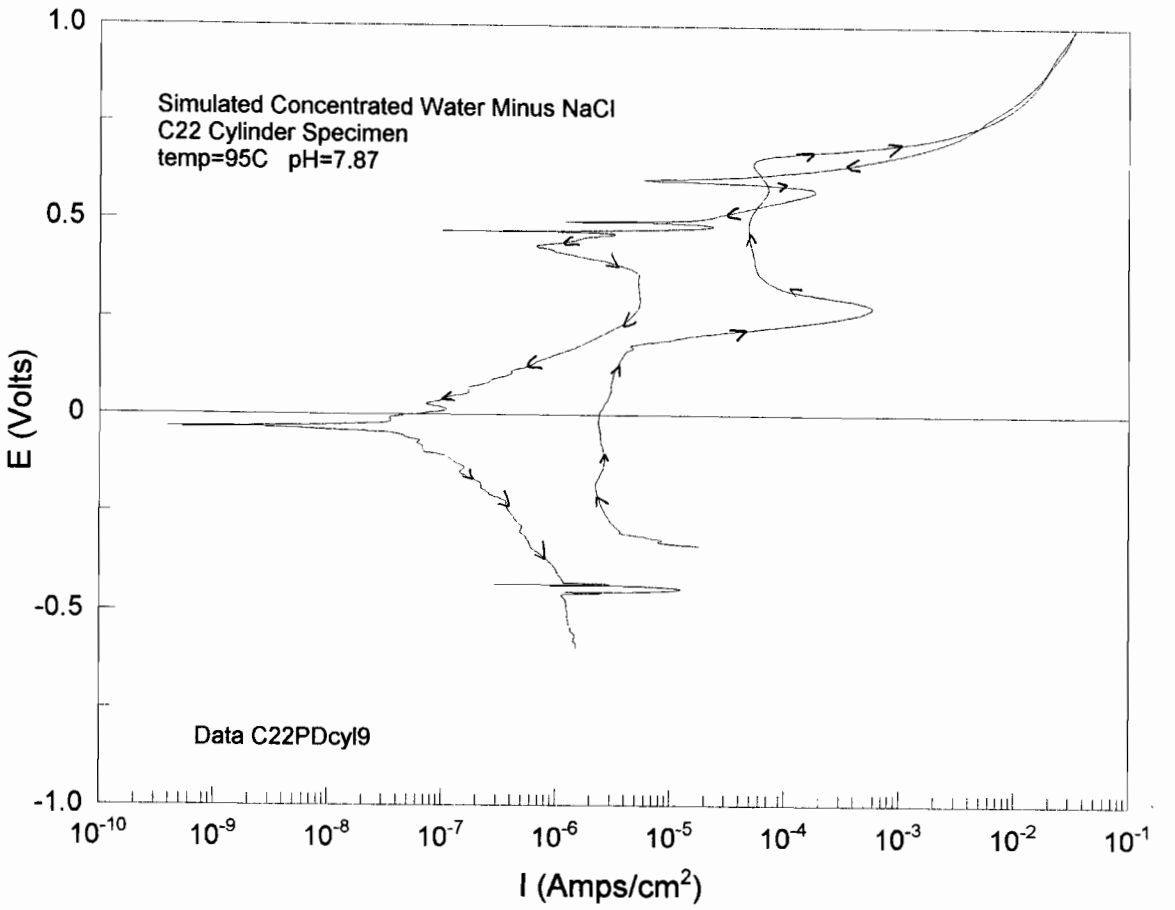
Gas: 99.999% Nitrogen
Ecorr: −241 mv **Model:** Keithley 614 **SN:** 0704934
Ept: −7 mv **Cal:** 6/09/03 **Due:** 6/09/04
Eapplied (vs SCE): –

Potentiostat: Solartron 1480 **SN#** 0024055)

Specimen Examination: No Visual Signs of Corrosion/Pitting
Surface Has Dull tint Staining

Data C22PD cyl 9

12/16/03


Simulated Concentrated Water Minus NaCl
C22 Cylinder Specimen
temp=95C pH=7.87
Data C22PDcyl9
E (Volts)
1.0
0.5
0
-0.5
-1.0
10-10
10-9
10-8
10-7
10-6
10-5
10-4
10-3
10-2
10-1
I (Amps/cm2)

12/17/03

POTENTIODYNAMIC TEST

Objective: see page #5

Specimen: C22 Cylinder Heat# ~~2277-8-3266~~ 2277-3-3266 CNWRA Drawing 20.01402.571.019 polished to a 600 grit finish 6/27/06

Initial Weight: 12.26250g **Model:** Sartorius Genius **SN:** 12809099
Final Weight: 12.25725g **Cal:** 11/14/03 **Due:** 5/14/04

SOLUTION: Simulated Concentrated Water Minus Cl^-

17.502g $NaNO_3$ Lot# 026809 192.7g $NaHCO_3$ Lot# 028924
41.39g Na_2SO_4 Lot# 035451 6.193g NaF Lot# 991559
+ DI water To 2000 mls

Reagents measured with **Model:** OHAUS **SN:** 2883
Cal: 7/29/03 **Due:** 1/29/~~03~~04 01/11/05

Initial pH: 7.78 **Model:** orion **SN:** S001A
Final pH: 9.26 **CAL:** 1/9/03 **DUE:** 1/9/04
pH Probe: #13-620-296 **SN:** 2291257P6

TEST TEMPERATURE: **Measured with Hg Thermometer SN:** C96-377
Cal: 7/15/03 **Due:** 1/15/04

Counter Electrode: Platinum Flag
Reference Electrode: Fisher SCE 13-620-52 **SN:** 0251439

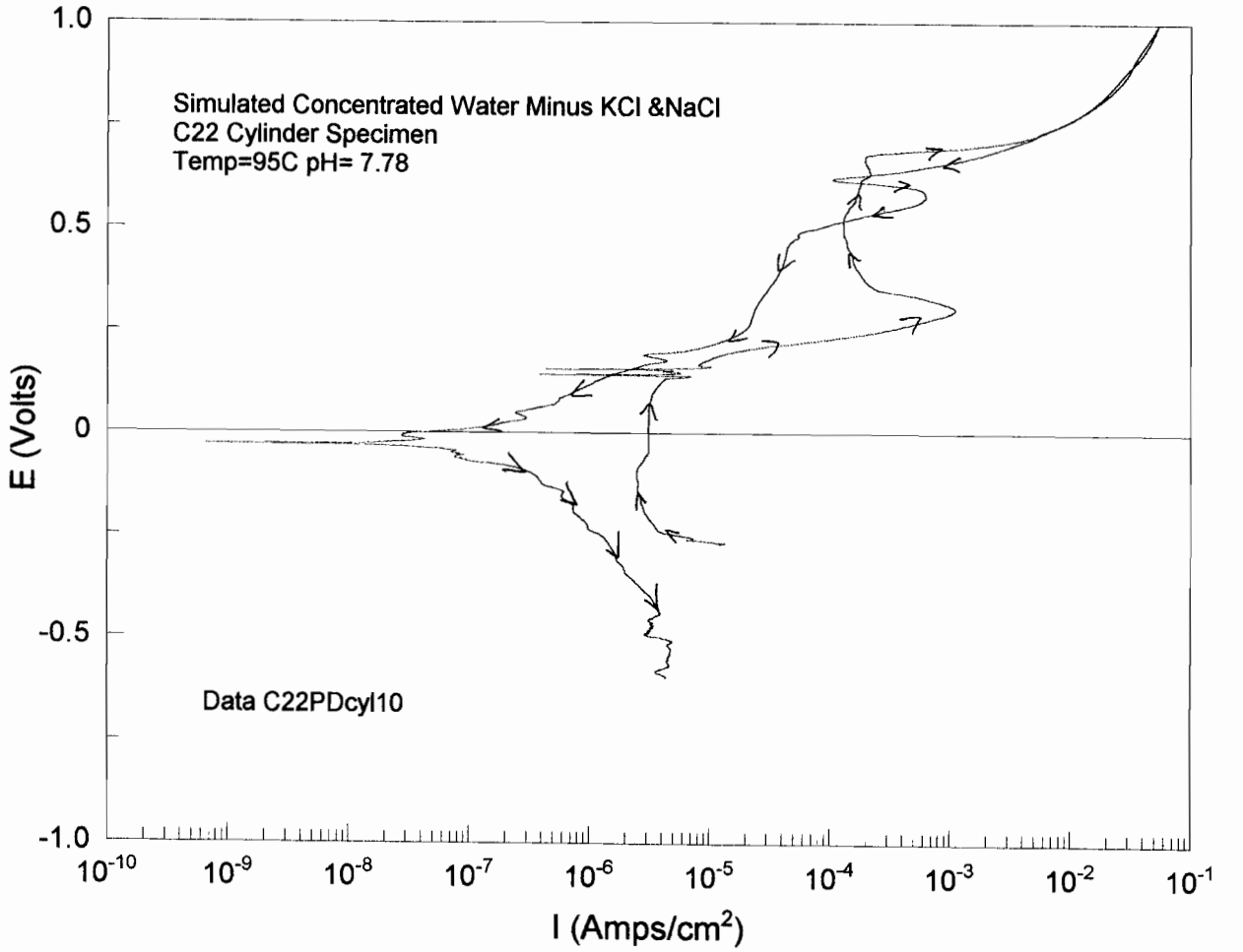
Gas: 99.999% Nitrogen
Ecorr: -224 mv **Model:** Keithley 614 **SN:** 0704934
Ept: -118 mv **Cal:** 6/09/03 **Due:** 6/09/04
Eapplied (vs SCE): —

Potentiostat: Solartron 1480 **SN#** 00240551

Specimen Examination: No visual signs of Corrosion/Pitting Surface has Dull Tint Staining - slight Build up of Material

Data C22PD04/10

12/17/03


Simulated Concentrated Water Minus KCl &NaCl
C22 Cylinder Specimen
Temp=95C pH= 7.78
Data C22PDcyl10
E (Volts)
1.0
0.5
0
-0.5
-1.0
10-10
10-9
10-8
10-7
10-6
10-5
10-4
10-3
10-2
10-1
I (Amps/cm2)

12/17/03

POTENTIODYNAMIC TEST

Objective: see page #5

Specimen: C22 Cylinder Heat# ~~2277-8-3266~~ a277-3-3266 CNWRA Drawing 20.01402.571.019 polished to a 600 grit finish BKO 6/27/04

Initial Weight:	12.42197g	**Model:** Sartorius Genius	**SN:** 12809099
Final Weight:	12.42240g	**Cal:** 11/14/03	**Due:** 5/14/04

SOLUTION: Simulated concentrated water - KCl

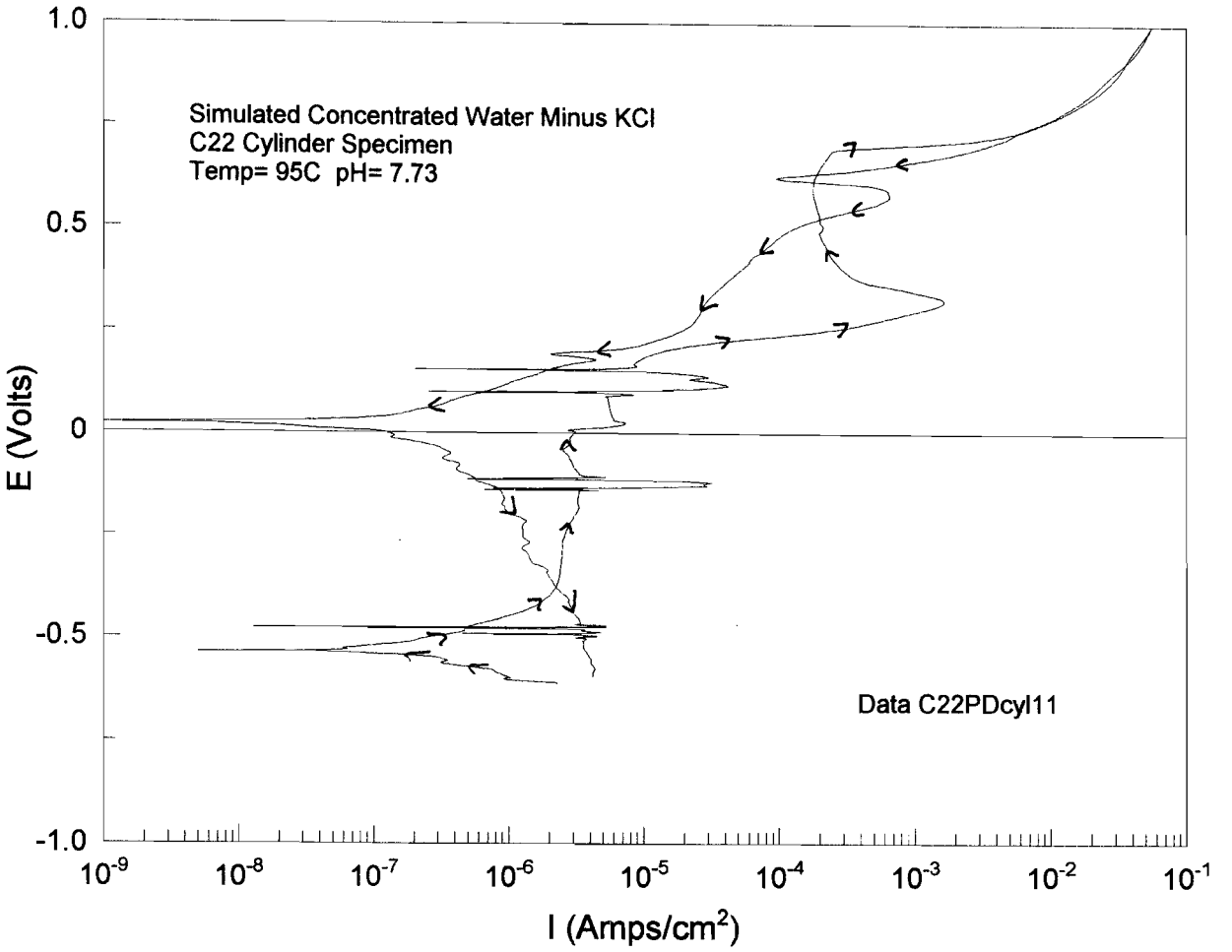
10.877g NaCl Lot # 034103 1.9269 $NaHCO_3$ Lot # 028966
17.522g $NaNO_3$ Lot # 020809 6.192g NaF Lot # 991559
41.39g Na_2SO_4 Lot # 035451
+ DI water to 2000mls

Reagents measured with		**Model:** OHAUS	**SN:** 2883
		Cal: 7/29/03	**Due:** 1/29/~~03~~ 04 BKO 12/11/03
Initial pH:	7.73	**Model:** orion	**SN:** S001A
Final pH:	9.18	**CAL:** 1/9/03	**DUE:** 1/9/04
		pH Probe: #13-620-296	**SN:** 2291257P6
TEST TEMPERATURE:		**Measured with Hg Thermometer SN:**	C96-377
		Cal: 7/15/03	**Due:** 1/15/04
Counter Electrode: Platinum Flag			
Reference Electrode: Fisher SCE		13-620-52	**SN:** 0251435
Gas: 99.999% Nitrogen			
Ecorr:	~ 510mV	**Model:** Keithley 614	**SN:** 0704934
Ept:	~ 277mV	**Cal:** 6/09/03	**Due:** 6/09/04
Eapplied (vs SCE):	—		
Potentiostat: Solartron 1480		**SN#** 00240551	

Specimen Examination: No visual signs of corrosion/pitting surface has dull tint staining

* Note ReRun of Test C22PDCyl8

Data C22PDCyl1 12/19/03


Simulated Concentrated Water Minus KCl
C22 Cylinder Specimen
Temp= 95C pH= 7.73
Data C22PDcyl11
E (Volts)
1.0
0.5
0
-0.5
-1.0
10-9
10-8
10-7
10-6
10-5
10-4
10-3
10-2
10-1
I (Amps/cm2)

12/14/03

POTENTIODYNAMIC TEST

Objective: see page #5

Specimen: C22 Cylinder Heat# ~~2277-8-3266~~ 2277-3-3266 CNWRA Drawing 20.01402.571.019 polished to a 600 grit finish BH 6/27/04

Initial Weight: 12.40619 g **Model:** Sartorius Genius **SN:** 12809099
Final Weight: 12.40991 g **Cal:** 11/14/03 **Due:** 5/14/04

SOLUTION: Simulated Concentrated Water x2 NaF
12.974 g KCl Lot# 006242
10.861 g NaCl Lot# 035421
17.562 g $NaNO_3$ Lot# 020809
41.42 g Na_2SO_4 Lot# 035451
192.69 g $NaHCO_3$ Lot# 028966
* 12.43 g NaF Lot# 991559
+ DI water To 2000 mls

Reagents measured with **Model:** OHAUS **SN:** 2883
Cal: 7/29/03 **Due:** 1/29/04

Initial pH: 7.69 **Model:** orion **SN:** 2230
Final pH: 8.91 **Cal:** 7/15/03 **DUE:** 7/15/04
pH Probe: #13-620-296 **SN:** 2291257P6

TEST TEMPERATURE: **Measured with Hg Thermometer SN:** C96-377
Cal: 7/15/03 **Due:** 1/15/04

Counter Electrode: Platinum Flag

Reference Electrode: Fisher SCE 13-620-52 **SN:** 0251439

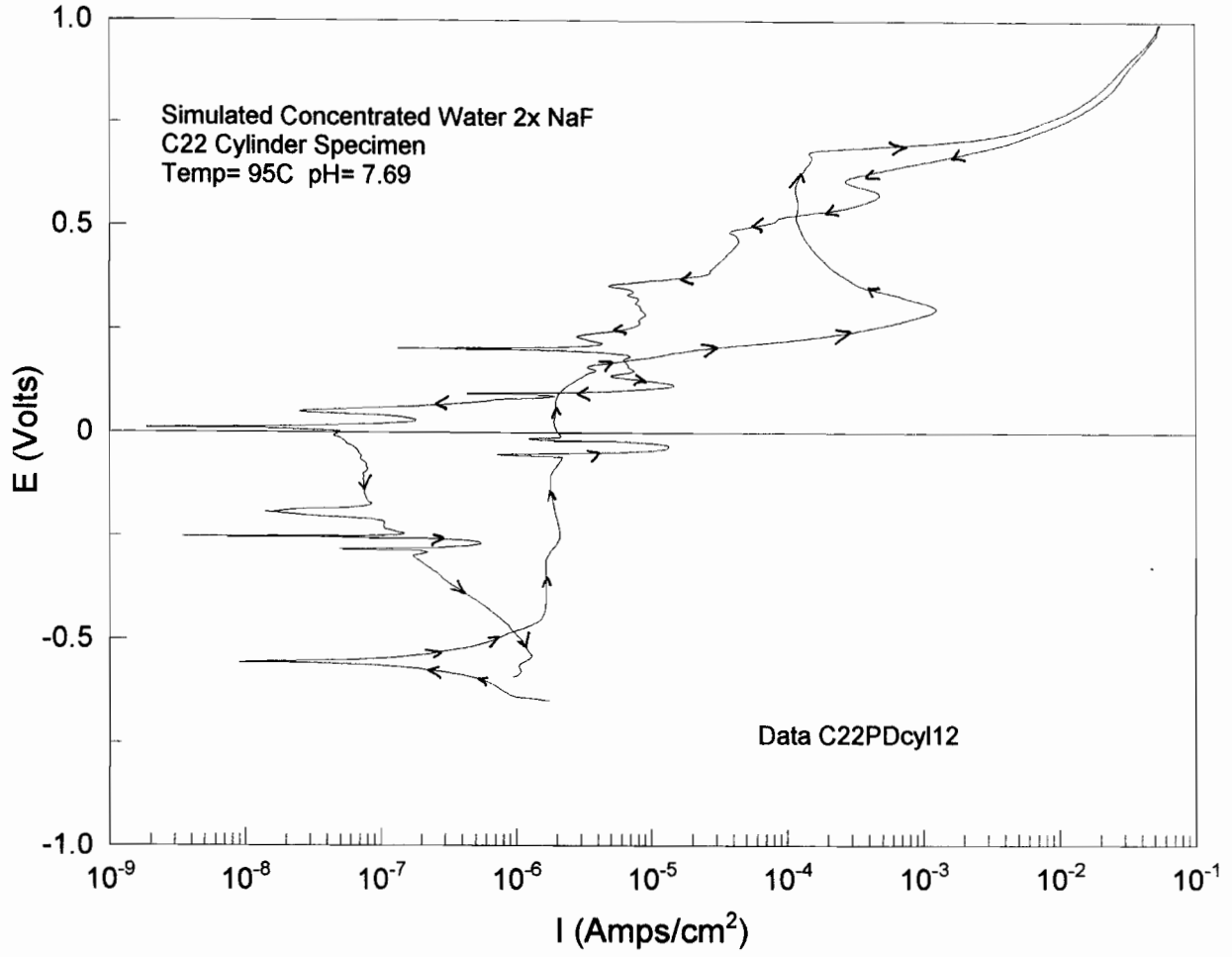
Gas: 99.999% Nitrogen

Ecorr: -550 mV **Model:** Keithley 614 **SN:** 0704934
Ept: -285 mV **Cal:** 6/09/03 **Due:** 6/09/04
Eapplied (vs SCE): –

Potentiostat: Solartron 1480 **SN#** 0024055/

Specimen Examination: No Visual Signs of Corrosion / Pitting
All Surface Area has Dull tint staining

Data C22P04/12 [signature] 1/13/04 KTC 1/13/04
HB/03



1/14/03 1/14/04
KTC 1/14/04

POTENTIODYNAMIC TEST

Objective: see page #5

Specimen: C22 Cylinder Heat# ~~2277-8-3266~~ 2277-3-3266 **CNWRA Drawing 20.01402.571.019 polished to a 600 grit finish** 600 6/27/04

Initial Weight:	12.38099 g	**Model:** Sartorius Genius	**SN:** 12809099
Final Weight:	12.31700 g	**Cal:**11/14/03	**Due:**5/14/04

SOLUTION: simulated Concentrated Water Minus $NaNO_3$ X2 NaF

12.974 g KCl Lot# 006242 — 192.71 g $NaHCO_3$ Lot# 028966

10.860 g NaCl Lot# 035421 — 12.44 g NaF Lot# 991559

41.41 g Na_2SO_4 Lot# 038451

+ DI water To 2000 mls

Reagents measured with	**Model:** OHAUS	**SN:** 2883
	Cal: 7/29/03	**Due:** 1/29/04
Initial pH: 7.69	**Model:** orion	**SN:2230**
Final pH: 8.93	**Cal:**7/15/03	**DUE:**7/15/04
	pH Probe: #13-620-296	**SN:** 2291257P6
TEST TEMPERATURE:	**Measured with Hg Thermometer SN:** C96-377	
	Cal: 7/15/03	**Due:** 1/15/04

Counter Electrode: Platinum Flag

Reference Electrode: Fisher SCE 13-620-52 **SN:** 025 1489

Gas: 99.999% Nitrogen

Ecorr: ~698 mV	**Model:** Keithley 614	**SN:** 0704934
Ept: ~ 383 mV	**Cal:** 6/09/03	**Due:** 6/09/04
Eapplied (vs SCE): –		

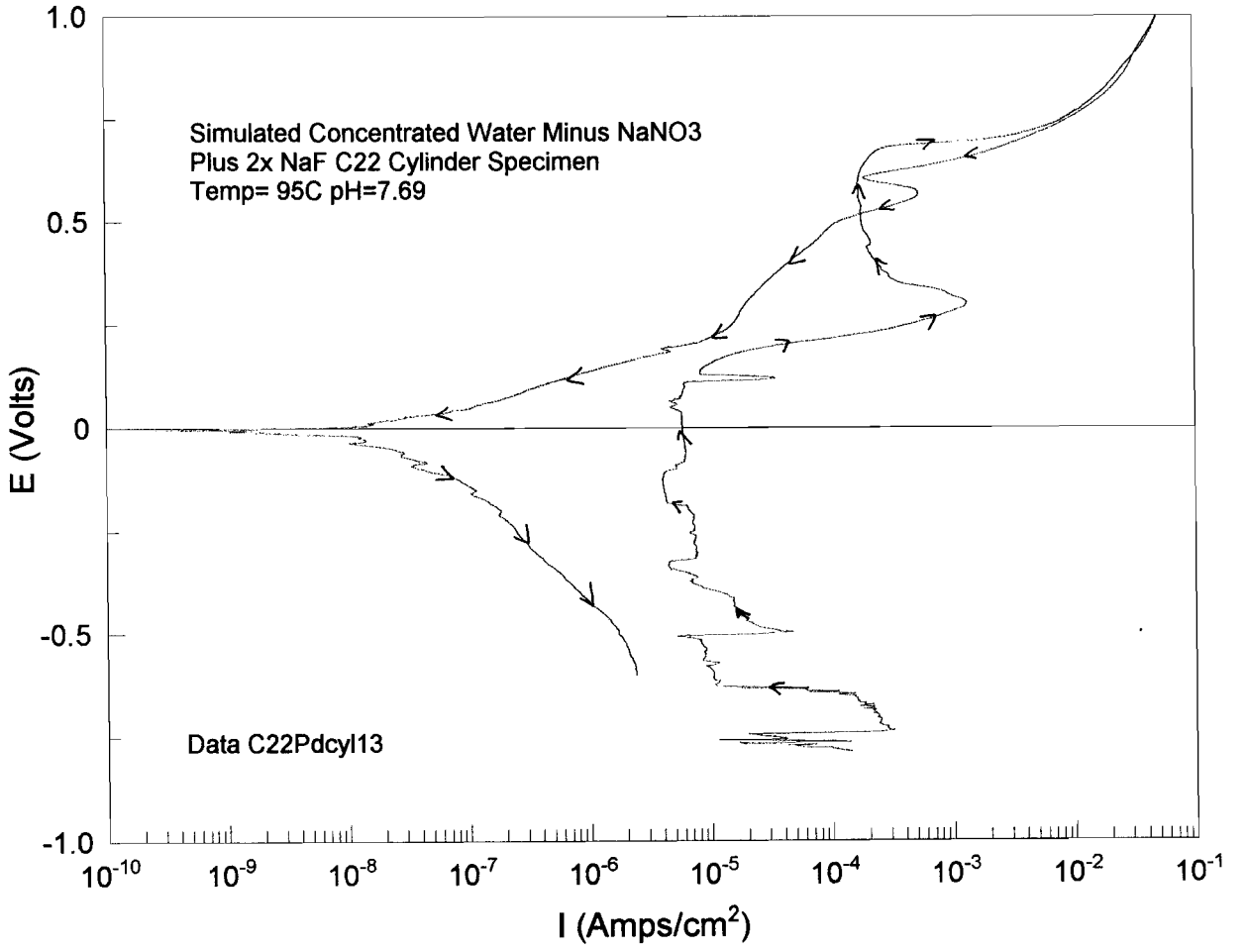
Potentiostat: Solartron 1480 **SN#** 00240557

Specimen Examination: No visual signs of Corrosion / pitting

dull tint staining on All surfaces of Specimen

Data C22PD04/13

1/14/03 1/14/04 KTC 1/14/04

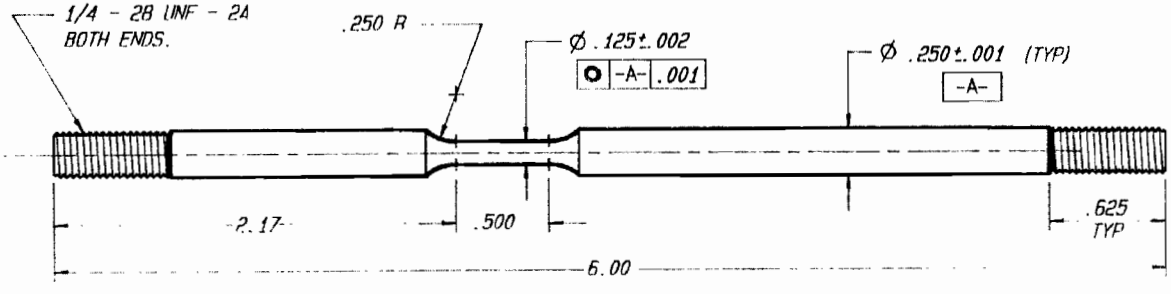


K. J. Chung 1/15/04

Ken Chiang
SwRI-CNWRA
Phone: (210) 522-2308
Fax: (210) 522-5184
e-mail: Kchiang@swri.org

SwRI DRAWING # 20-03704-042-001

LTR	DESCRIPTION	DATE	APPROVED



NOTE:
1. DO NOT UNDERCUT RADII
2. USE LOW STRESS MACHINING PROCEDURE

FIND NO.	QTY REQ.	SIZE	CODE IDENT NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
					PARTS LIST

BASIC DIMENSIONS	DECIMALS 2 PLACE	DECIMALS 3 PLACE	FRACTIONS
UNDER 6	± .01	± .003	± 1/32
6-84 INCL	± .03	± .010	± 1/16
OVER 84	± .06	± .015	± 1/8
ANGLES	± 0° 30'		± 1° 0'

CONTRACT		
DWN	4-10-1992	A. NAGY
CKD		
MECH		
ELECT		

MATERIAL: 0.5 THICK PLATE SUPPLIED
FINISH: 16 RMS
USED ON:
QTY. REQD.:
D:\20\SSRSPEC1

SOUTHWEST RESEARCH INSTITUTE
SLOW STRAIN RATE SPECIMEN
B
DRAWING NO. 20-3704-042-1
SCALE 2 = 1
SHEET

K.J. Chiang 1-13-04
Initiator: K. Chiang Date

Daniel Dunn for V. Jain
Reviewer: V. Jain Date 1/13/04

Mark R. Shinstine for 1/13/04
QA Approval: R. Brient Date

K.J. Chiang
4/8/04

Initial Entry for Corrosion Resistant Material:
Slow Strain Rate Tests:

Title: Slow Strain Rate Tests

Tests performed by: Walter Machowski

Objective: see page 5 of Notebook #695

Equipment: ESC 440 multichannel Potentiostat w/ National Instruments Labview data aquisition software. Glass test cell (~500ml) w/ Teflon top & bottom. Load cell #1 on Frame #5
SwRI Test Frame #5

Materials: Alloy C-22 mill annealed; GMAW and GTAW alloy 22 welded
HT # 2277-3-3292 Filler WN 813/XX1977.8611 Bld 6/27/06

Specimens: Cylindrical SSR Specimens; see drawing on page 62

see revised initial entry on
p. 70 of Notebook #695

K. J. Chiang 4/26/04

Load Cell Calibration Data

Load Cell 1

Volts	1	2	3	Load Cell 4
0.463	500	496	495	507
0.893	998	996	994	998
1.325	1500	1497	1500	1508
1.755	2000	1995	1999	2005
2.185	2499	2499	2500	2505
2.614	2999	2999	2996	2997
3.041	3501	3495	3497	3492
3.410	3995	3992	3993	3983

LVDT Calibration

Gage ID	Value	1	2	3
	0	1.000	1.000	1.000
X369A	0.0625	0.938	0.938	0.938
Y242A	0.1251	0.875	0.875	0.875
Y455A	0.2500	0.749	0.749	0.749
Y649A	0.5001	0.500	0.500	0.500
Y189B	1.000	0.000	0.000	0.000

*All readings in inches

K. T. Chung
4/26/04

SLOW STRAIN RATE TEST

Objective: see page #5 NOTEBK #695

Specimen: MA Alloy 22 SwRI Drawing # 20-03704-042-001

Heat# ~~2277-3-3266~~ 2277-3-3266 MT 6/21/04

Solution: N/A specimen run in air

Reagents measured with **Model:** N/A **SN:**
Cal: **Due:**

Counter Electrode: N/A **Reference Electrode:**

Gas: N/A **Ecorr:**

Eapplied: **Potentiostat:** N/A **SN:**

Specimen Visual:

metallic sheen - ~~no~~ discoloration
looks like normal ductile failure

$\dot{\varepsilon}^{o} = 3.2 \times 10^{-6}\ s^{-1}$

data file: SSRMA22_air

Walter J. Mackowiak 4/26/2004

SLOW STRAIN RATE TEST

SSRMA_SCW01

Objective: see page #5

Specimen: MA Alloy 22 SwRI Drawing # 20-03704-042-001 2277-3-3266 6/27/06
Heat # ~~2277-8-3266~~

Solution: Simulated Concentrated Water w/DI x2 liters

12.956	KCl	Lot # 006242	$NaHCO_3$	192.684	#028966
10.862	NaCl	# 035421	NaF	6.185	#006679
17.503	$NaNO_3$	# 897674			
41.384	Na_2SO_4	# 035451			

pH 7.76 adj to 8.90 w/ NaOH

Reagents measured with **Model:** Orion S **SN:** 2883
Cal: 2 Feb 04 **Due:** 2 Aug 04

Counter Electrode: Pt flag **Reference Electrode:** Ag/AgCl

Gas: 99.999 N_2 **Ecorr:** −196 mV in house w/3M KCl

Eapplied: * +415 mV **Potentiostat:** ESC 440-2 **SN:** 9209138

Specimen Visual:

no discoloration - many crack initiation sites; looks like brittle failure

post test pH 9.70 $\dot{\epsilon} = 3.2 \times 10^{-6}\ s^{-1}$

* Temp offset between RT and 95°C Δ13 mV

data file: SSRMA_SCW01
SSRMA22_SCW01

Walter J. Markuski 4/26/04

SLOW STRAIN RATE TEST

Objective: see page #5 Notebook #695

Specimen: MA Alloy 22 SwRI Drawing # 20-03704-042-001 BKa 6/27/06

Heat # ~~2277-8-3266~~ 2277-3-3266

Solution:

same solution as p.66

SCW

(used remaining 1 liter)

Reagents measured with **Model:** OHAUS **SN:** 2883
Cal: 2 FEB 04 **Due:** 2 AUG 04

Counter Electrode: Pt Flag **Reference Electrode:** Ag/AgCl in house w/ 3M KCl

Gas: 99.999 N_2 **Ecorr:** −230 mV

Eapplied: * +415 mV **Potentiostat:** ESC 440-2 **SN:** 9209138

Specimen Visual: very slight "gold-brown" discoloration; many crack initiation sites; looks like brittle fracture

$\dot{\epsilon}^{\circ} = 3.2 \times 10^{-6}\ s^{-1}$ final pH 9.86

* Temp offset between RT + 95°C Δ13 mV

data file: 55RMA22_SCW02

Walter J. Mackerle 4/5/11/04

SLOW STRAIN RATE TEST

Objective: see page #5

Specimen: MA Alloy 22 SwRI Drawing # 20-03704-042-001

Heat # ~~2299-8-3266~~ 2277-3-3266 BIW 6/27/01

Solution: X 1 liter w/DI

96.339 $NaHCO_3$ #991559
6.479 KCl Lot#005573
5.438 NaCl Na_2SO_4 #035421
20.699 ~~$NaHCO_3$~~ #028964
3.088 NaF 7/8/04 #991559

SCW minus NO_3^-

pH_{ini} 7.34 ↓ 8.73

pH_{final} 9.02

Reagents measured with **Model:** ORION S **SN:** 2683
Cal: 2 FEB 04 **Due:** 2 AUG 04

Counter Electrode: Pt Flag **Reference Electrode:** Ag/AgCl in house w/3M KCl

Gas 99.99% N_2 **Ecorr:** −403 mV

Eapplied: +415 mV* **Potentiostat:** ESC 440-2 **SN:** 9209138

Specimen Visual: slightly dull color; still metallic grey-silver; many crack initiation sites; looks like brittle fracture

$\dot{\epsilon} = 3.2 \times 10^{-6}\ s^{-1}$

* Temp offset between RT and 95°C Δ13mV

pH adj from 7.34 → 8.73 w/10M NaOH

data file: SSRMA22_SCW03

Walter J. Mecharthi 5/13/04

SLOW STRAIN RATE TEST

Objective: see page #5 Notebook # 695

Specimen: MA Alloy 22 SwRI Drawing # 20-03704-042-001

SCW minus $SO_4^=$ Heat ~~# 2277-8-3266~~ 2277-3-3266 BID 6/27/06

Solution: X liter w/DI

6.480 g KCl LA#005593 96.341 g $NaHCO_3$ #028966

5.433 g NaCl #035421 3.109 g NaF #006679

8.749 g $NaNO_3$ #020809 pH ini 7.45 adj → 8.73

pH final 9.99

Reagents measured with **Model:** OHAUS **SN:** 2883

Cal: 2 FEB 04 **Due:** 2 AUG 04

Counter Electrode: Pt flag **Reference Electrode:** $Ag/AgCl$ in bridge w/ 3M KCl

Gas: 99.999 N_2 **Ecorr:** −142 mV

* **Eapplied:** +415mV **Potentiostat:** ESC 440-2 **SN:** 950938

Specimen Visual: slightly dull color; still metallic grey-silver; many crack initiation sites; look like brittle fracture

$\dot{\epsilon}^\circ = 3.2 \times 10^{-6}\ s^{-1}$

* Temp offset between RT and 95°C Δ13 mV
pH adjusted w/ 10M NaOH

---

data file: SSRMA22_SCW04

Walter J. Mackowski 5/18/04

SLOW STRAIN RATE TEST

Objective: see page #5

Specimen: MA Alloy 22 SwRI Drawing # 20-03704-042-001

Heat # ~~2277-8-3266~~ 2277-3-3266 BLD 6/27/01

Solution: x 1 liter DI SCW minus NaCl

6.146 g KCl Lot # 005623
8.758 $NaNO_3$ # 020809
20.697 Na_2SO_4 # 035451
96.349 g $NaHCO_3$ # 028966
3.098 NaF # 006679

Reagents measured with **Model:** ~~ORION~~ **SN:** 2883
Cal: 2 FEB 04 **Due:** 2 AUG 04

Counter Electrode: Pt flag **Reference Electrode:** Ag/AgCl in house w/ 3M KCl

Gas: N_2 (99.999%) **Ecorr:** -167 mV

*Eapplied: +415 mV **Potentiostat:** ESC 440-2 **SN:** 9209138

Specimen Visual: metallic-grey silver; crack initiation sites; looks like brittle fracture

$\dot{\varepsilon}^{\circ} = 3.2 \times 10^{-6}\ s^{-1}$ pH = 7.38 → 8.81 final 9.98

* temp difference between RT and 95 °C Δ13 mV

data file: SSRMA22_SCW06

Walter J. Mankowski
5/24/04

SLOW STRAIN RATE TEST

Objective: see page #5 Notebook # 695

Specimen: MA Alloy 22 SwRI Drawing # 20-03704-042-001
Heat # ~~2222-8-3266~~ 2277-3-3266 BHD 6/27/06

Solution: x 1 liter DI SCW minus F⁻

6.460 g KCl # 005593 20.693 Na_2SO_4 035451
5.340 NaCl 035421 96.352 $NaHCO_3$ 028966
8.754 $NaNO_3$ 020809

Reagents measured with **Model:** ORION 5 **SN:** 2883
Cal: 2 FEB 04 **Due:** 2 AUG 04

Counter Electrode: Pt flag **Reference Electrode:** $Ag/AgCl$ in house w/3M KCl

Gas: N_2 99.999 **Ecorr:** −335 mV

*Eapplied: +415 mV **Potentiostat:** ESC 440-2 **SN:** 9209138

Specimen Visual: metallic grey-silver; many crack initiation sites; look like brittle fracture

$\dot{\epsilon} = 3.2 \times 10^{-6} s^{-1}$ pH 7.37 adj → 8.72 10.00 final

* temp difference between RT and 95°C Δ 13 mV

data file: SSRMA22_SCW05

K. J. Chung 5/28/04

SLOW STRAIN RATE TEST

Objective: see page #5

Specimen: MA Alloy 22 SwRI Drawing # 20-03704-042-001

Heat # ~~2277-8-3266~~ 2277-3-3266 BKD 6/27/06

Solution: ~~X~~ 1 liter DI 3.8M NaCl + 0.38M $NaNO_3$

44.243 g $NaNO_3$ lot # 020809

222.27 g NaCl # 035421

Reagents measured with **Model:** ~~OHAUS~~ **SN:** 2883
Cal: 2 FEB 04 **Due:** 2 AUG 04

Counter Electrode: Pt flag **Reference Electrode:** Ag/AgCl in home w/ 3M KCl

Gas: N_2 (99.999) **Ecorr:** −311 mV

*Eapplied: +415 mV **Potentiostat:** ESC 440-2 **SN:** 9209138

Specimen Visual: metallic grey-silver; very slight staining; looks like ductile fracture

$\dot{\epsilon} = 3.2 \times 10^{-6}\ s^{-1}$ pH = 4.10 → 9.80 final 10.00

* temp difference between RT and 95°C Δ13 mV

data file: SSRMA22_SCW 07

Walter J. Mackowiak
6/1/2004

SLOW STRAIN RATE TEST

Objective: see page #5 Notebook #695

Specimen: MA Alloy 22 SwRI Drawing # 20-03704-042-001

Heat # ~~2227-8-3266~~ 2277-3-3266 B/ED 6/27/06

Solution: x / liter DI 3.8M NaCl + 0.38M $NaNO_3$

same solution as p. 72
(used on SSRMA22-SCW07)
(used remaining 500 ml)

Reagents measured with **Model:** ONAUS **SN:** 2883
Cal: 2 FEB 04 **Due:** 2 AUG 04

Counter Electrode: **Reference Electrode:**

Gas: **Ecorr:** −283 mV

* **Eapplied:** +215 mV **Potentiostat:** ESC440-2 **SN:** 9209138

Specimen Visual: metallic grey-silver; very slight staining; looks like ductile fracture

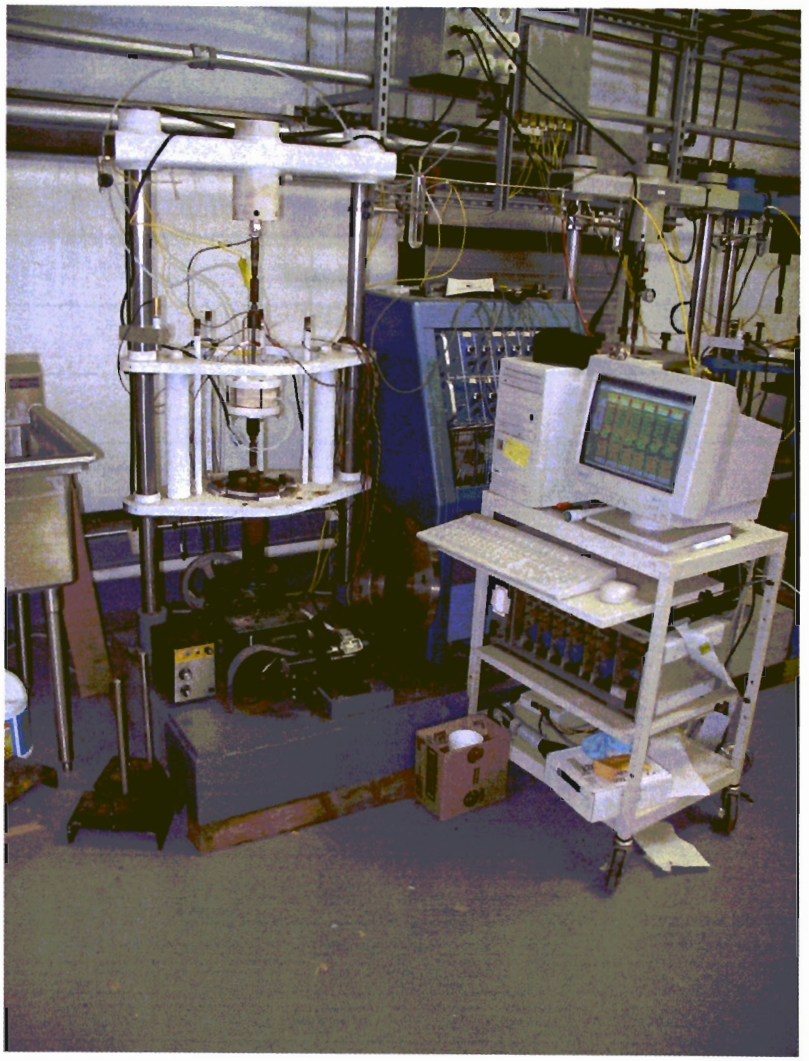
$\dot{\epsilon}^{\circ} = 3.2 \times 10^{-6}\ s^{-1}$

pH = 4.10 → 9.80
final 10.09

* temp difference between RT and 95°C Δ13 mV

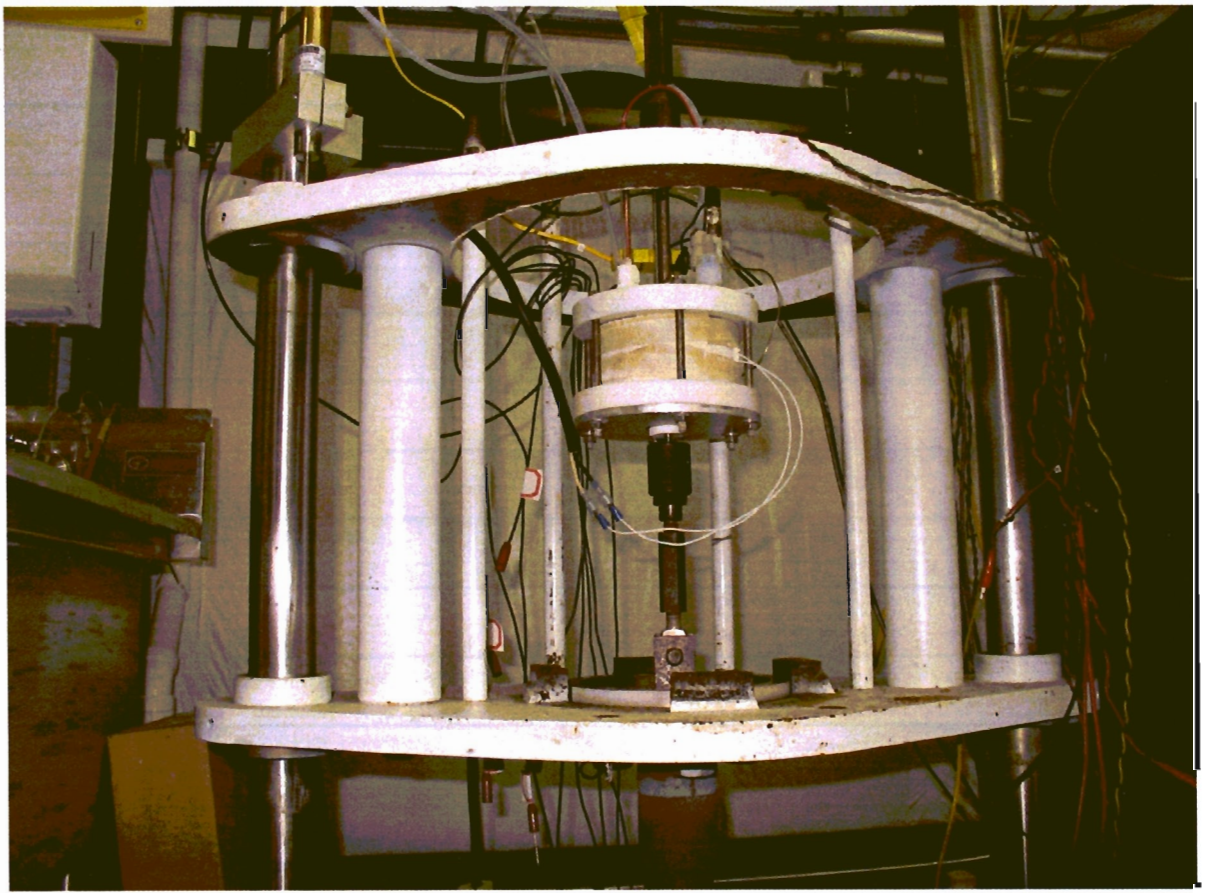
data file: SSRMA22-SCW08

Walter J. Mackowiak 6/8/2004



Test frame with test cell and peripheral data aquisition equipment

Walter J. Mackowski
6/11/04



Close-up of test cell mounted in test frame.

Walter K. Boesenberg
6/11/04

SLOW STRAIN RATE TEST

Objective: see page #5 Notebook #695

Specimen: MA Alloy 22 SwRI Drawing # 20-03704-042-001

Heat # ~~2277-8-3266~~ 2277-3-3266 BJD 6/27/01

Solution: x 1 liter DI 3.8M NaCl + 0.38M $NaNO_3$

44.290 g $NaNO_3$ Lot # 030809

222.300 g NaCl # 035421

Reagents measured with **Model:** ~~ORION~~ **SN:** 2883
Cal: 2 FEB 04 **Due:** 6 AUG 04

Counter Electrode: Pt flag **Reference Electrode:** Ag/AgCl in bore w/ 3m KCl

Gas: N_2 (99.999%) **Ecorr:** −283 mV

*Eapplied: +415 mV **Potentiostat:** ESC 440-2 **SN:** 9209138

Specimen Visual:

metallic grey-silver; looks like ductile fracture

pH 8.18
not adjusted
final pH 6.77

$\dot{\epsilon}^{\circ} = 3.2 \times 10^{-6}\ s^{-1}$

* temp difference between RT and 95°C Δ13 mV

data file: SSRMA22—SCW09

Walter J. Mackowiak
6/14/04

SLOW STRAIN RATE TEST

Objective: see page #5 Notebook #695

Specimen: MA Alloy 22 SwRI Drawing # 20-03704-042-001

Heat # ~~2277-3-3266~~ 2277-3-3266 BM 6/21/06

Solution:

same solution mixed for SCW09 on p. 76

Reagents measured with **Model:** ORION **SN:** 2883
Cal: 2 FEB 04 **Due:** 6 AUG 04

Counter Electrode: Pt flag **Reference Electrode:** Ag/AgCl w/3m KCl

Gas: N_2 (99.999) **Ecorr:** −297

Eapplied: +215mV **Potentiostat:** ESC 440-2 **SN:** 9209138

Specimen Visual:

metallic grey-silver; looks like ductile fracture

pH 8.18
not adjusted
final pH 7.49

$\dot{\epsilon} = 3.2 \times 10^{-6}\ s^{-1}$

* temp difference RT and 95°C Δ13mV

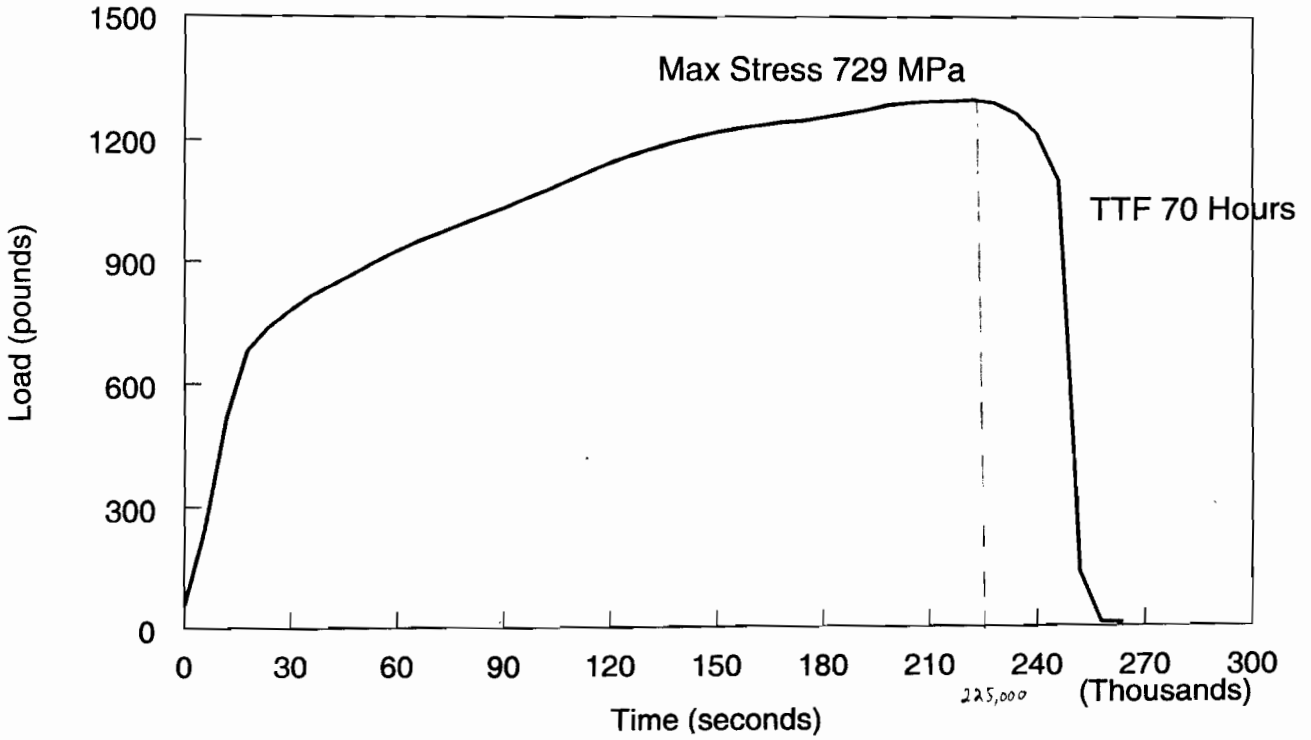
data file: SSRMA22 – SCW10

Walter J. Mackerras
6/21/04

Slow Strain Rate test

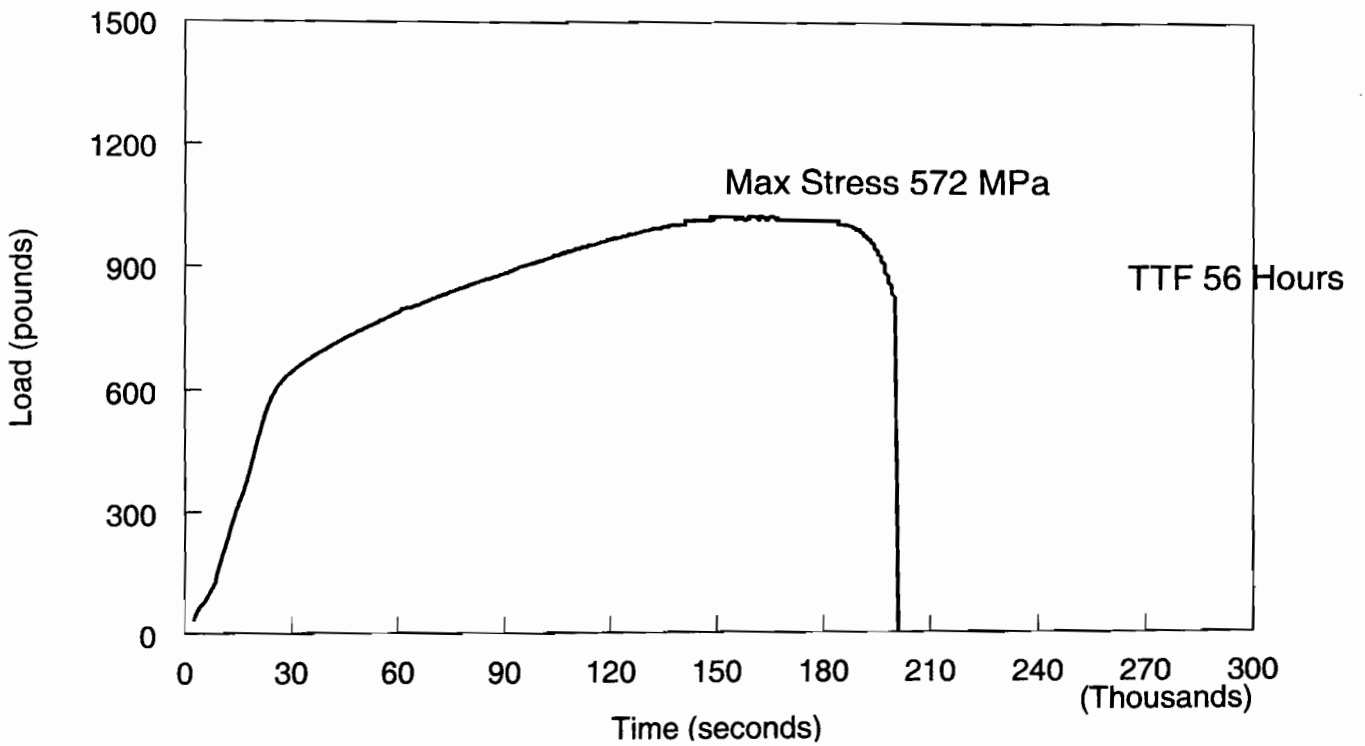
Ambient Air

SSRMA22_air



Simulated Concentrated Water

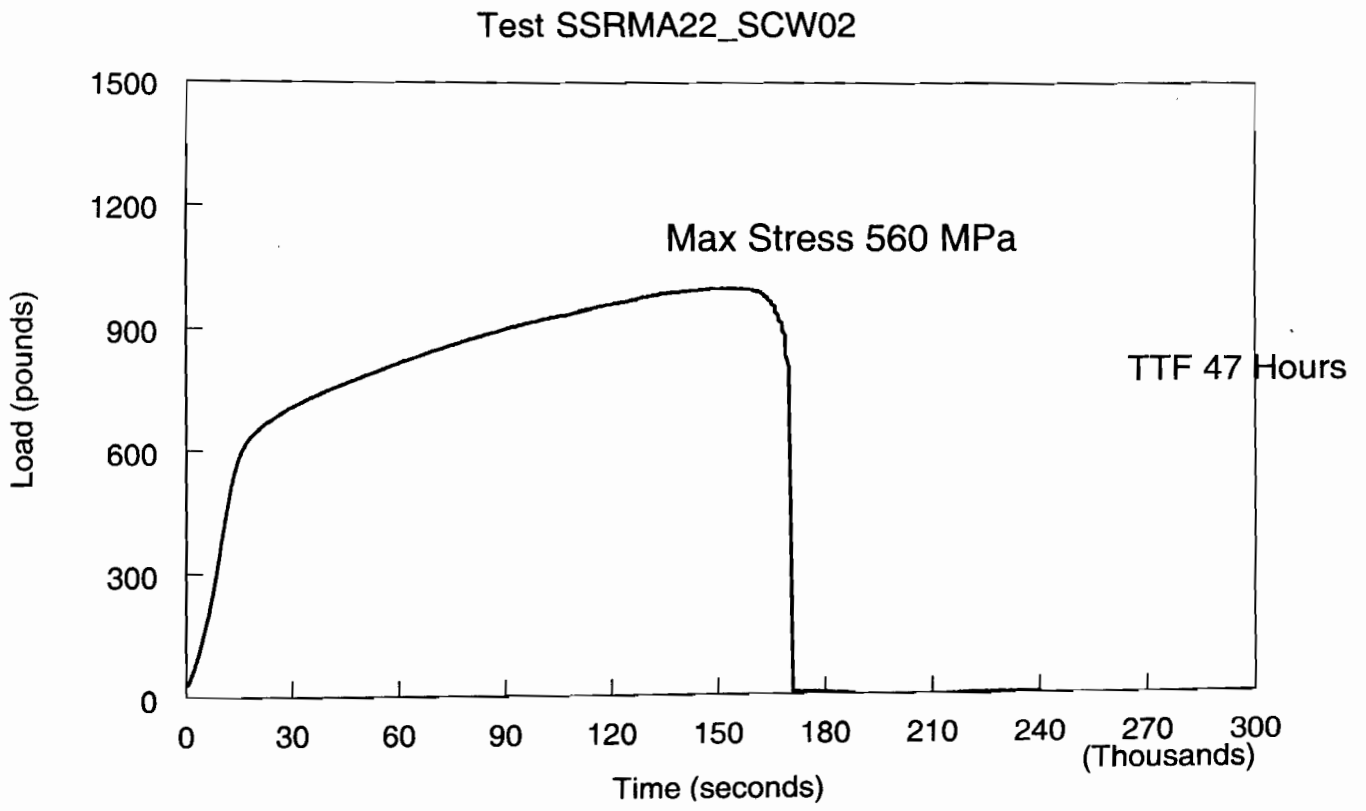
Test SSRMA22_SCW01



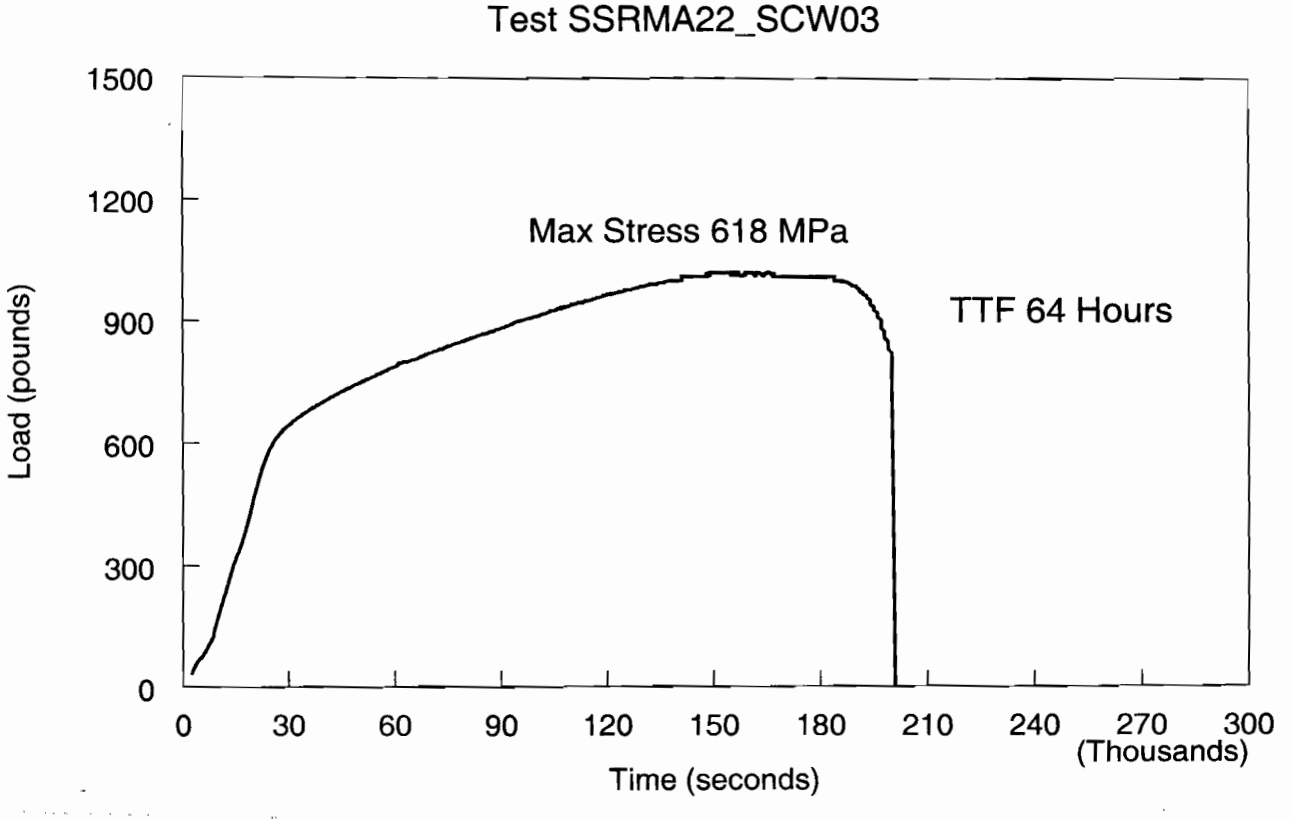
Walter D. Mackowski 6/21/04

Slow Strain Rate test

Simulated Concentrated Water



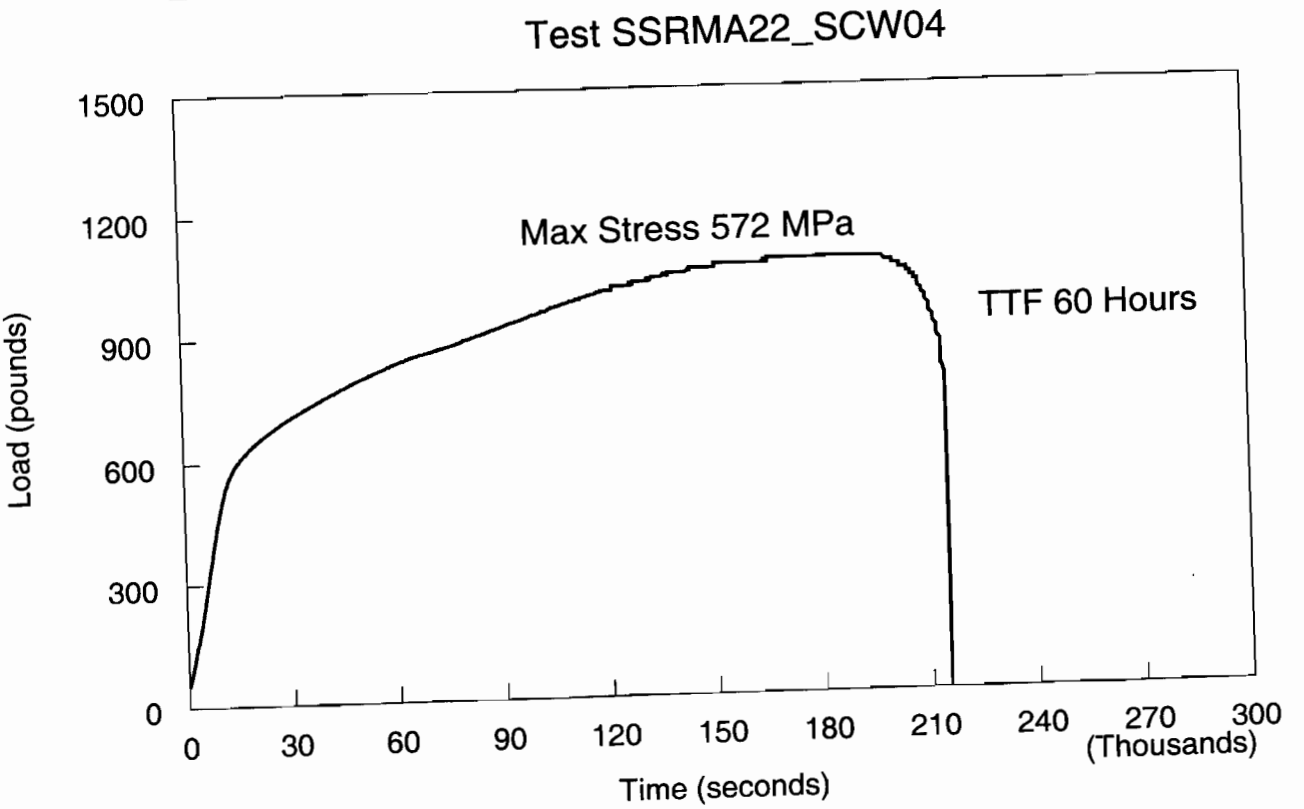
Simulated Concentrated Water - NO3



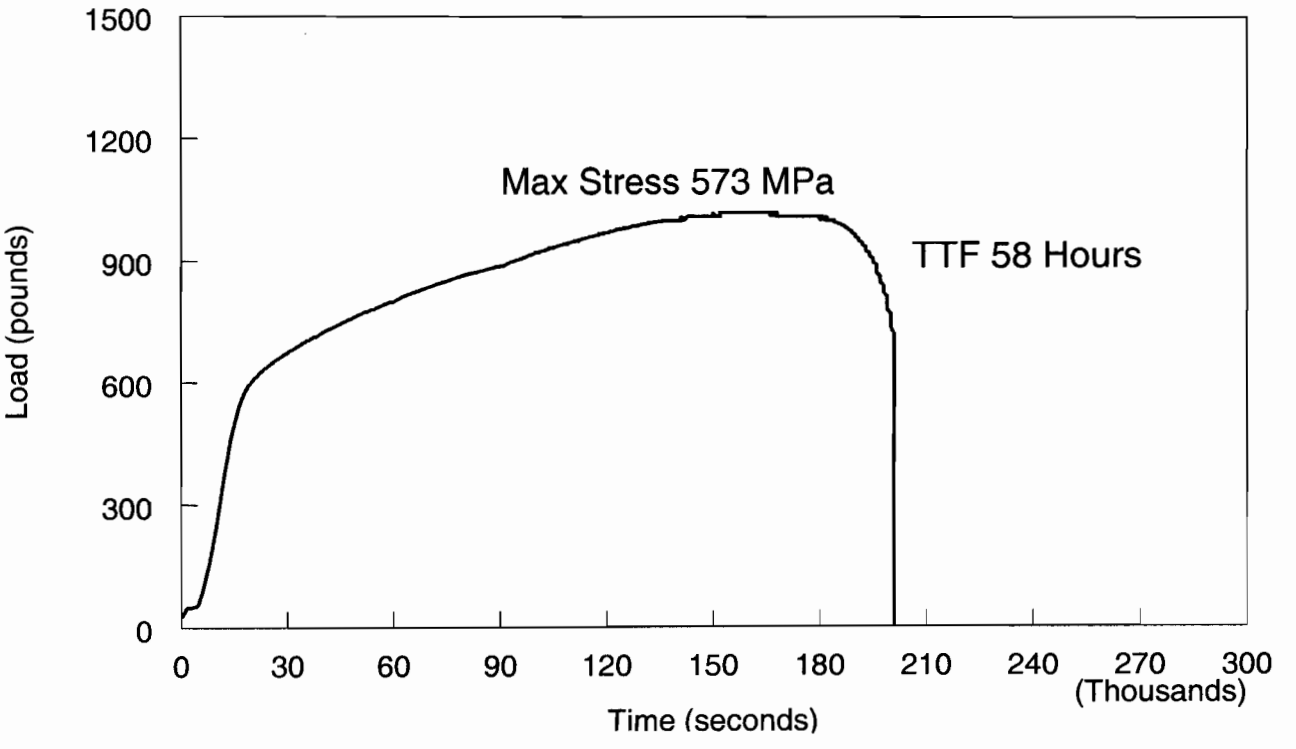
Walter J. Machowski 6/21/04

Slow Strain Rate test

Simulated Concentrated Water - SO4



Simulated Concentrated Water - F

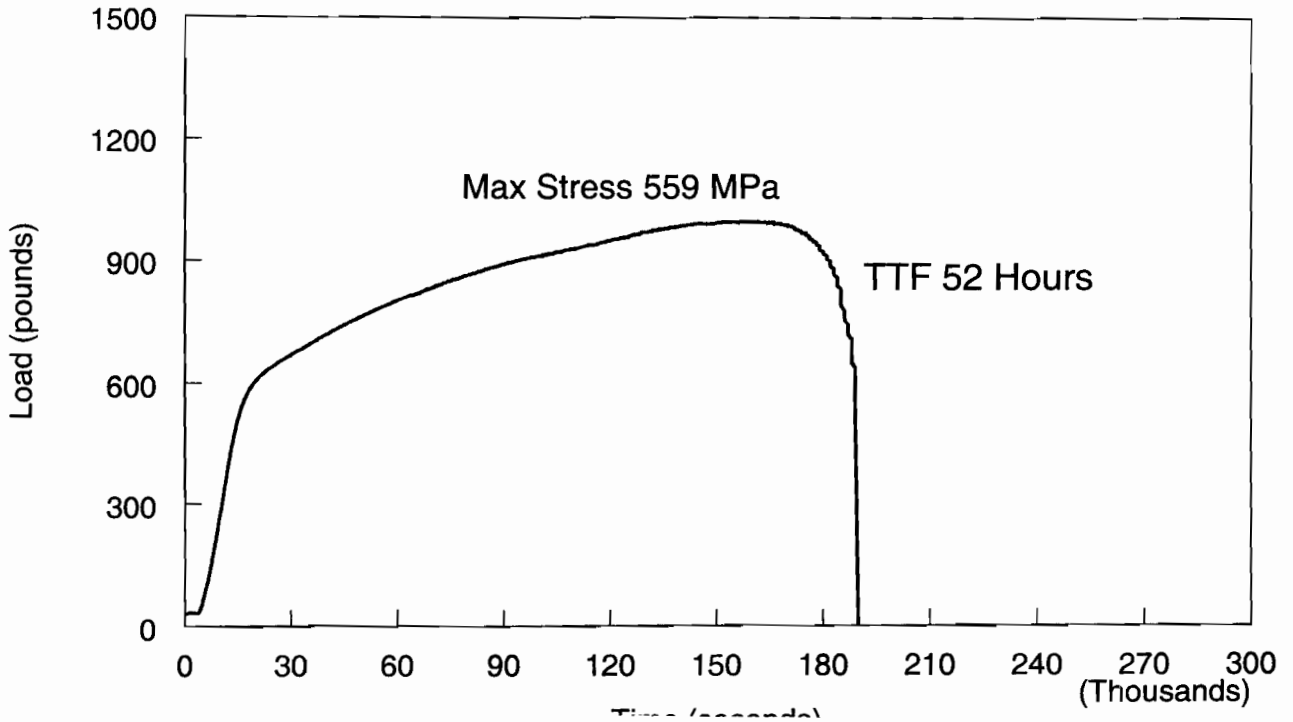


Walter J. Machowski 6/21/04

Slow Strain Rate Test

Simulated Concentrated Water - NaCl

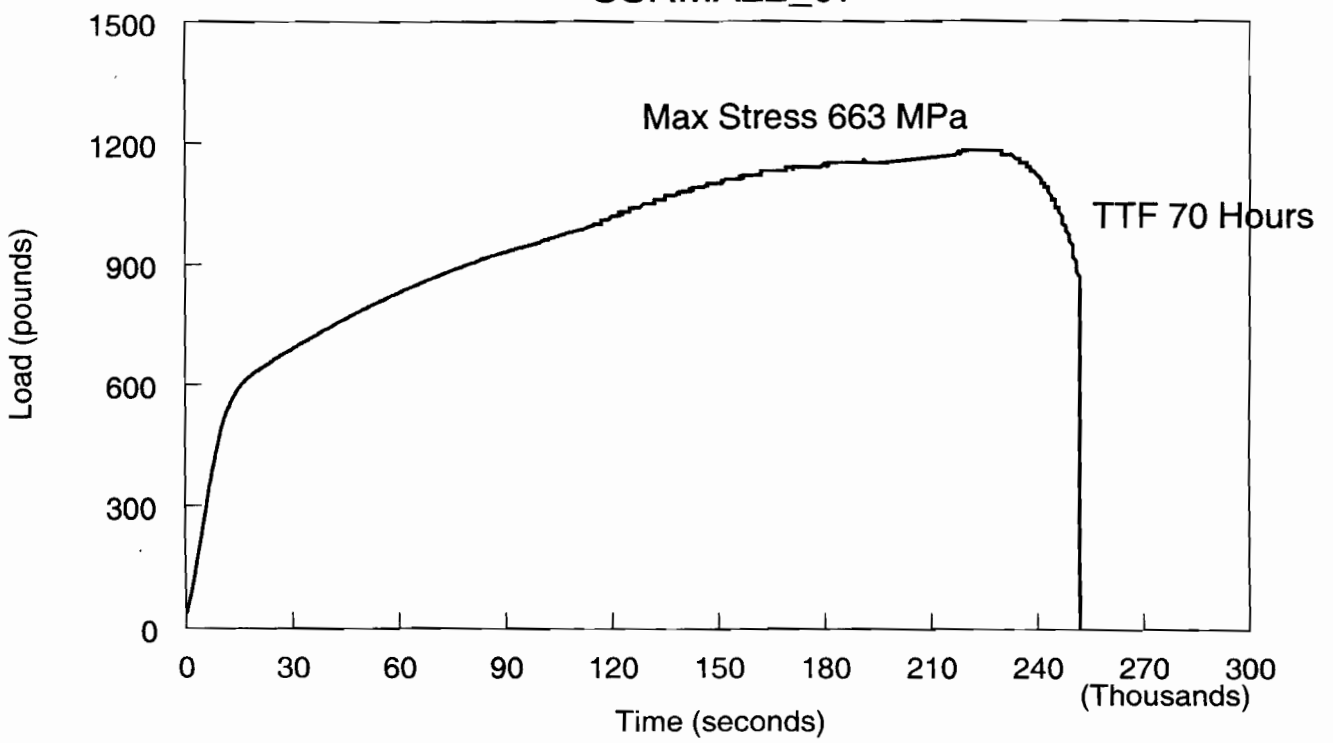
SSRMA22_SCW06



3.8M NaCl+0.38M NaNO3

+400mV v. Ag/AgCl

SSRMA22_07



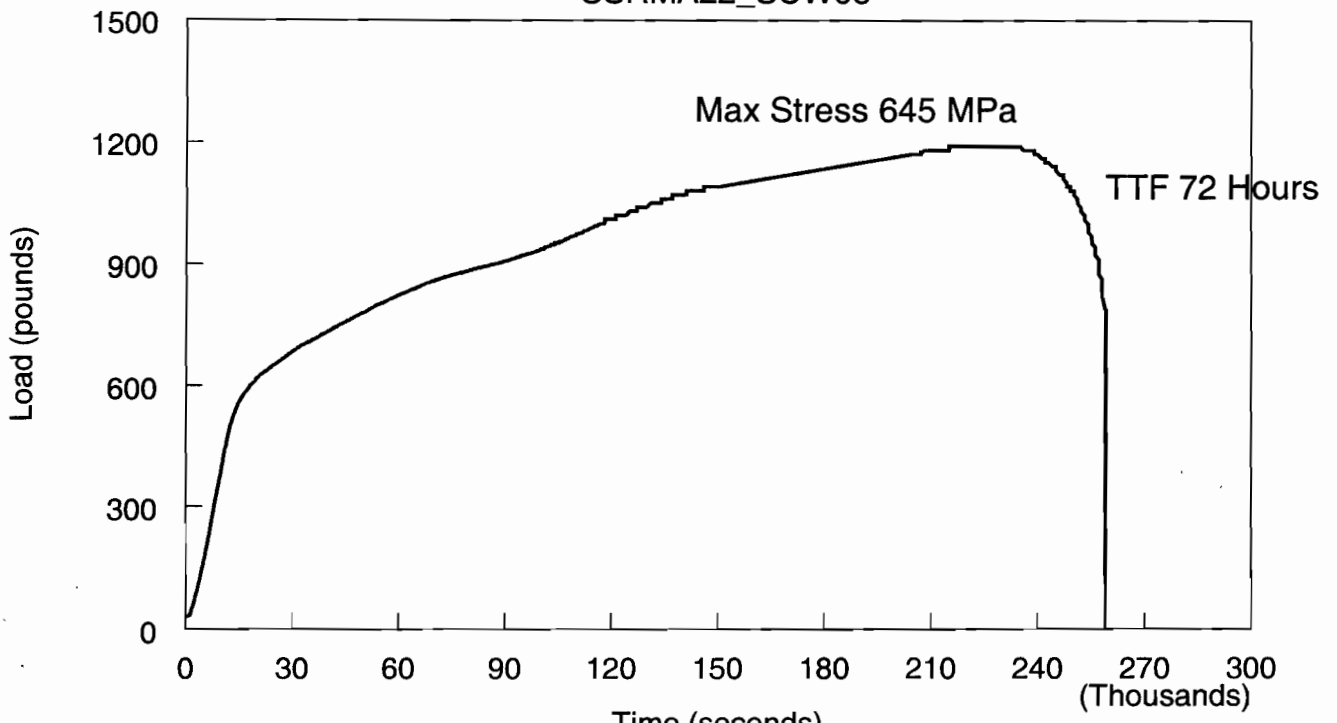
Walter J. Mackerras 6/21/04

Slow Strain Rate Test

3.8M NaCl+0.38M NaNO3

+200 mV v. Ag/AgCl

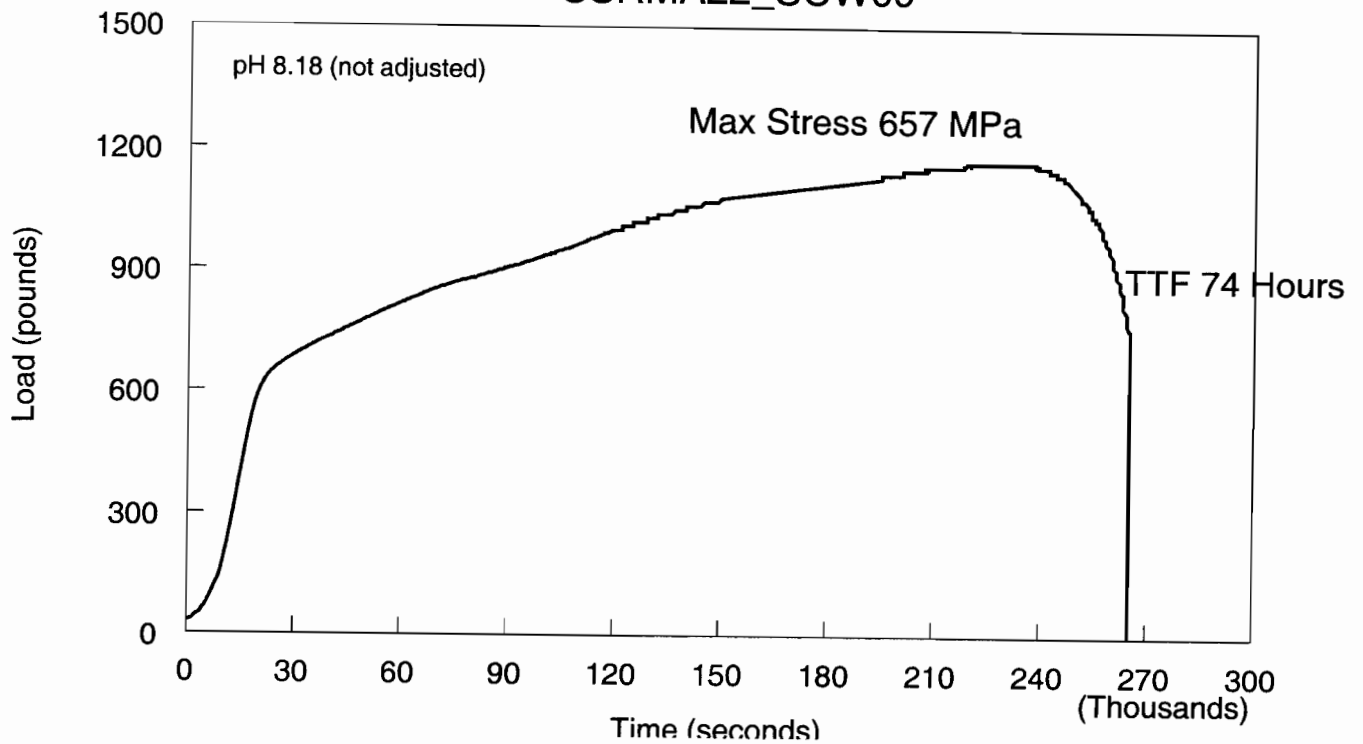
SSRMA22_SCW08



3.8M NaCl+0.38M NaNO3

+400mV v. Ag/AgCl

SSRMA22_SCW09

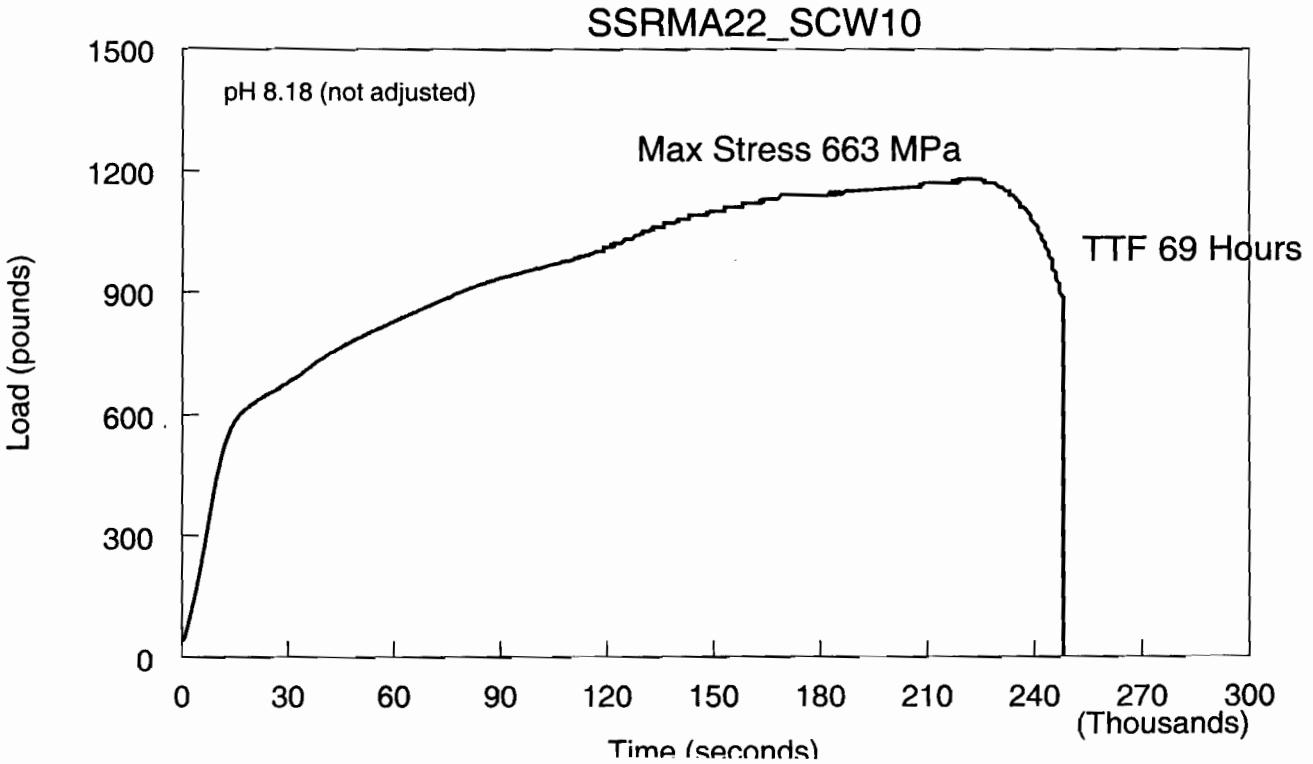


Walter J. Mackowiak 6/21/04

Slow Strain Rate Test

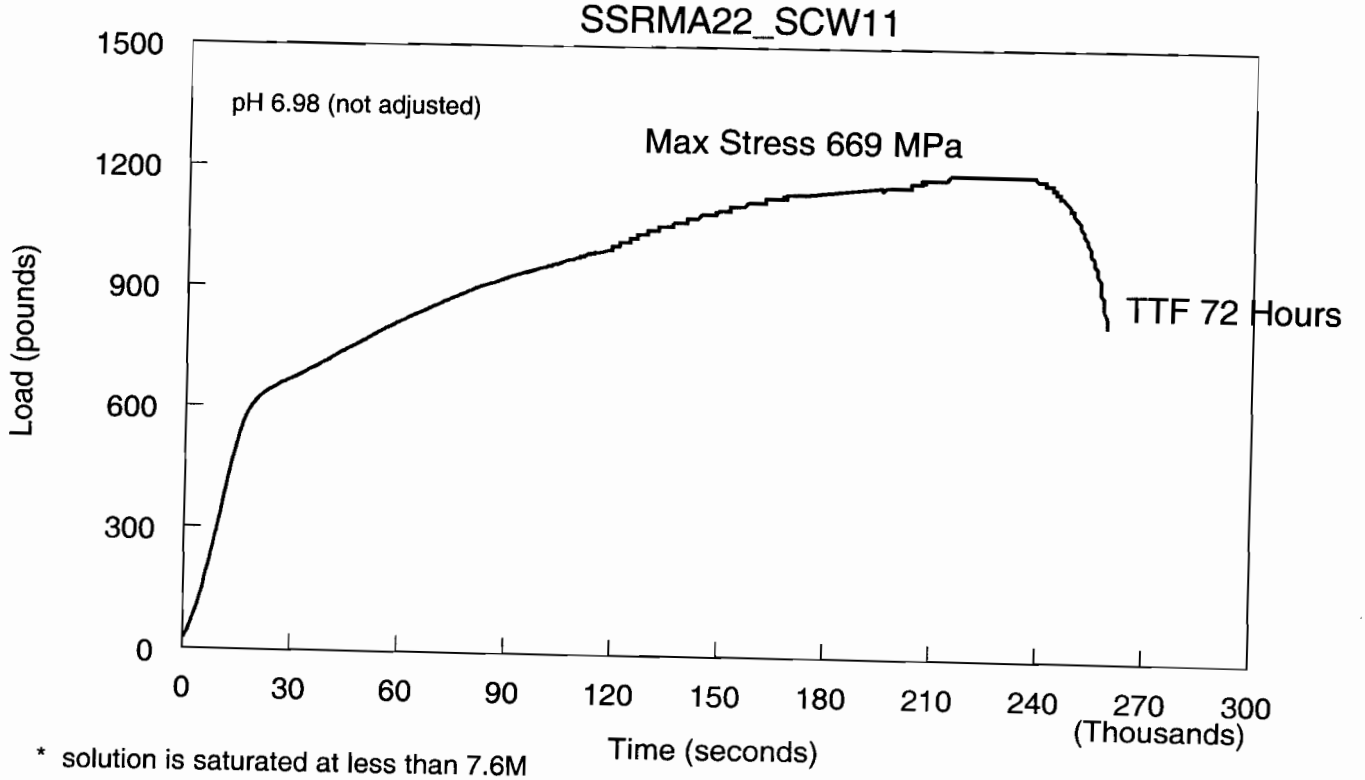
3.8M NaCl+0.38M NaNO3

+200 mV v. Ag/AgCl



7.6M* NaCl+0.38M NaNO3

+400 mV v. Ag/AgCl



* solution is saturated at less than 7.6M

Walter D. Machowski 6/30/04

SLOW STRAIN RATE TEST

Objective: see page #5 Notebook #695

Specimen: MA Alloy 22 SwRI Drawing # 20-03704-042-001

Heat ~~#2277-8-3266~~ #2277-3-3266 BJC 6/22/06

Solution: x ½ liter 7.6* M NaCl + 0.38M $NaNO_3$

222.39 g NaCl lot #035421 pH 6.98

32.680 $NaNO_3$ #020809 pH 7.22

Reagents measured with **Model:** Olympus S **SN:** 2883
Cal: 2 FEB 04 **Due:** 6 AUG 04

Counter Electrode: Pt foil **Reference Electrode:** Hg/HgCl in house w/3M KCl

Gas: N_2 (99.996%) **Ecorr:**

Eapplied: **+415mV **Potentiostat:** GSC 440-2 **SN:** 9209138

Specimen Visual: grey-silver metallic; some slight staining (darker grey); looks like ductile fracture

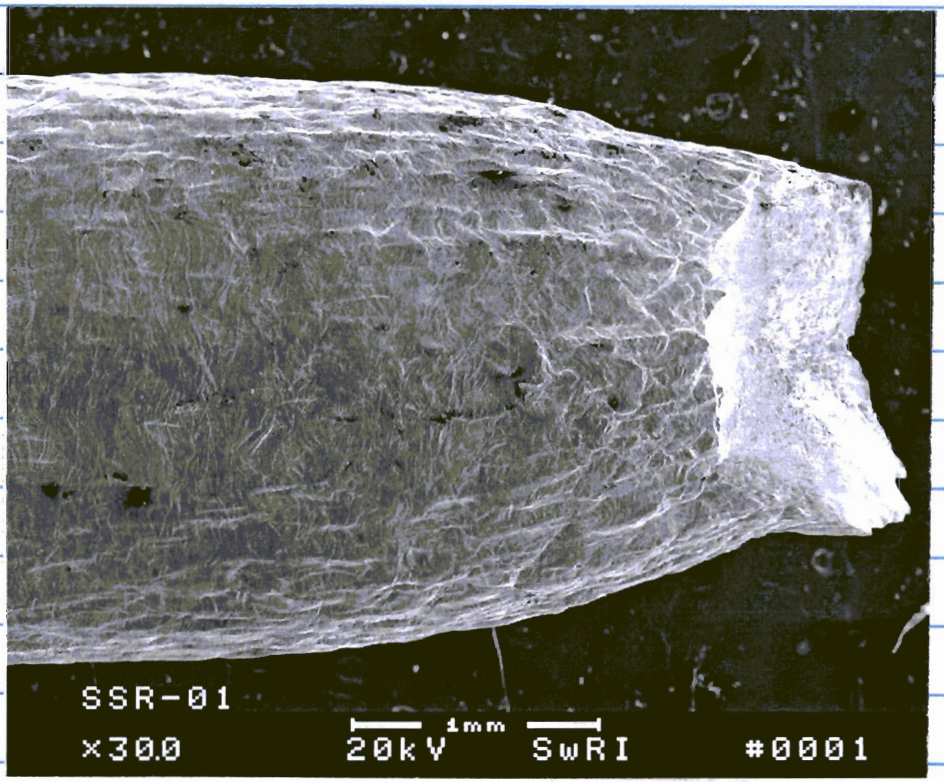
$\dot{\epsilon} = 3.2 \times 10^{-6} s^{-1}$

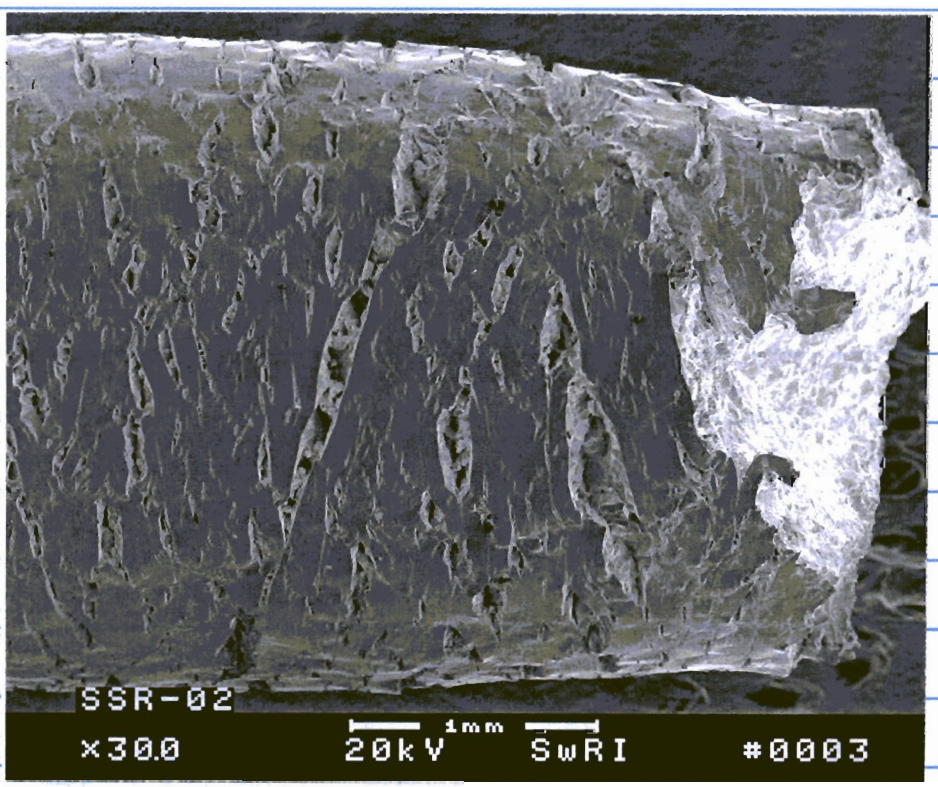
** Temp difference between RT + 95°C = Δ13mV

* this concentration is above saturation; solution plus residual salt were put into test cell

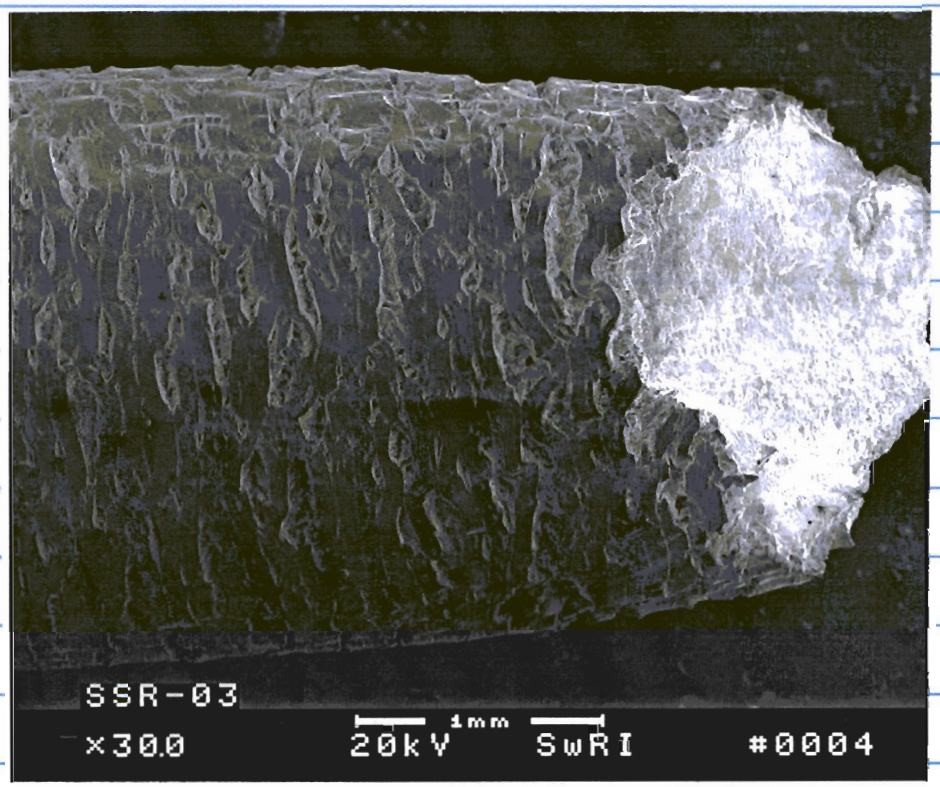
data file: SSRMA22_SCW11

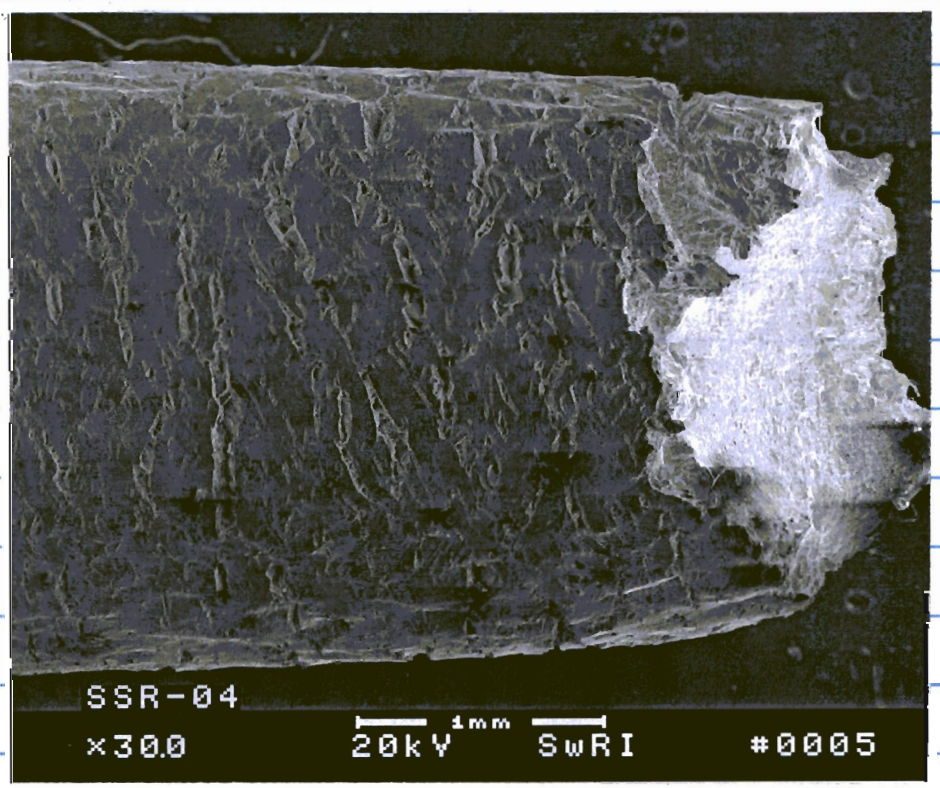
Walter J. Mackowiak
6/28/04



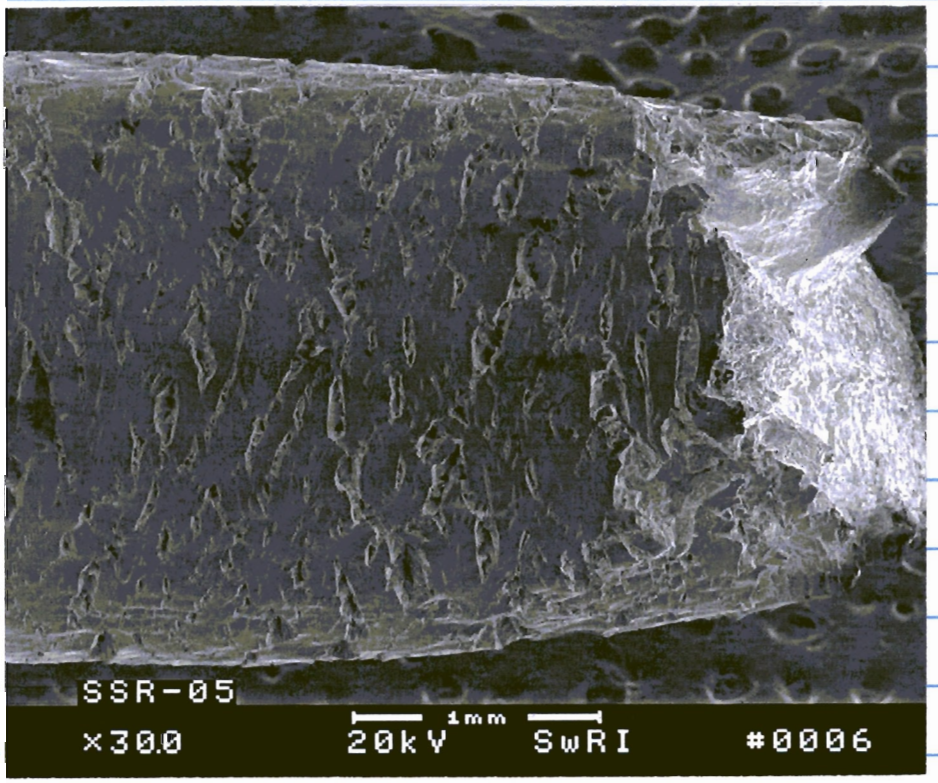


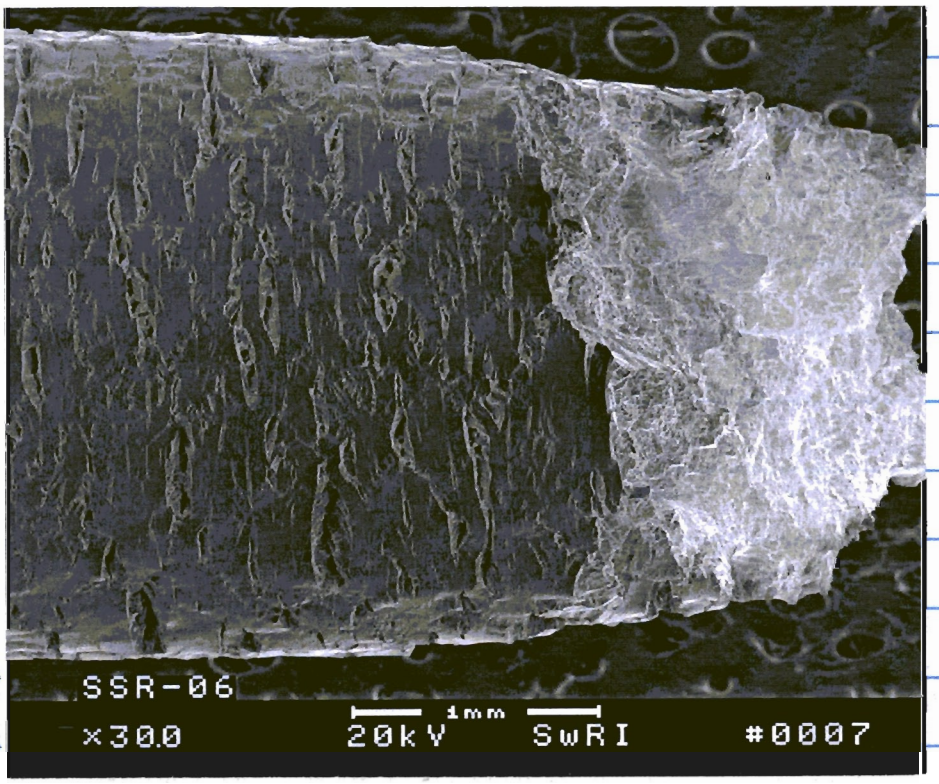
K. T. Chiang 6/23/04



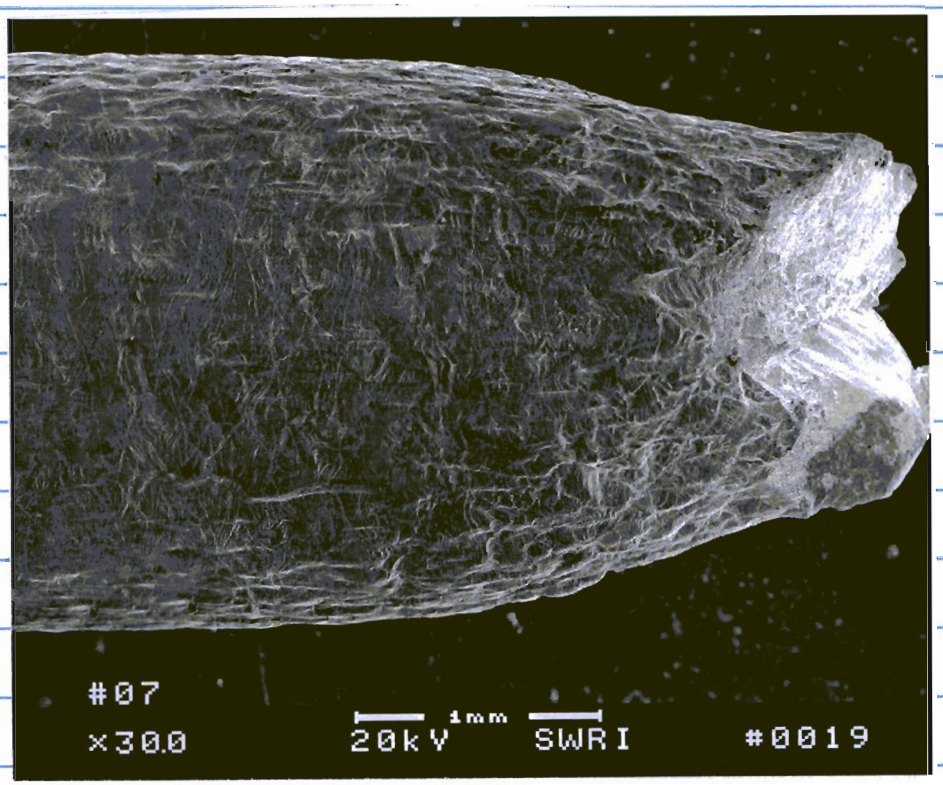


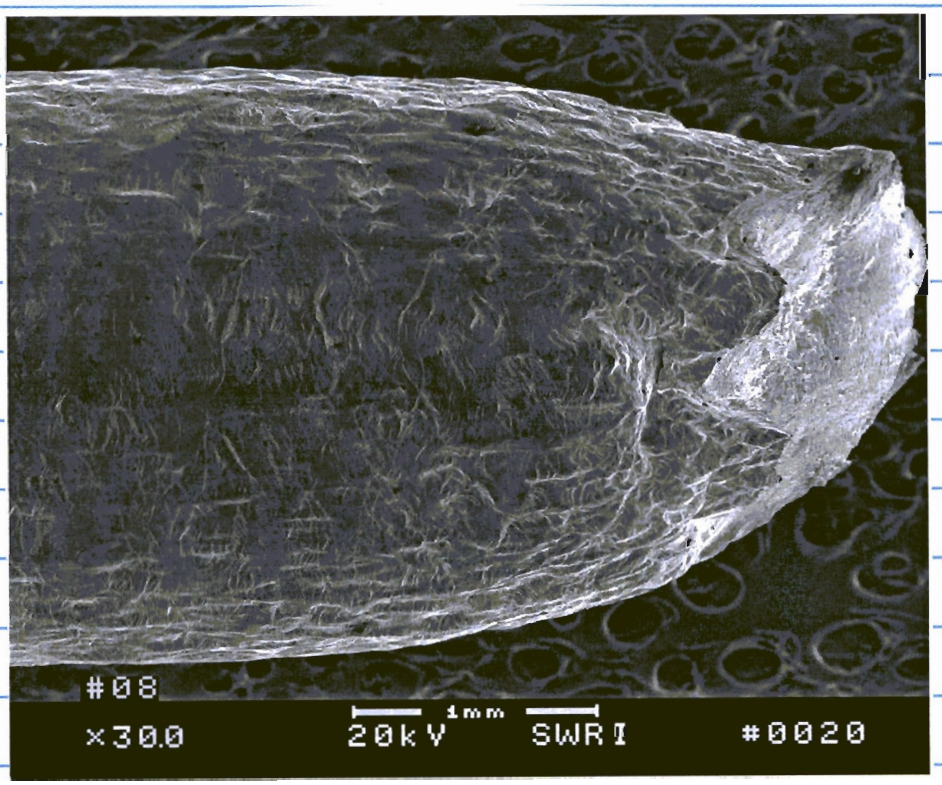
K. T. Chiang 6/23/04



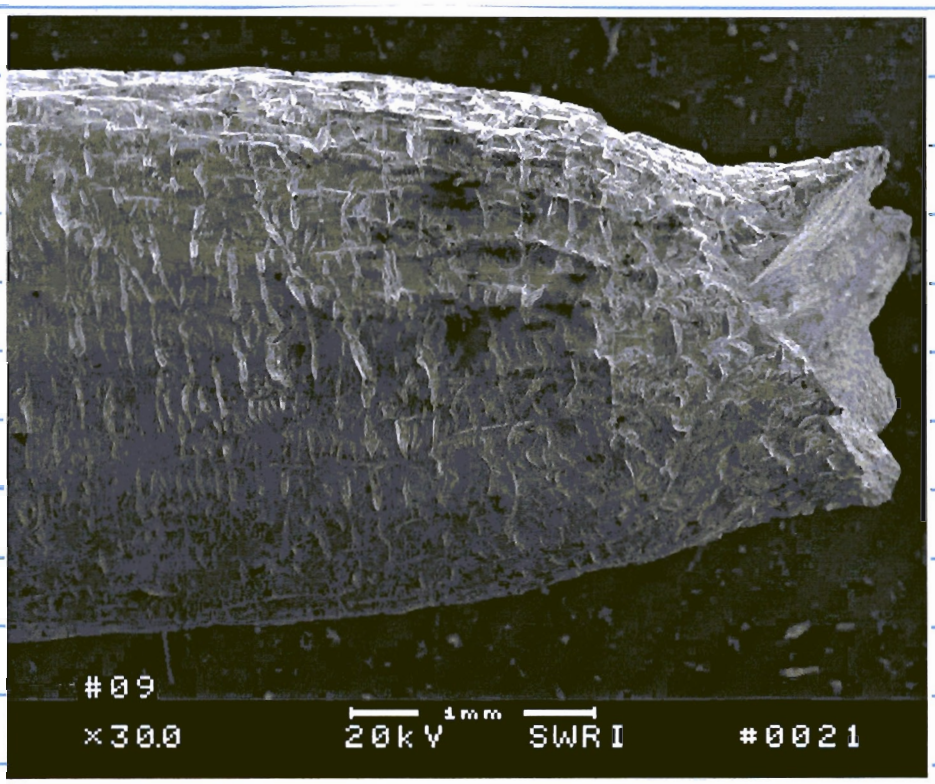


K. T. Chiang
6/23/04





K. J. Chiang
6/23/04



K. J. Ching
6/23/04

SLOW STRAIN RATE TEST

Objective: see page #5 Notebook #695

Specimen: MA Alloy 22 SwRI Drawing # 20-03704-042-001

Heat ~~#2277-8-3266~~ #2277-3-3266 BWG 6/27/06

Solution: x ½ liter

2.720 g NaCl lot # 035421
4.342 $NaNO_3$ ~~# 0260~~ 020609 BWG 6/27/06
} amount in SCW sol'n

pH 5.44 adj to 9.43 post pH 7.38

Reagents measured with **Model:** OHAUS **SN:** 2883
Cal: 2 FEB 04 **Due:** 6 AUG 04

Counter Electrode: Pt flag **Reference Electrode:** Ag/AgCl in bridge w/ 3M KCl

Gas: N_2 (99.999%) **Ecorr:** −288 mV

* **Eapplied:** +415 mV **Potentiostat:** EG&G 440-2 **SN:** 920938

Specimen Visual: grey-silver metallic; looks like ductile fracture

$\dot{\varepsilon}^o = 3.2 \times 10^{-6}$ s^{-1}

* temp diff between RT and 95°C Δ13 mV

data file: SSRMA22_SCW12

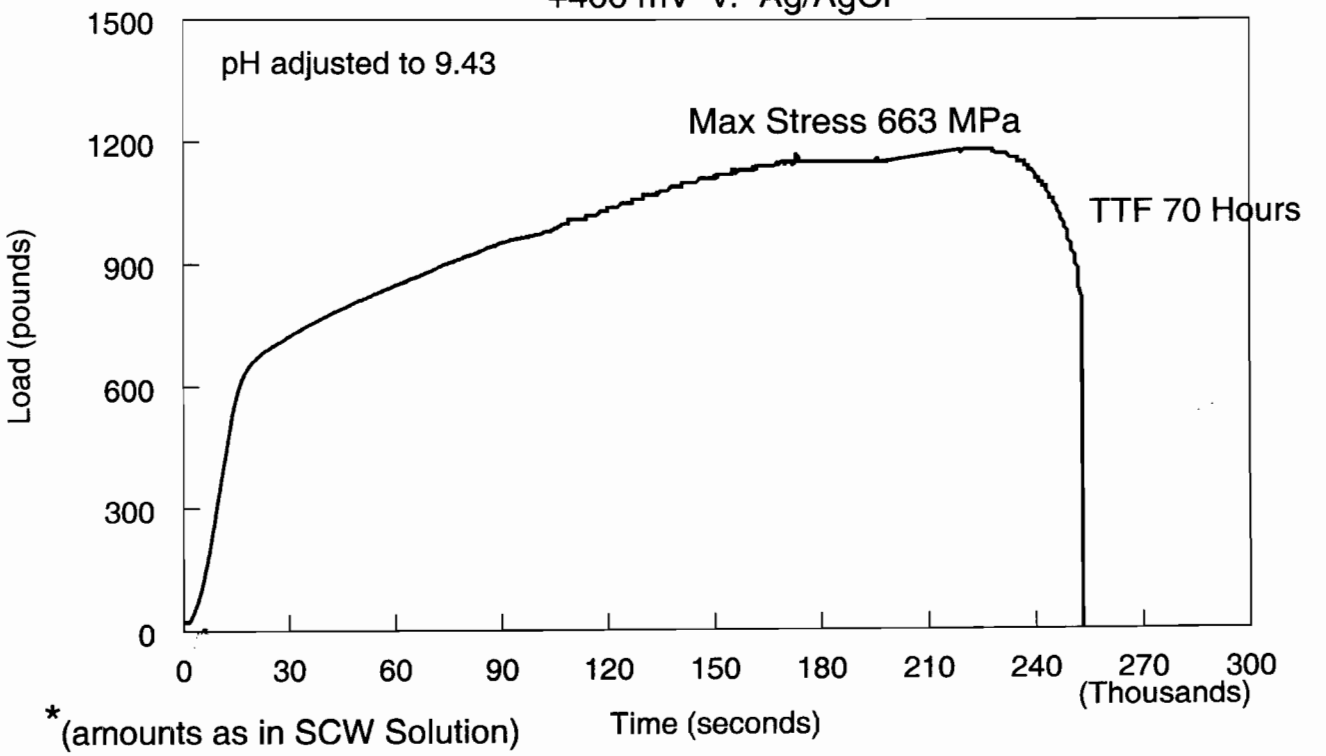
Walter J. Mackowiak
7/2/04

Slow Strain Rate Test

NaCl + NaNO3*

SSRMA22_SCW12

+400 mV v. Ag/AgCl



*(amounts as in SCW Solution)

Walter J. Mochowski
7/2/04

SLOW STRAIN RATE TEST

Objective: see page #5 Notebook #695

Specimen: MA Alloy 22 SwRI Drawing # 20-03704-042-001

Heat # ~~2277-8-3266~~ 2277-3-3266 DFS 6/27/01

Solution: x / liter SCW minus $NaHCO_3$

KCl	6.472 g	#005593	Na_2SO_4	20.691	#035451
NaCl	5.427	# 035421	NaF	3.113	#991559
$NaNO_3$	8.259	#020809			

pH 6.87 adj → 9.79

Reagents measured with **Model:** ORION 5 **SN:** 2883
Cal: 2 Feb 04 **Due:** 2 Aug 04

Counter Electrode: Pt flag **Reference Electrode:** Ag/AgCl in house w/ 3M KCl

Gas: N_2 (99.99%) **Ecorr:** -305 mV

*Eapplied: +415 mV **Potentiostat:** ESC 440-2 **SN:** 9209138

Specimen Visual: grey silver metallic color looks like ductile fracture

$\dot{\epsilon}^\circ = 3.2 \times 10^{-6}\ s^{-1}$

post pH 7.53

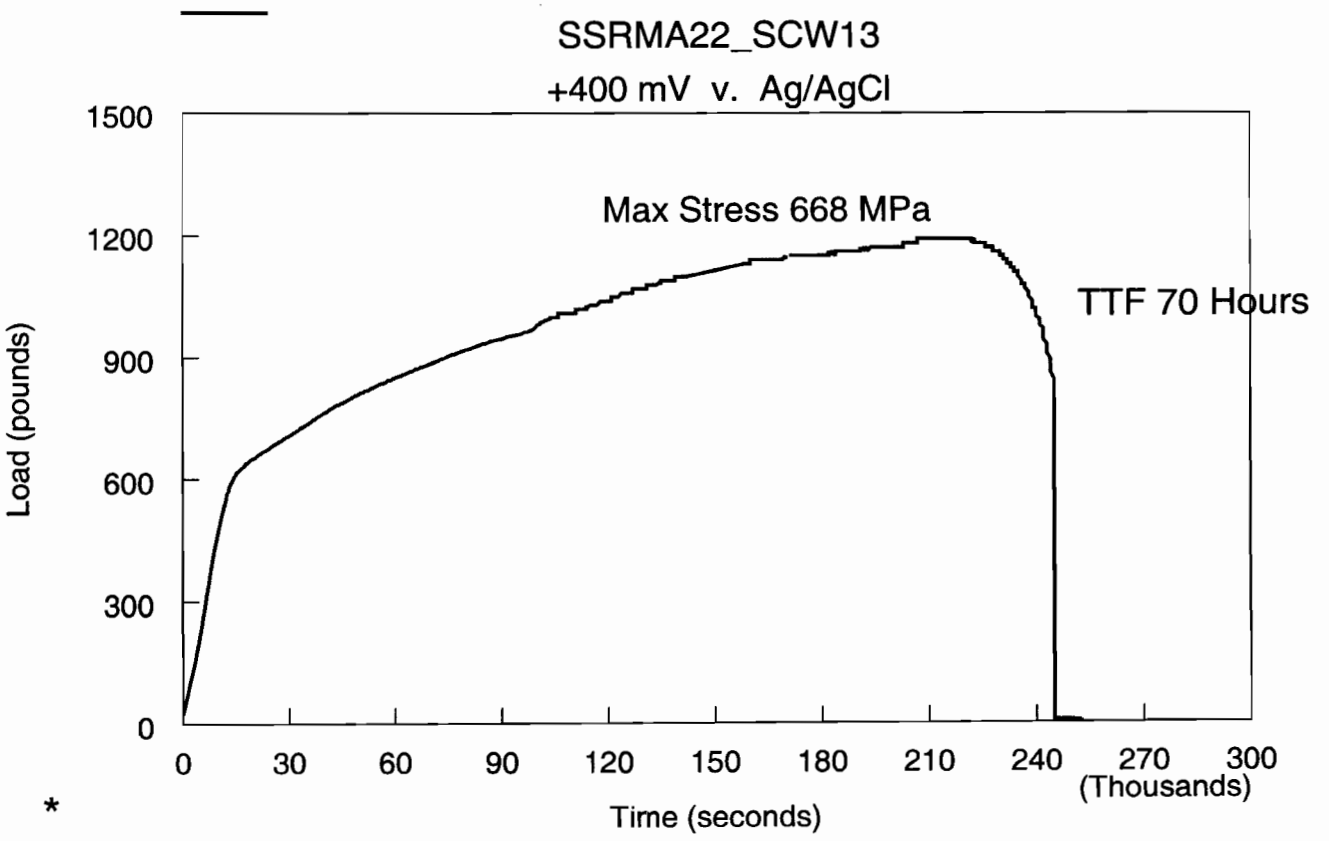
* Temp offset between RT and 95°C Δ13 mV

file name: SSR MA 22 - SCW 13

Walter J. Mankowski
7/19/04

Slow Strain Rate Test

SCW minus NaHCO3



*

Walter J. Mackowiak
7/19/04

SLOW STRAIN RATE TEST

Objective: see page #5 Notebook #695

Specimen: MA Alloy 22 SwRI Drawing # 20-03704-042-001

Heat # ~~2277-8-3266~~ 2277-3-3266 BKD 6/27/04

Solution:

N/A specimen run in air

Reagents measured with **Model:** **SN:**
Cal: N/A **Due:**

Counter Electrode: **Reference Electrode:**

Gas: N/A **Ecorr:** N/A

Eapplied: **Potentiostat:** **SN:**

Specimen Visual:

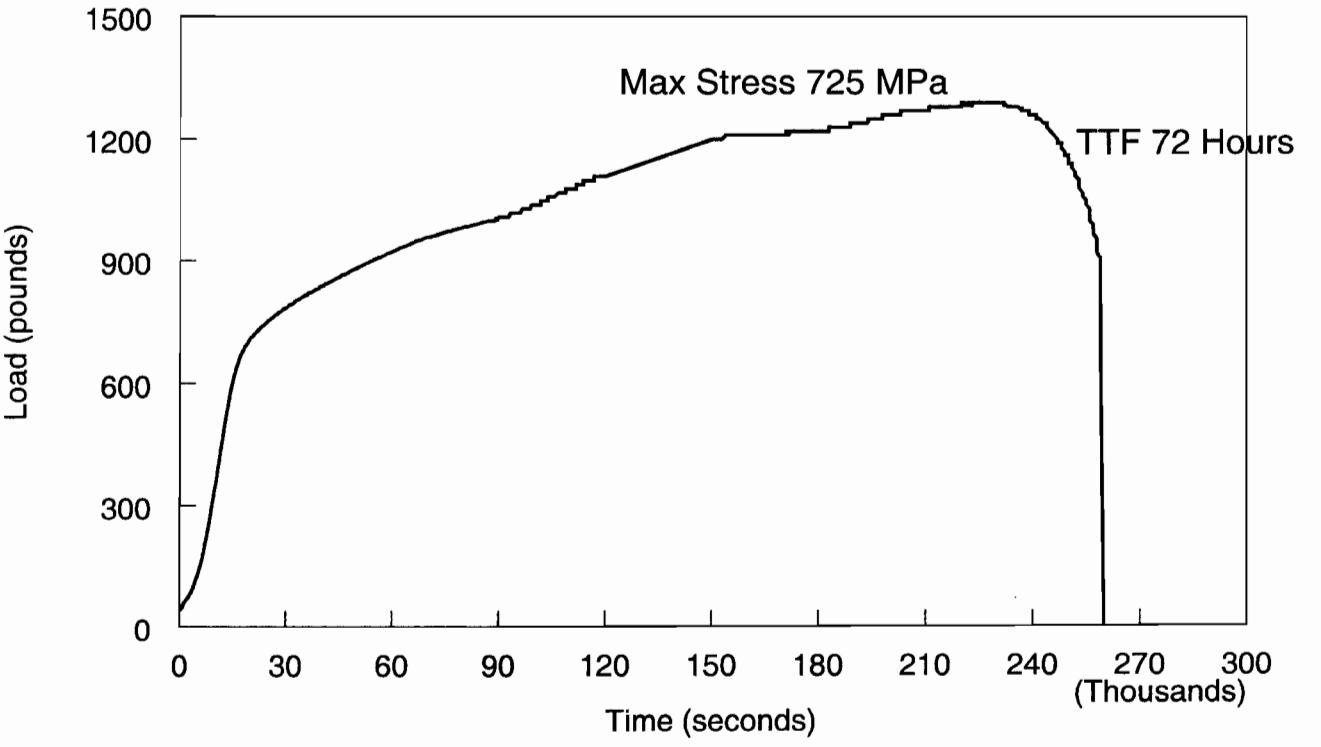
metallic sheen; looks like ductile failure

$\dot{\epsilon}^{\circ} = 3.2 \times 10^{-6} s^{-1}$

data file: SSRMA22_air2 Dottie Macdonald 7/20/04

Slow Strain Rate Test

Ambient Air



Walter J. Moskowski
7/26/04

SLOW STRAIN RATE TEST

Objective: see page #5 Notebook #695

Specimen: MA Alloy 22 SwRI Drawing # 20-03704-042-001

Heat # ~~2277-8-3266~~ 2277-3-3266 BJD 6/27/06

Solution: × 1/2 l

48.171 g $NaHCO_3$ #028924

pH 6.50 adj → 8.58 final → 10.38

Reagents measured with **Model:** OAKTON S **SN:** 2883
Cal: 2 FEB 04 **Due:** 2 AUG 04

Counter Electrode: Pt flag **Reference Electrode:** $Ag/AgCl$ in house w/3M KCl

Gas: N_2 (99.999) **Ecorr:** −294 mV

*Eapplied: +415 mV **Potentiostat:** EG&G 440-2 **SN:** 9209138

Specimen Visual:

looks like ductile fracture still silver-grey metallic, slight stain

$\dot{\epsilon}^0 = 3.24 \times 10^{-6}\ s^{-1}$

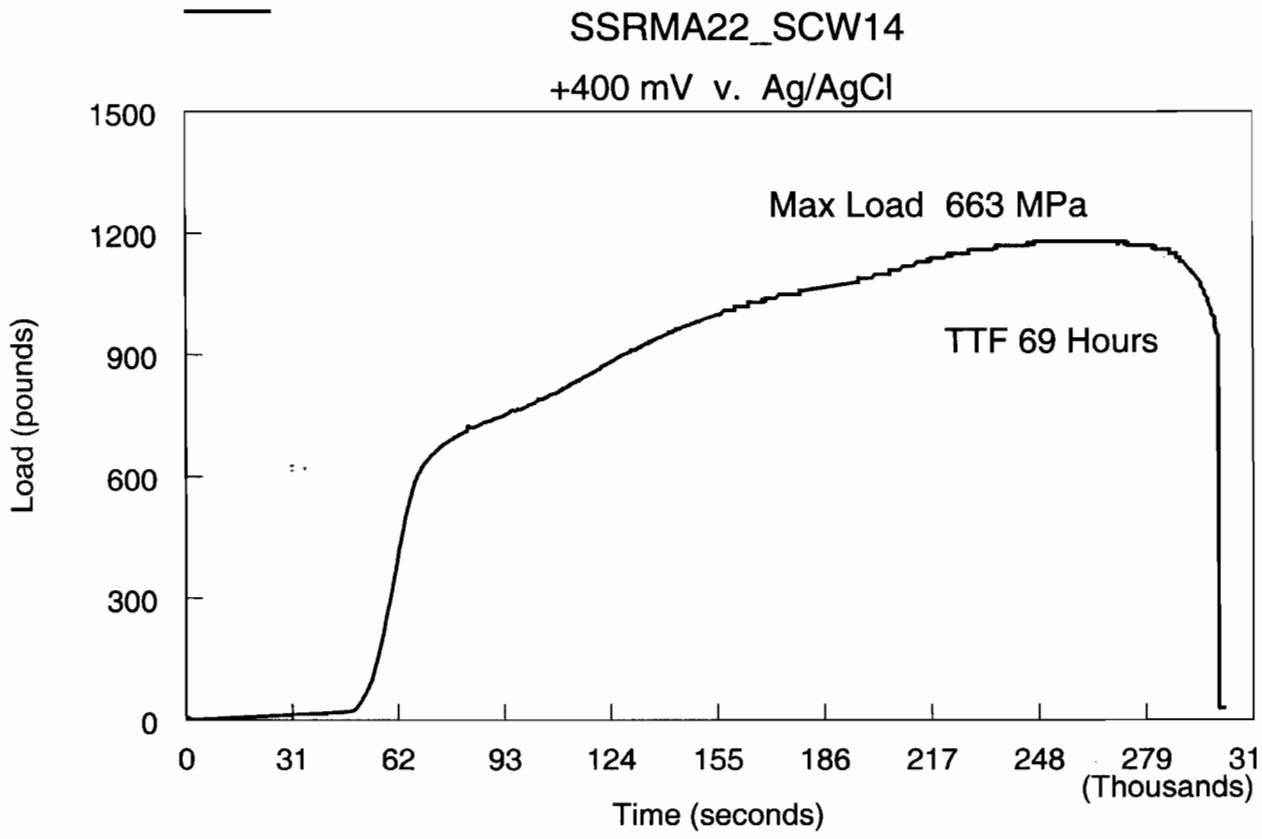
* temp difference between RT & 95°C Δ13 mV

data file: SSRMA22_SC014

Walter J. Mackowiak
7/23/04

Slow Strain Rate Test

NaHCO3 as in SCW



Walter J. Mackowski
7/23/04

SLOW STRAIN RATE TEST

Objective: see page #5 Notebook #695

Specimen: MA Alloy 22 SwRI Drawing # 20-03704-042-001

Heat ~~#2277-8-3266~~ 2277-3-3266

Solution: × ½ liter

KCl	8.241 g	#005573	$NaHCO_3$ 48.21 #028924
NaCl	2.720 g	035421	NaF 1.560 #991559
$NaNO_3$	4.375	020809	
Na_2SO_4	10.348	035451	pH 7.71 adj → 8.66 pot test 10.18

Reagents measured with Model: ONAUS SN: 2683
Cal: 2 FEB 04 Due: 2 AUG 04

Counter Electrode: Pt flag **Reference Electrode:** Ag/AgCl in house ~1M KCl

Gas: N_2 (99.99%) **Ecorr:** −186 mV

*Eapplied: +415 mV **Potentiostat:** ~~EG&G~~ 440-2 **SN:** 920938

Specimen Visual: silver-grey metallic, looks like brittle fracture

$\dot{\varepsilon}^o = 3.2 \times 10^{-6}\ s^{-1}$

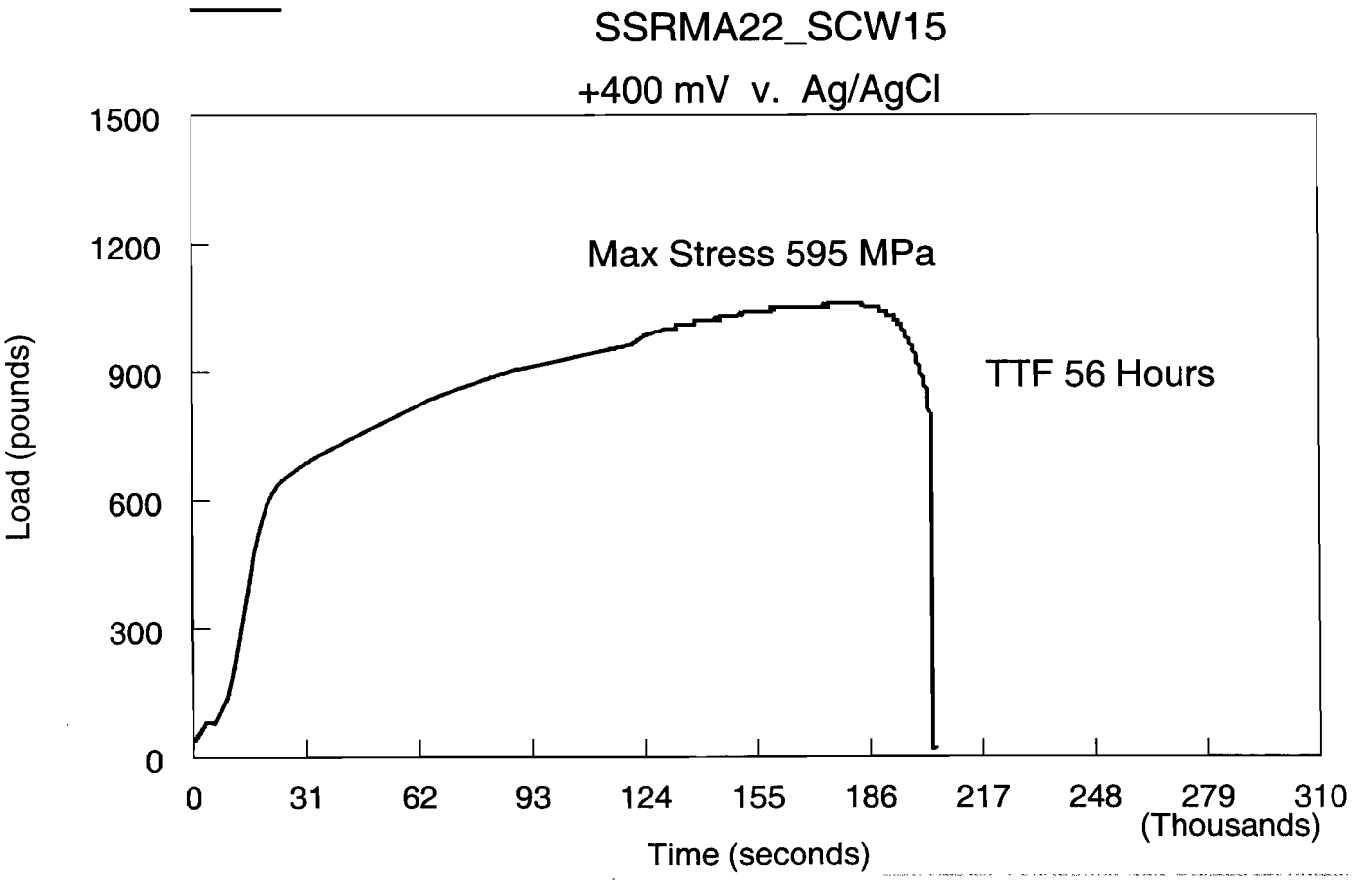
+ temp difference between RT and 95°C Δ13 mV

data file: SSRMA22_SCW15

Walter J. Mechowski
8/3/04

Slow Strain Rate Test

Simulated Concentrated Water



Walter J. Mechowski
6/3/04

SLOW STRAIN RATE TEST

Objective: see page #5 Notebook #695

Specimen: MA Alloy 22 SwRI Drawing # 20-03704-042-001

Solution: x ½ liter Heat ~~# 2277-8-3266~~ 2277-3-3266 BJ 6/17/04

KCl	3.252 g	# 005573	pH 7.76
NaCl	2.726	035509	adj → 8.68
$NaNO_3$	4.372	020809	
$NaHCO_3$	48.18	028294	post test 9.78

Reagents measured with **Model:** OHAUS **SN:** 2883
Cal: 2 FEB 04 **Due:** 4 AUG 04

Counter Electrode: Pt flag **Reference Electrode:** $Ag/AgCl$ in house w/ 3m KCl

Gas: N_2 (99.999) **Ecorr:** −68 mV

*Eapplied: +415 mV **Potentiostat:** ESC 440-2 **SN:** 9209138

Specimen Visual: brittle fracture

note: Luggin probe failed; i.e. some solution was lost and there is a question as to the actual potential applied since reference solution was lost too.

$\epsilon^\circ = 3.2 \times 10^{-6}\ s^{-1}$

* temp effect RT → 95°C Δ13 mV

data file: SSRMA22_SCW16

Walter J. Mackowiak
6/10/04

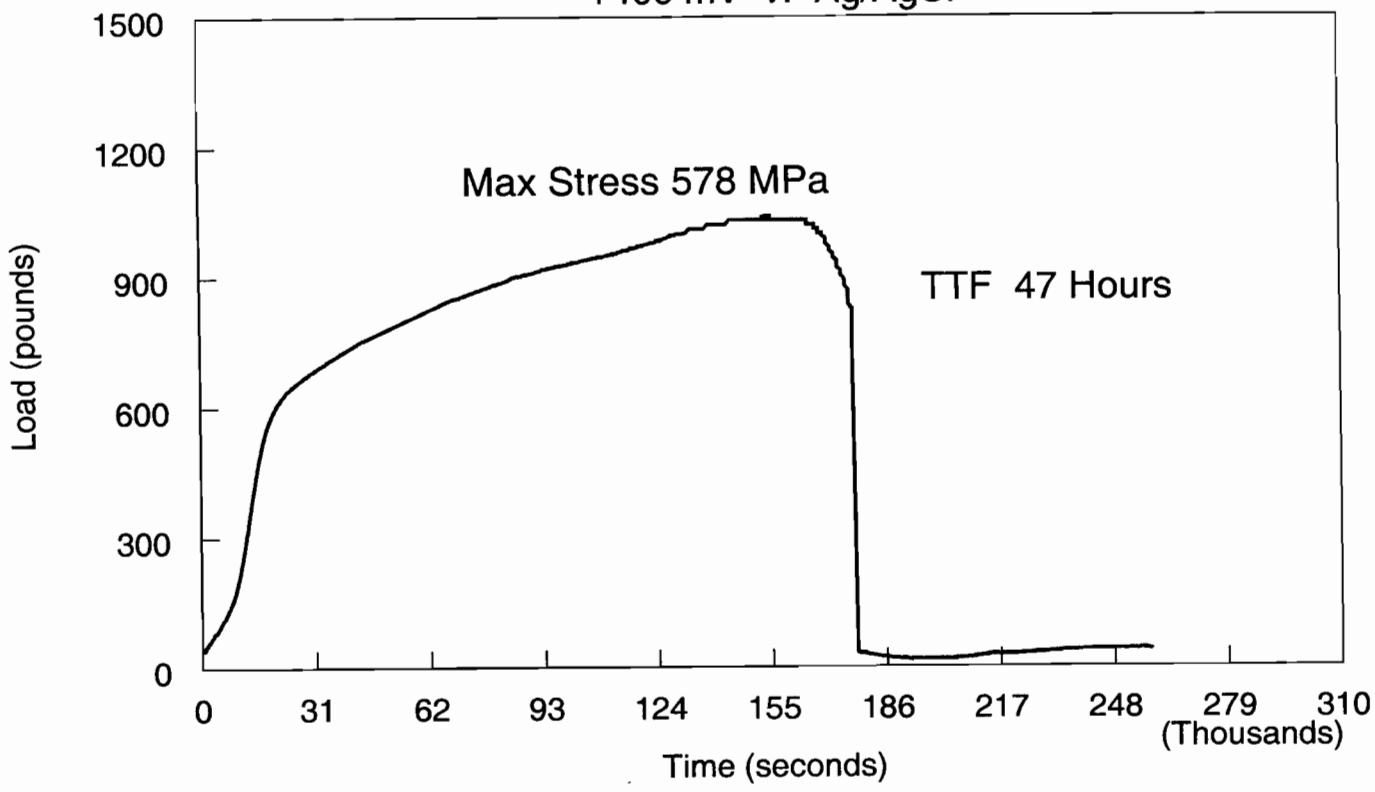
Slow Strain Rate Test

SCW minus F and ~~NO3~~ SO4

8/10/04 wjm

SSRMA22_SCW16

+400 mV v. Ag/AgCl



Walter J. Mackowski
8/10/04

SLOW STRAIN RATE TEST

Objective: see page #5 Notebook #695

Specimen: MA Alloy 22 SwRI Drawing # 20-03704-042-001

Heat ~~#2277-8-3266~~ 2277-3-3266 BKD 6/22/06

Solution: ~ 1/2 liter

KCl	3.275 g	#005573	pH 8.45
NaCl	2.738	035509	adj → 8.70
$NaNO_3$	4.383	020809	
$NaHCO_3$	48.18	028294	final 10.14

Reagents measured with **Model:** ONAMS **SN:** 2883
Cal: 2 FEB 04 **Due:** 4 AUG 04

Counter Electrode: Pt flag **Reference Electrode:** Ag/AgCl in bore w/3M KCl

Gas: N_2 (99.999) **Ecorr:** −528 mV

Eapplied: +415 mV* **Potentiostat:** ECS440-2 **SN:** 9209138

Specimen Visual: metallic silver-grey; looks like brittle fracture

$\dot{\varepsilon}^{\circ} = 3.2 \times 10^{-6} s^{-1}$

* temp effect from RT → 95°C Δ13mV

data file: SSRMA22_SCW17

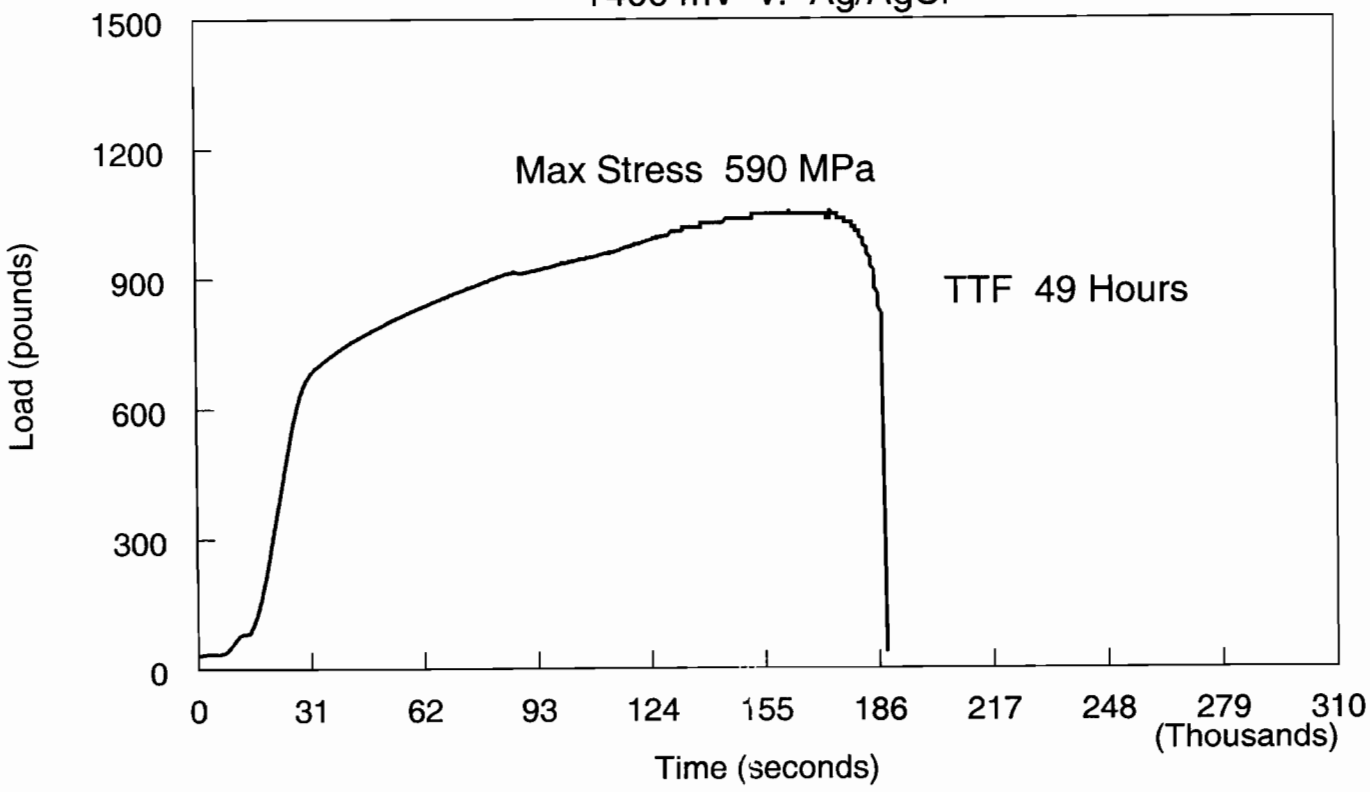
Walter J. Mackowiak
8/12/04

Slow Strain Rate Test

SCW minus F and SO4

SSRMA22_SCW17

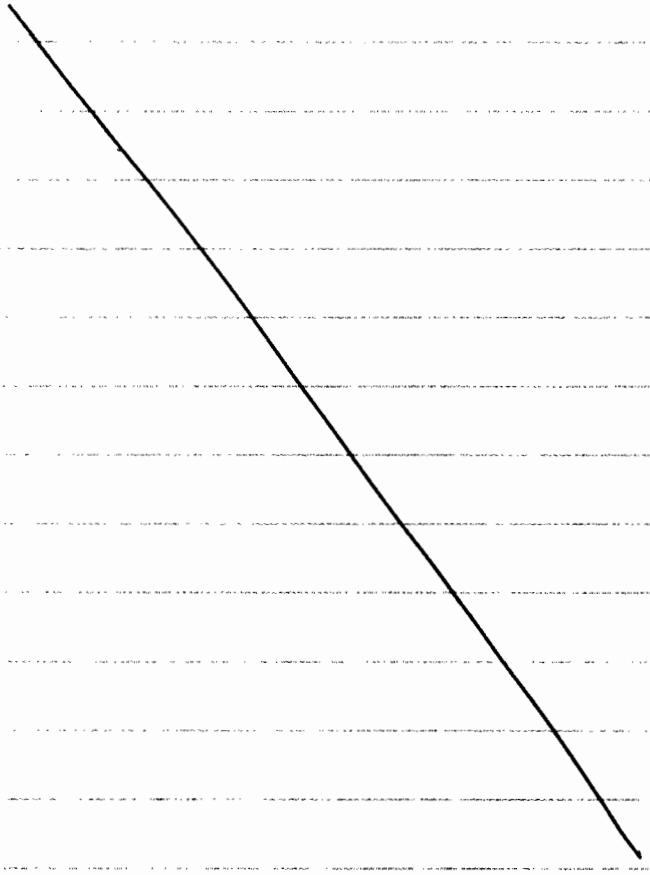
+400 mV v. Ag/AgCl



This is a duplicate of SSRMA22_SCW16 which was run due to the failure of the probe in *_SCW16.

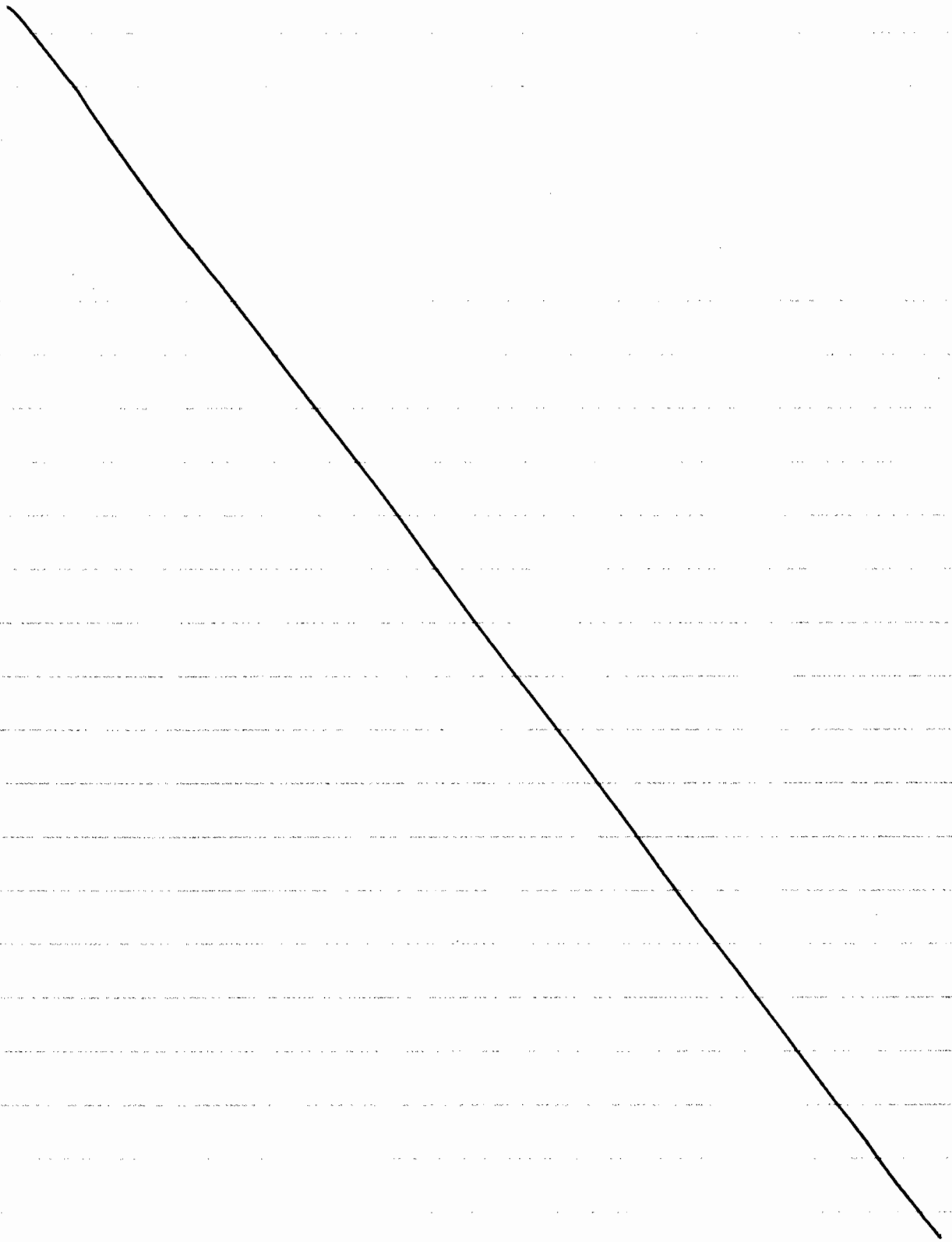
Walter J. Mackerras
6/12/04

It should be noted that in solutions containing HCO3, the amount of OH required to raise the pH is relatively considerable. There is an equilibrium that exist between CO3, HCO3, and OH such that in any solution only two of these can exist in appreciable quantities. The effect here is that the addition of OH reduces the HCO3 concentration by converting it to CO3. Therefore adjusting the pH of these solutions with OH is, in effect, altering the HCO3 concentration of the original SCW solution.



Walter J. Machowski

8/12/04



Walter J. Machowski
8/12/04

SLOW STRAIN RATE TEST

Objective: see page #5 Notebook #695

Specimen: MA Alloy 22 SwRI Drawing # 20-03704-042-001

Heat ~~# 2277-8-3266~~ BIO 6/27/06
2277-3-3266

Solution: x 1 liter

KCl	6.487 g	#006573	pH 7.806
NaCl	5.444	035509	Lab: 8.726
$NaHCO_3$	96.38	028954	9/6/04 HBW final ~~10.14~~ 10.36

Reagents measured with **Model:** ORION 5 **SN:** 2883
Cal: 15 JUL 04 **Due:** 15 JAN 05

Counter Electrode: Pt flag **Reference Electrode:** Ag/AgCl in house w/3M KCl

Gas: N_2 (99.999%) **Ecorr:** -203 mV

*Eapplied: +415 mV **Potentiostat:** ESC440-2 **SN:** 9209138

Specimen Visual: metallic suture-gray; looks like brittle fracture

$\dot{\varepsilon}^{\circ} = 3.2 \times 10^{-6}\ s^{-1}$

* temp effect from RT to 95°C Δ13 mV

data file: SSRMA22_SOW18

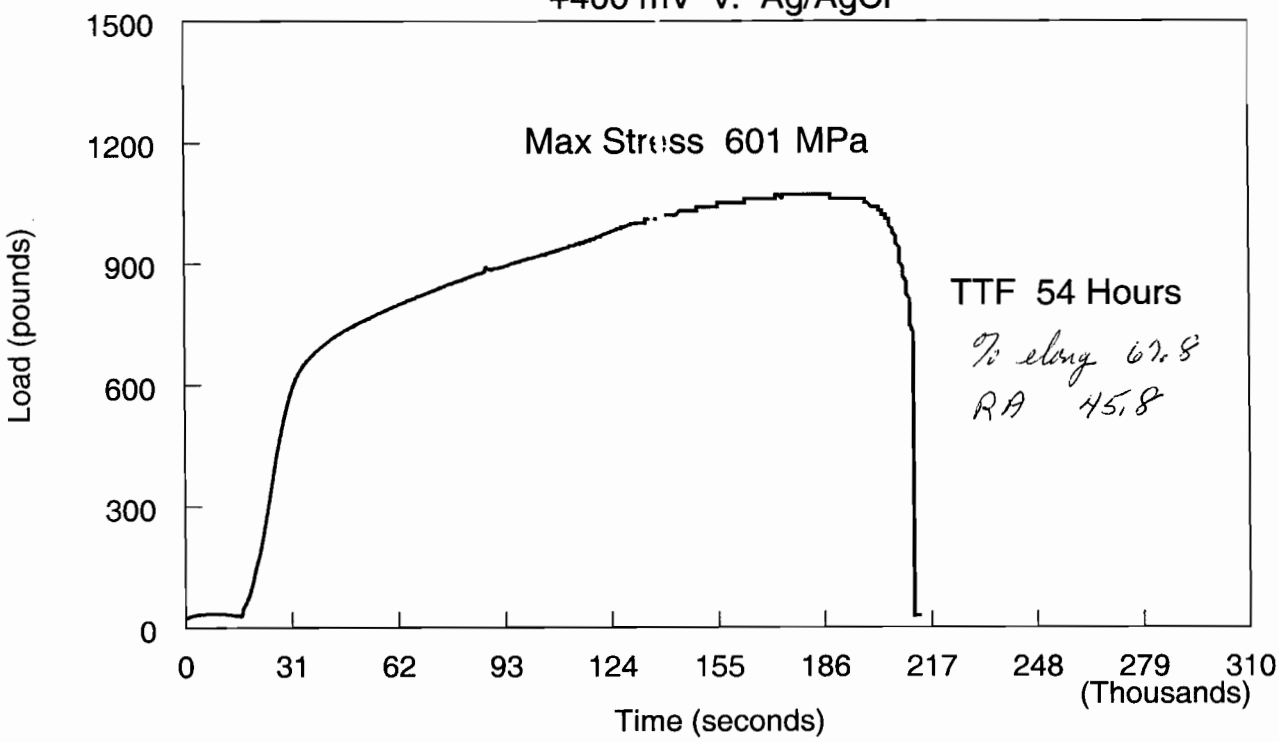
Walter J. Markowski
9/2/04

Slow Strain Rate Test

Cl and HCO3 as in SCW

SSRMA22_SCW18

+400 mV v. Ag/AgCl



Walter J. Mochinski
9/2/04

SLOW STRAIN RATE TEST

Objective: see page #5 Notebook #695

Specimen: MA Alloy 22 SwRI Drawing # 20-03704-042-001

Heat ~~#2277-8-3266~~ 2277-3-3266 BH 6/27/02

Solution: ½ liter

$NaHCO_3$ 96.341 g #028924

NaF 3.077 g #028924

pH 7.856 adj → 8.695 final pH 10.28

Reagents measured with **Model:** Orion 5 **SN:** 2883
Cal: 15 JUL 04 **Due:** 15 JAN 05

Counter Electrode: Pt flag **Reference Electrode:** Ag/AgCl in lumen w/3M KCl

Gas: N_2 (99.999%) **Ecorr:** −238 mV

*Eapplied: +415 mV **Potentiostat:** EG&G 440-2 **SN:** 92 09138

Specimen Visual: silver metallic gray; could be brittle failure

$\dot{\epsilon}^{\circ} = 3.2 \times 10^{-6}\ s^{-1}$

* temp effect from RT to 95°C Δ13mV

data file: SSRMA22_SCW19

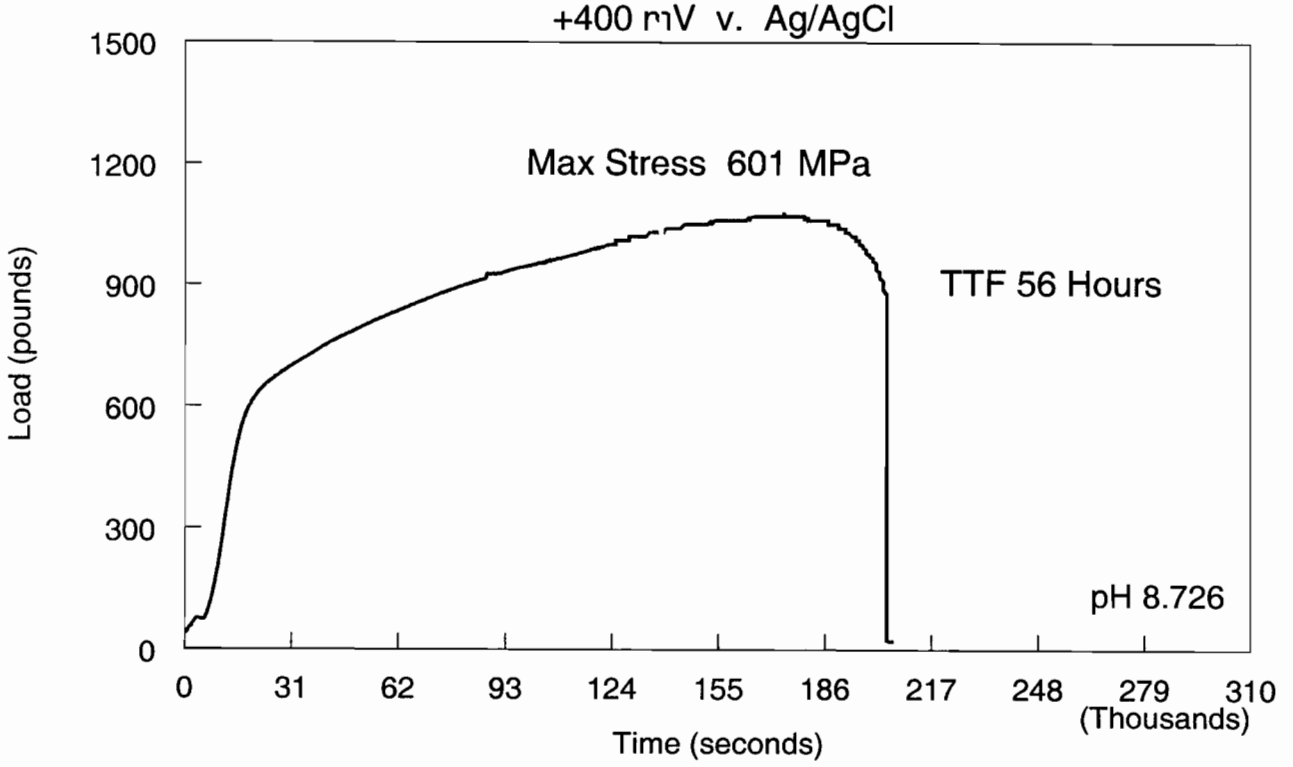
Natalie J. Machuca
9/3/04

Slow Strain Rate Test

F and HCO3 as in SCW

SSRMA22_SCW19

+400 mV v. Ag/AgCl



Walter J. Mackowski
9/3/04

SLOW STRAIN RATE TEST

Objective: see page #5 Notebook #695

Specimen: MA Alloy 22 SwRI Drawing # 20-03704-042-001

Heat ~~# 2277-8-3266~~ 2277-3-3266 BJP 6/27/06

Solution: 4 l liter

$NaHCO_3$	88.240 g	# 028924	pH 8.384
NaCl	29.252 g	# 035509	final
NaOH	1.662	# 033972	pH 10.42

Reagents measured with **Model:** OHAUS **SN:** 2883
Cal: 15 JUL 04 **Due:** 15 JAN 05

Counter Electrode: Pt flag **Reference Electrode:** Ag/AgCl in house w/3M NaCl

Gas: N_2 (99.999%) **Ecorr:** −268 mV

*Eapplied: +415 mV **Potentiostat:** GSC 440-2 **SN:** 9209138

Specimen Visual: metallic silver-gray; looks like brittle fracture

$\dot{\epsilon}^{\circ} = 3.3 \times 10^{-6}\ s^{-1}$

* temp effect from RT to 95°C Δ 15 mV

data file: SSRMA22_SCW20

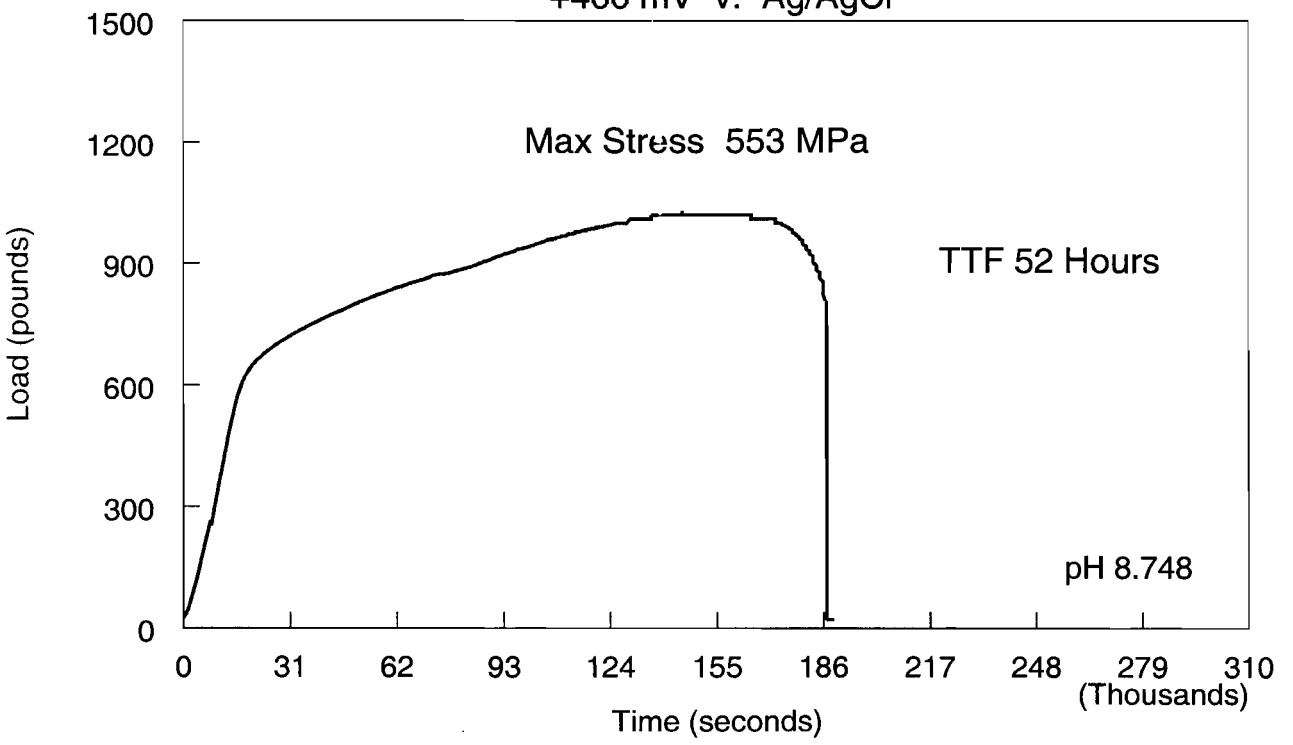
Walter J. Mackowiak
9/7/04

Slow Strain Rate Test

1.05M NaHCO3; 0.5M NaCl; 0.19M NaOH

SSRMA22_SCW20

+400 mV v. Ag/AgCl



Walter J. Mackowski
9/7/04

SLOW STRAIN RATE TEST

Objective: see page #5 Notebook #695

Specimen: MA Alloy 22 SwRI Drawing # 20-03704-042-001

Heat ~~#2277-8-3266~~ 2277-3-3266 gas 6/24/04

Solution: x 2 liters

$NaHCO_3$	176.50 g	#028966	pH 8.683
NaCl	58.50	#035509	not adj.
NaOH	15.35	#033972	
KCl	223.65	#005573	final pH 10.1

Reagents measured with **Model:** OHAUS **SN:** 2883
Cal: 15 JUL 04 **Due:** 15 JAN 05

Counter Electrode: Pt flag **Reference Electrode:** Ag/AgCl in house w/3M ~~NaCl~~ with KCl

Gas: N_2 (99.999%) **Ecorr:** −234 mV

*Eapplied: +415 mV **Potentiostat:** ESC 440-2 **SN:** 9209138

Specimen Visual: metallic silver-gray; looks like brittle fracture

$\dot{\varepsilon}^o = 3.2 \times 10^{-6}\ s^{-1}$

* temp effect from RT to 95°C Δ 13 mV

data file: SSRMA22_SCW21

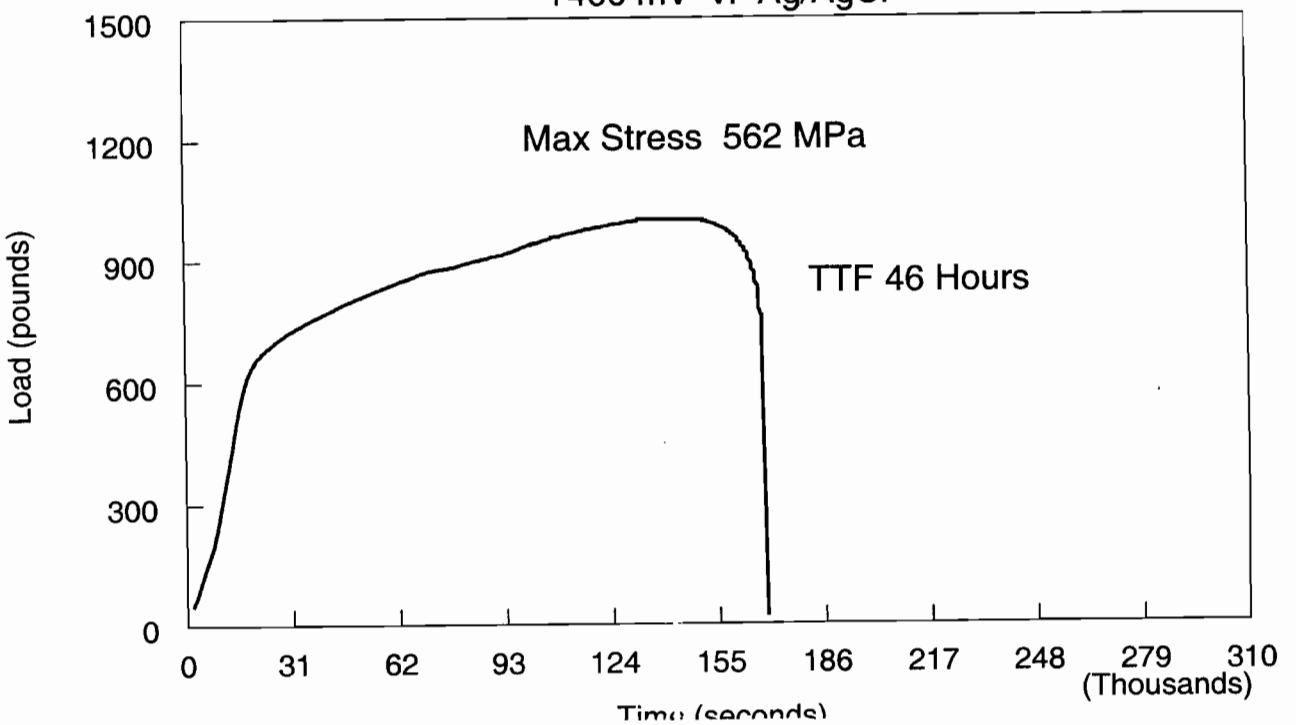
Walter J. Mackowiak
9/17/04

Slow Strain Rate Test

1.05M NaHCO3; 0.5M NaCl; 0.19M NaOH; 1.5M KCl

SSRMA22_SCW21

+400 mV v. Ag/AgCl



Walter D. Mackowiak
9/17/04

POTENTIODYNAMIC TEST

Objective: see page #5

Specimen: C22 Cylinder Heat# ~~2277-8-3268~~ 2277-3-2266 **CNWRA Drawing 20.01402.571.019 polished to a 600 grit finish**

6/27/04

Initial Weight: 12.46190g **Model:** Sartorius Genius **SN:** 12809099
Final Weight: 12.33808g **Cal:**5/14/04 **Due:**11/14/04

SOLUTION: SCW - $NaHCO_3$

KCl = 12.974g Lot# 005573
NaCl = 16.879g Lot# 035509
$NaNO_3$ = 17.869g Lot# 020809
Na_2SO_4 = 41.39g Lot# 035451
NaF = 6.198g Lot# 991559
+ DI water 2000 ml's

Reagents measured with **Model:** OHAUS **SN:** 2883
Cal: 7/15/04 **Due:** 7/15/05

Initial pH: 7.012 **Model:** orion **SN:** 2330
Final pH: 7.836 **CAL:** 7/21/04 **DUE:** ~~7/21/05~~ 7/21/05 BD 6/27/06
pH Probe: #13-620-296 **SN:** 4079126

TEST TEMPERATURE: 95°C **Measured with Hg Thermometer SN:** 498-149
Cal: 6/8/04 **Due:** 12/8/04

Counter Electrode: Platinum Flag

Reference Electrode: Fisher SCE 13-620-52 **SN:** 3289206

Gas: 99.999% Nitrogen

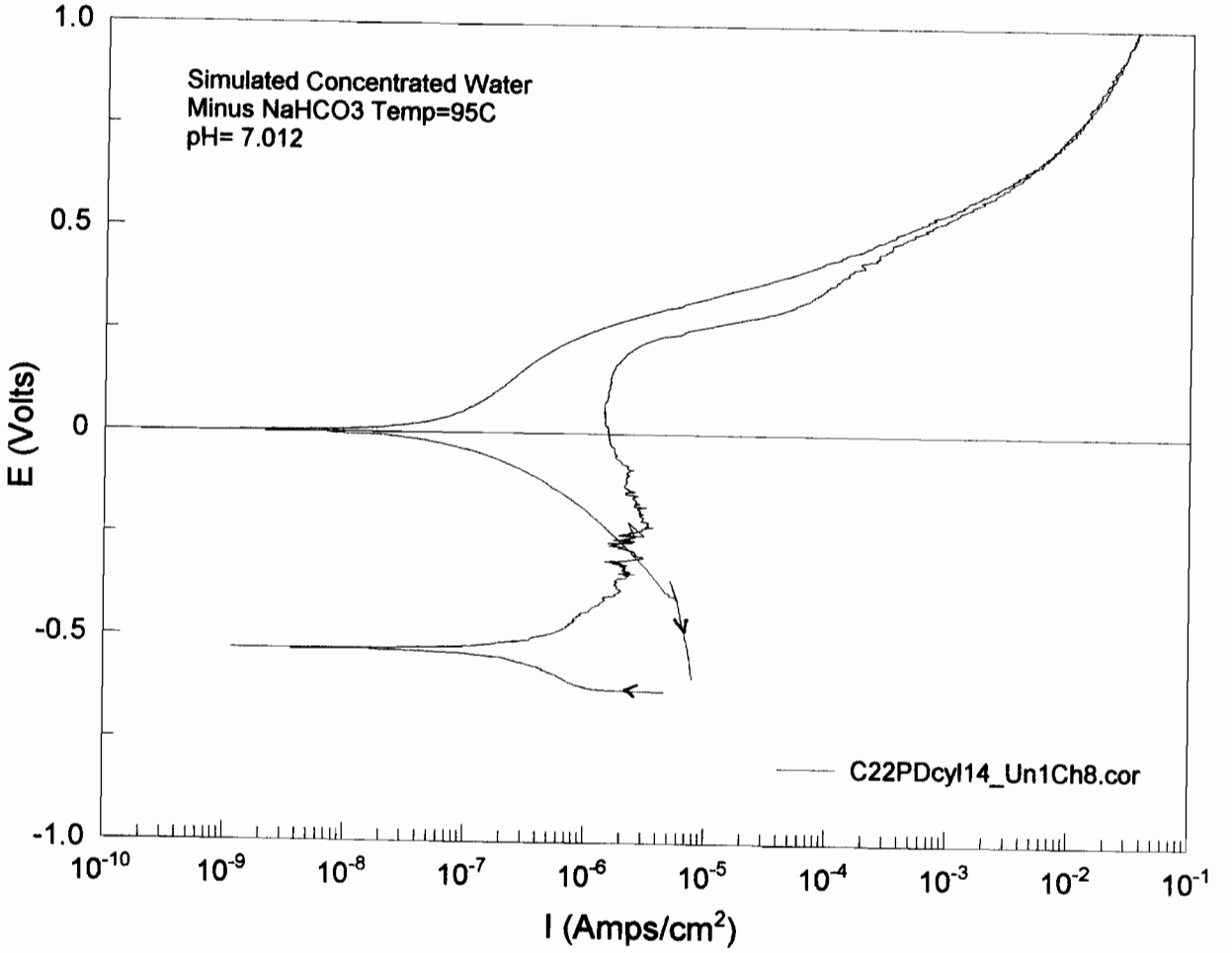
Ecorr: -545 mv **Model:** Keithley 614 **SN:** 6704936
Ept: -43 mv **Cal:** 6/7/04 **Due:** 6/7/05
Eapplied (vs SCE): -

Potentiostat: Solartron 1480 **SN#** 00238265

Specimen Examination: No pitting - Mild Surface Etching on Specimen Staining on All Surfaces of Specimen

Data C22 PD cyl 14

9/8/04


Simulated Concentrated Water
Minus NaHCO3 Temp=95C
pH= 7.012
C22PDcyl14_Un1Ch8.cor
E (Volts)
I (Amps/cm²)
1.0
0.5
0
-0.5
-1.0
10⁻¹⁰
10⁻⁹
10⁻⁸
10⁻⁷
10⁻⁶
10⁻⁵
10⁻⁴
10⁻³
10⁻²
10⁻¹

9/8/04

POTENTIODYNAMIC TEST

Objective: see page #5

Specimen: C22 Cylinder Heat# ~~2277-8-3266~~ 2277-3-3266 BMS 4/27/04 **CNWRA Drawing** 20.01402.571.019 **polished to a 600 grit finish**

Initial Weight: 12.37657g **Model:** Sartorius Genius **SN:** 12809099
Final Weight: 12.37598g **Cal:** 5/14/04 **Due:** 11/14/04

SOLUTION: .5m NaCl + .105 m $NaHCO_3$ + 1.5m KCl + 0.19m NaOH

58.48g NaCl Lot # 035509 15.24g NaOH # 033972
176.46g $NaHCO_3$ Lot # 028524
223.68g KCl Lot # 005573

Reagents measured with **Model:** OHAUS **SN:** 2883
Cal: 7/15/04 **Due:** 7/15/05

Initial pH: 8.790 **Model:** orion **SN:** 2330
Final pH: 8.826 **CAL:** 7/21/04 **DUE:** 7/21/05
pH Probe: #13-620-296 **SN:** 4079126

TEST TEMPERATURE: 95°C **Measured with Hg Thermometer SN:** H58-149
Cal: 6/8/04 **Due:** 12/8/04

Counter Electrode: Platinum Flag

Reference Electrode: Fisher SCE 13-620-52 **SN:** 3285266

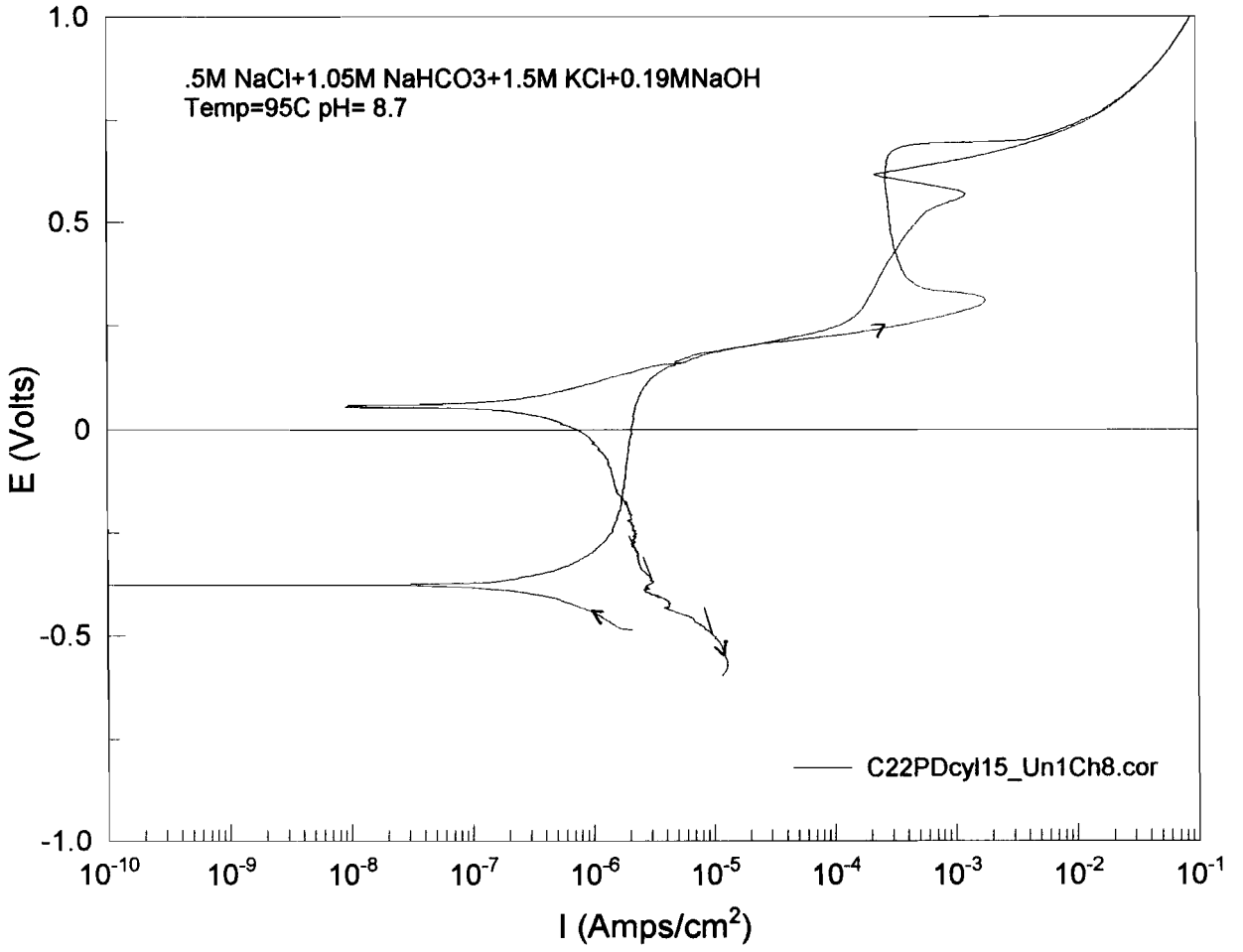
Gas: 99.999% Nitrogen
Ecorr: -389 mv **Model:** Keithley 614 **SN:** 0764536
Ept: +70 mv **Cal:** 6/7/04 **Due:** 6/7/05
Eapplied (vs SCE): —

Potentiostat: Solartron 1480 **SN#** 0602382G5

Specimen Examination: No pitting on specimen Very mirror surface staining will Repolish Specimen for further testing

Data C2200 cyl 15

9/8/04


.5M NaCl+1.05M NaHCO3+1.5M KCl+0.19MNaOH
Temp=95C pH= 8.7
C22PDcyl15_Un1Ch8.cor
E (Volts)
I (Amps/cm2)
1.0
0.5
0
-0.5
-1.0
10-10
10-9
10-8
10-7
10-6
10-5
10-4
10-3
10-2
10-1

9/8/04

POTENTIODYNAMIC TEST

Objective: see page #5

Specimen: C22 Cylinder Heat# ~~2277-8-3266~~ CNWRA Drawing 20.01402.571.019 polished to a 600 grit finish 2277-3-3266 BH 4/21/04

Initial Weight: 12.35894g **Model:** Sartorius Genius **SN:** 12809099
Final Weight: 12.35550g **Cal:**5/14/04 **Due:**11/14/04

SOLUTION: .5 m $NaCl$ + 1.05 m $NaHCO_3$ + 0.19m $NaOH$

58.46g $NaCl$ Lot # 035509
176.53g $NaHCO_3$ Lot # 028924
15.245g $NaOH$ Lot # 033972

Reagents measured with **Model:** OHAUS **SN:** 2883
Cal: 7/15/04 **Due:** 7/15/05

Initial pH: 8.510 **Model:** orion **SN:** 2330
Final pH: 9.123 **CAL:** 7/21/04 **DUE:** ~~7/21/05~~ 7/21/05 BH 6/27/04
pH Probe: #13-620-296 **SN:** 4079126

TEST TEMPERATURE: 95°C **Measured with Hg Thermometer SN:** M 98-149
Cal: 6/8/04 **Due:** 12/8/04

Counter Electrode: Platinum Flag

Reference Electrode: Fisher SCE 13-620-52 **SN:** 3285206

Gas: 99.999% Nitrogen
Ecorr: -383 mv **Model:** Keithley 614 **SN:** 0704936
Ept: -287 mv **Cal:** 6/7/04 **Due:** 6/7/05
Eapplied (vs SCE): –

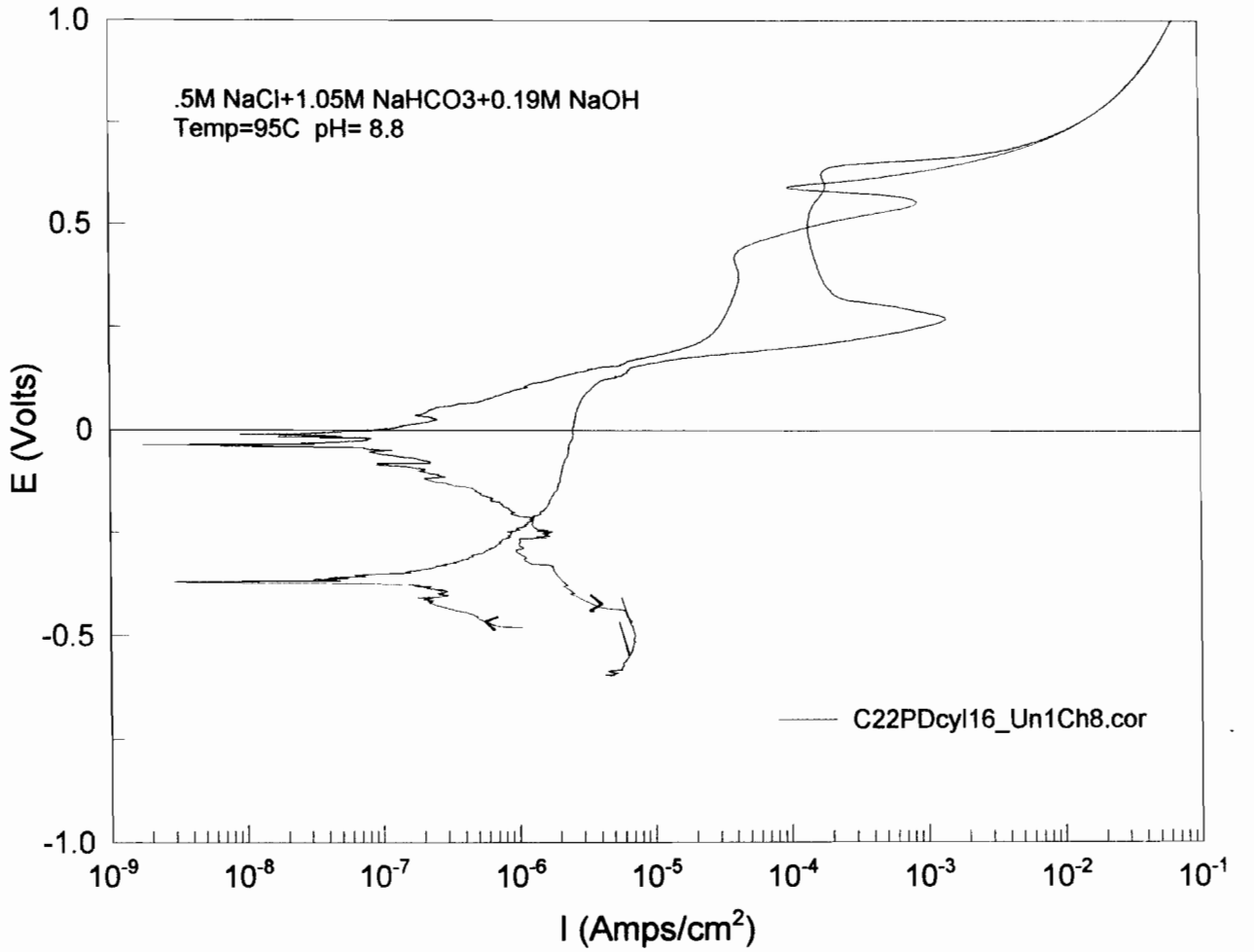
Potentiostat: Solartron 1480 **SN#** 00238265

Specimen Examination: No corrosion or pitting - Surface staining on specimen

* will Repolish Specimen for further Testing

Data C22PDcyl16

D. H. 9/8/04


.5M NaCl+1.05M NaHCO3+0.19M NaOH
Temp=95C pH= 8.8
1.0
0.5
0
-0.5
-1.0
E (Volts)
C22PDcyl16_Un1Ch8.cor
10-9
10-8
10-7
10-6
10-5
10-4
10-3
10-2
10-1
I (Amps/cm2)

9/9/04

POTENTIODYNAMIC TEST

Objective: see page #5

Specimen: C22 Cylinder Heat# ~~2277-8-3286~~ 2277-3-3266 BMO 6/27/06 **CNWRA Drawing 20.01402.571.019 polished to a 600 grit finish**

Initial Weight: 12.34298g **Model:** Sartorius Genius **SN:** 12809099
Final Weight: 12.33724g **Cal:**5/14/04 **Due:**11/14/04

SOLUTION: SCW with NaCl + $NaNO_3$ Only

10.870g NaCl Lot # 035509
17.511g $NaNO_3$ Lot # 020809
+ DI water to 2000mls

Reagents measured with **Model:** OHAUS **SN:** 2883
Cal: 7/15/04 **Due:** 7/15/05

Initial pH: 5.324 **Model:** orion **SN:** 2330
Final pH: 8.023 **CAL:** 7/21/04 **DUE:** 7/21/05
pH Probe: #13-620-296 **SN:** 4079126

TEST TEMPERATURE: 95°C **Measured with Hg Thermometer SN:** H 98-149
Cal: 6/8/04 **Due:** 12/8/04

Counter Electrode: Platinum Flag

Reference Electrode: Fisher SCE 13-620-52 **SN:** 3289206

Gas: 99.999% Nitrogen

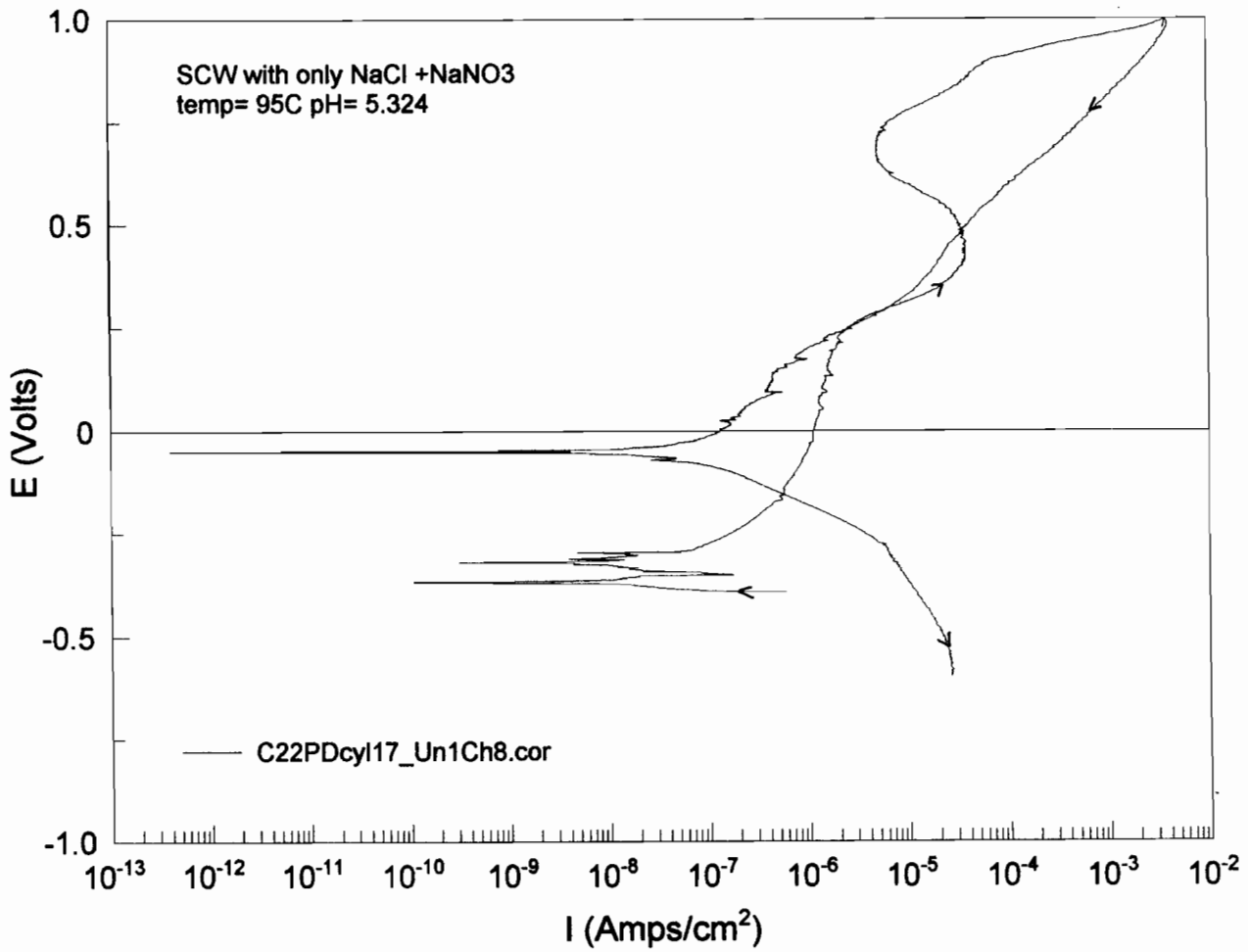
Ecorr: -264mv **Model:** Keithley 614 **SN:** 0704936
Ept: -98 mv **Cal:** 6/7/04 **Due:** 6/7/05
Eapplied (vs SCE): –

Potentiostat: Solartron 1480 **SN#** 0623826S

Specimen Examination: No Sign of Corrosion or pitting
Gold color tint staining on All surfaces of Specimen

Data C22POCyl17

9/13/06


SCW with only NaCl +NaNO3
temp= 95C pH= 5.324
C22PDcyl17_Un1Ch8.cor
E (Volts)
1.0
0.5
0
-0.5
-1.0
10-13
10-12
10-11
10-10
10-9
10-8
10-7
10-6
10-5
10-4
10-3
10-2
I (Amps/cm2)

9/14/01

POTENTIODYNAMIC TEST

Objective: see page #5

Specimen: C22 Cylinder Heat# ~~2277-0-3260~~ 2277-3-3266 **CNWRA Drawing 20.01402.571.019 polished to a 600 grit finish** BKS 6/27/04

Initial Weight: 12.32176g **Model:** Sartorius Genius **SN:** 12809099
Final Weight: **Cal:**5/14/04 **Due:**11/14/04

SOLUTION: 3.8 m NaCl + 0.38 m $NaNO_3$

444.16g NaCl Lot # 035509
64.62g $NaNO_3$ Lot # 020809
+ DI water To 2000 ml

Reagents measured with **Model:** OHAUS **SN:** 2883
Cal: 7/15/04 **Due:** 7/15/05

Initial pH: 5.507 **Model:** orion **SN:** 2330
Final pH: 6.718 **CAL:** 7/21/04 **DUE:** 7/21/05
pH Probe: #13-620-296 **SN:** 4079126

TEST TEMPERATURE: 95°C **Measured with Hg Thermometer SN:** H 98-149
Cal: 6/8/04 **Due:** 12/8/04

Counter Electrode: Platinum Flag

Reference Electrode: Fisher SCE 13-620-52 **SN:** 3289206

Gas: 99.999% Nitrogen
Ecorr: -460 mV **Model:** Keithley 614 **SN:** 0704936
Ept: -51 mV **Cal:** 6/7/04 **Due:** 6/7/05
Eapplied (vs SCE): ~

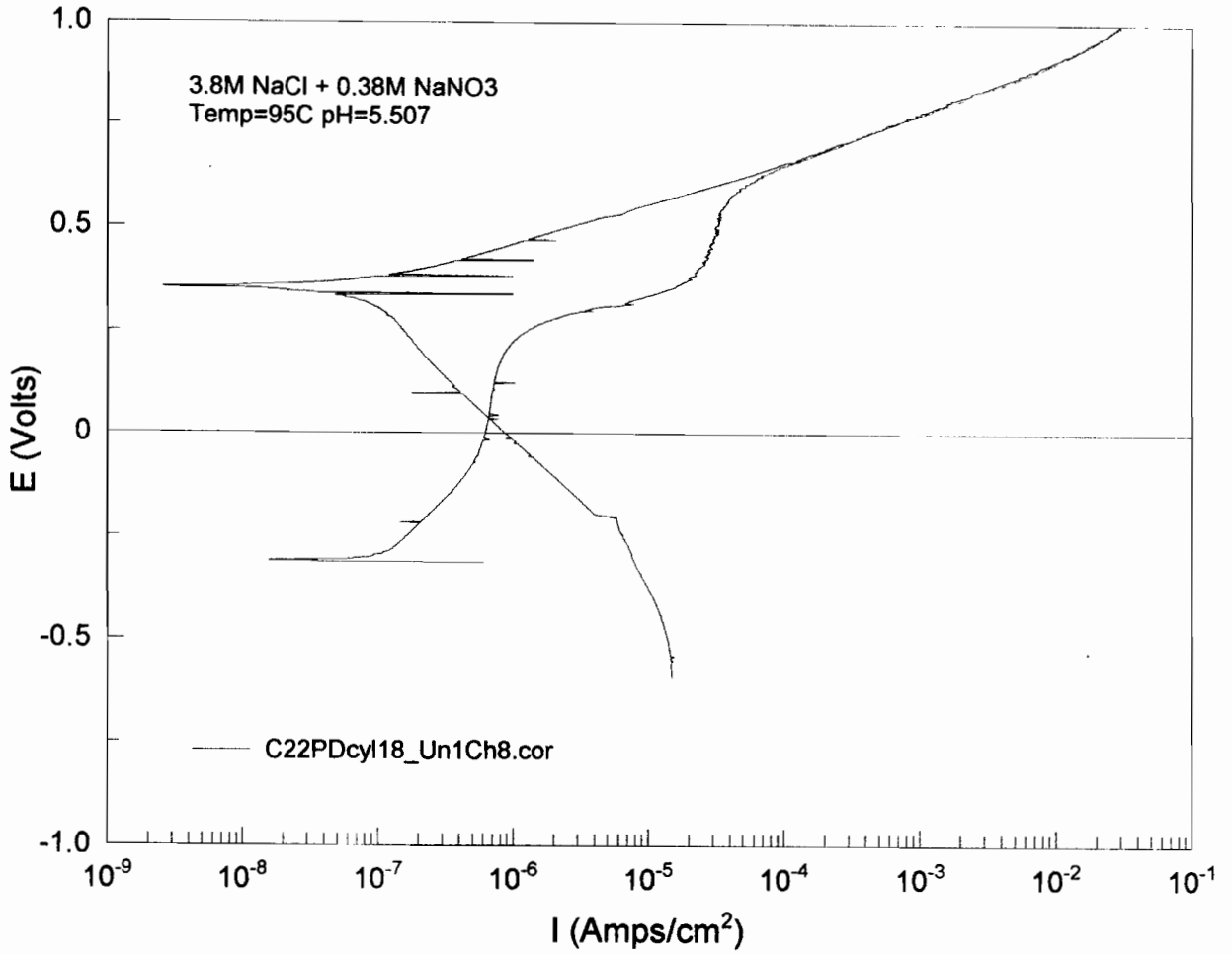
Potentiostat: Solartron 1480 **SN#** 60 238265

Specimen Examination: No Corrosion or Pitting - Gold tint staining on All Surfaces of Specimen

* Note will Repolish Specimen for Further Testing

Data C22POCyl

9/14/04


3.8M NaCl + 0.38M NaNO3
Temp=95C pH=5.507
C22PDcyl18_Un1Ch8.cor
E (Volts)
I (Amps/cm²)
1.0
0.5
0
-0.5
-1.0
10⁻⁹
10⁻⁸
10⁻⁷
10⁻⁶
10⁻⁵
10⁻⁴
10⁻³
10⁻²
10⁻¹

9/15/04

POTENTIODYNAMIC TEST

Objective: see page #5

Specimen: C22 Cylinder Heat# ~~2277-3-3266~~ CNWRA Drawing 20.01402.571.019 polished to a 600 grit finish 2277-3-3266 BM 6/27/01

Initial Weight: 12.27016g **Model:** Sartorius Genius **SN:** 12809099
Final Weight: 12.25543g **Cal:** 5/14/04 **Due:** 11/14/04

SOLUTION: 3.8 M $NaCl$ + 0.38 m $NaNO_3$
444.18g $NaCl$ Lot # 035509
64.60g $NaNO_3$ Lot # 020809
+ DI water To 2000 ml

Reagents measured with **Model:** OHAUS **SN:** 2883
Cal: 7/15/04 **Due:** 7/15/05

Initial pH: 6.231 **Model:** orion **SN:** 2370
Final pH: 7.609 **CAL:** 7/21/04 **DUE:** 7/21/05
pH Probe: #13-620-296 **SN:**

TEST TEMPERATURE: 95°C **Measured with Hg Thermometer SN:** H 98-149
Cal: 6/8/04 **Due:** 12/8/04

Counter Electrode: Platinum Flag

Reference Electrode: Fisher SCE 13-620-52 **SN:** 3285206

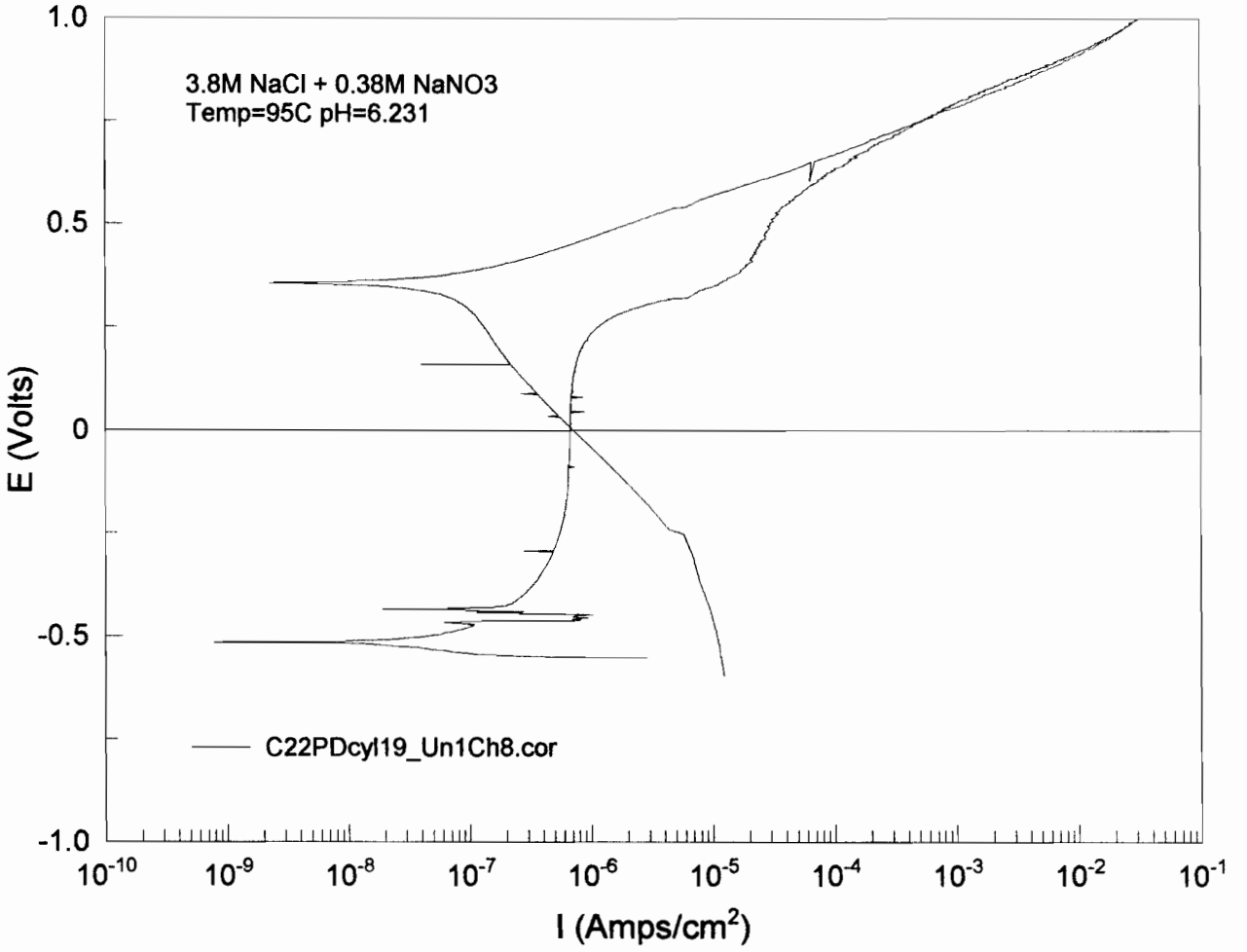
Gas: 99.999% Nitrogen
Ecorr: - 459 mV **Model:** Keithley 614 **SN:** 0704936
Ept: - 63 mV **Cal:** 6/7/04 **Due:** 6/7/05
Eapplied (vs SCE): -

Potentiostat: Solartron 1480 **SN#** 00238265

Specimen Examination: No Corrosion or pitting - Gold tint Staining on All Surfaces of Specimen

Data C22POcyl1G * Re Run of Test #18

9/15/04


3.8M NaCl + 0.38M NaNO3
Temp=95C pH=6.231
C22PDcyl19_Un1Ch8.cor
E (Volts)
I (Amps/cm2)
1.0
0.5
0
-0.5
-1.0
10-10
10-9
10-8
10-7
10-6
10-5
10-4
10-3
10-2
10-1

9/16/04

SLOW STRAIN RATE TEST

Objective: see page #5 Notebook #695

Specimen: MA Alloy 22 SwRI Drawing # 20-03704-042-001

Solution: ~ 1/2 liter Heat # ~~2277-8-3266~~ 2277-3-3266 BM 6/27/06 Lot

$NaHCO_3$	48.156 g	# 028924
NaCl	14.997 "	# 03550 9
KCl	12.309 g	# 055573 / # 006242

Reagents measured with **Model:** ORION 5 **SN:** 2883
Cal: 15 JUL 04 **Due:** 15 JAN 05

Counter Electrode: Pt flag **Reference Electrode:** Ag/AgCl in home w/3M KCl

Gas: N_2 (99.999%) **Ecorr:** −267 mV

*Eapplied: +415 mV **Potentiostat:** ESC 440-2 **SN:** 9209138

Specimen Visual: silver-gray metallic; much secondary cracking & brittle failure

$\dot{\epsilon}^{o} = 3.2 \times 10^{-6}\ s^{-1}$

* temp effect from RT to 95°C Δ13 mV

data file: SSRMA22_SCW22

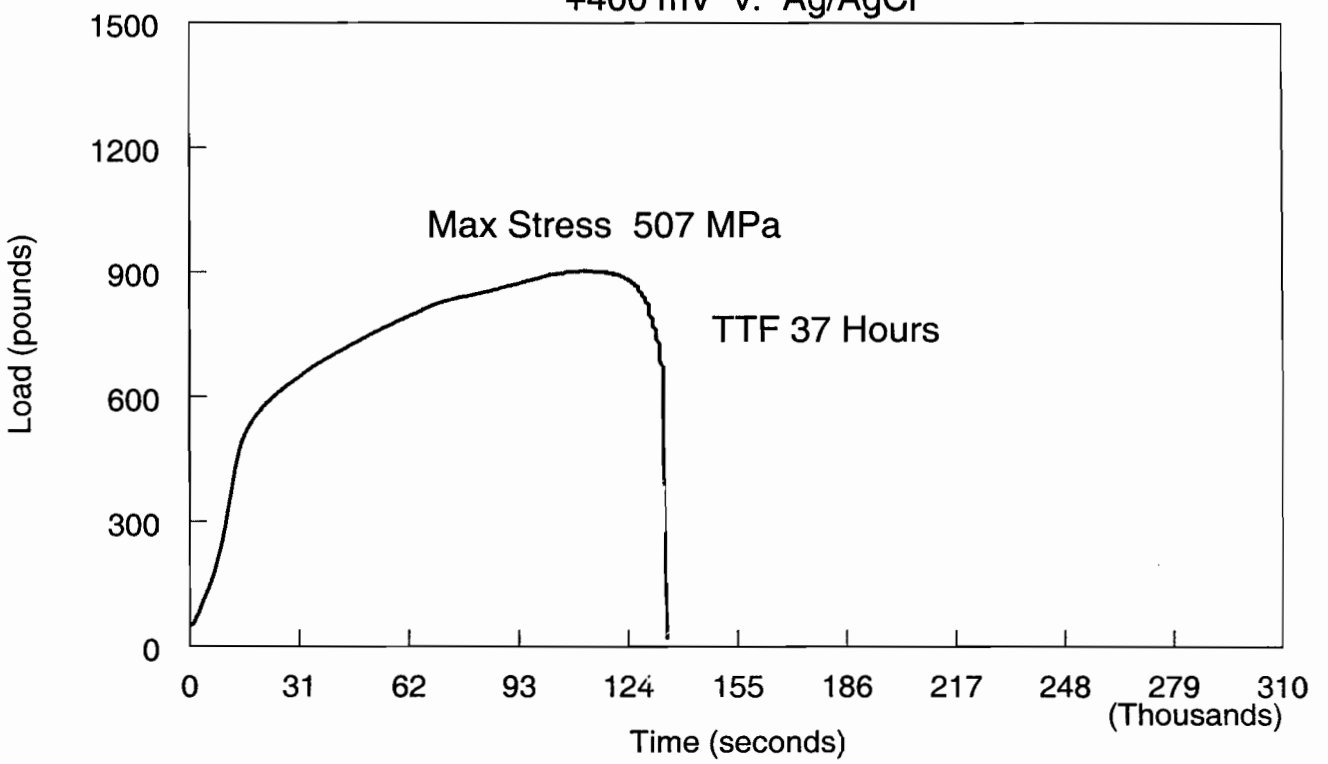
Walter J. Mackowski
10/21/04

Slow Strain Rate Test

0.5M NaCl; 3.3M KCl; NaHCO3 as in SCW

SSRMA22_SCW22

+400 mV v. Ag/AgCl



Walter J. Mochrowski
10/21/04

SLOW STRAIN RATE TEST

Objective: see page #5 Notebook #695

Specimen: MA Alloy 22 SwRI Drawing # 20-03704-042-001

Heat # ~~2277-8-3266~~ 2277-3-3266 BKG 6/27/06

Solution: ~ 1/2 liter pH 8.169

NaCl	14.926 g	#36309
$NaHCO_3$	48.10 g	#02894
KCl	264.83 g	#006242

post pH 9.98 (pH not adjusted)

Reagents measured with **Model:** OHAUS **SN:** 2883 **Cal:** 15 JUL 04 **Due:** 15 JAN 05

Counter Electrode: Pt flag **Reference Electrode:** Ag/AgCl in home ~/3M KCl

Gas: N_2 (99.999) **Ecorr:** −290 mV

Eapplied: ~ 415 mV **Potentiostat:** ESC440-2 **SN:** 920938

Specimen Visual: silver-gray metallic; several secondary cracking; brittle failure

$\epsilon^0 = 3.2 \times 10^{-6}\ s^{-1}$

* temp effect from RT to 95°C Δ15 mV

data file: SSRMA22 — SCW23

Walter J. Mackowiak

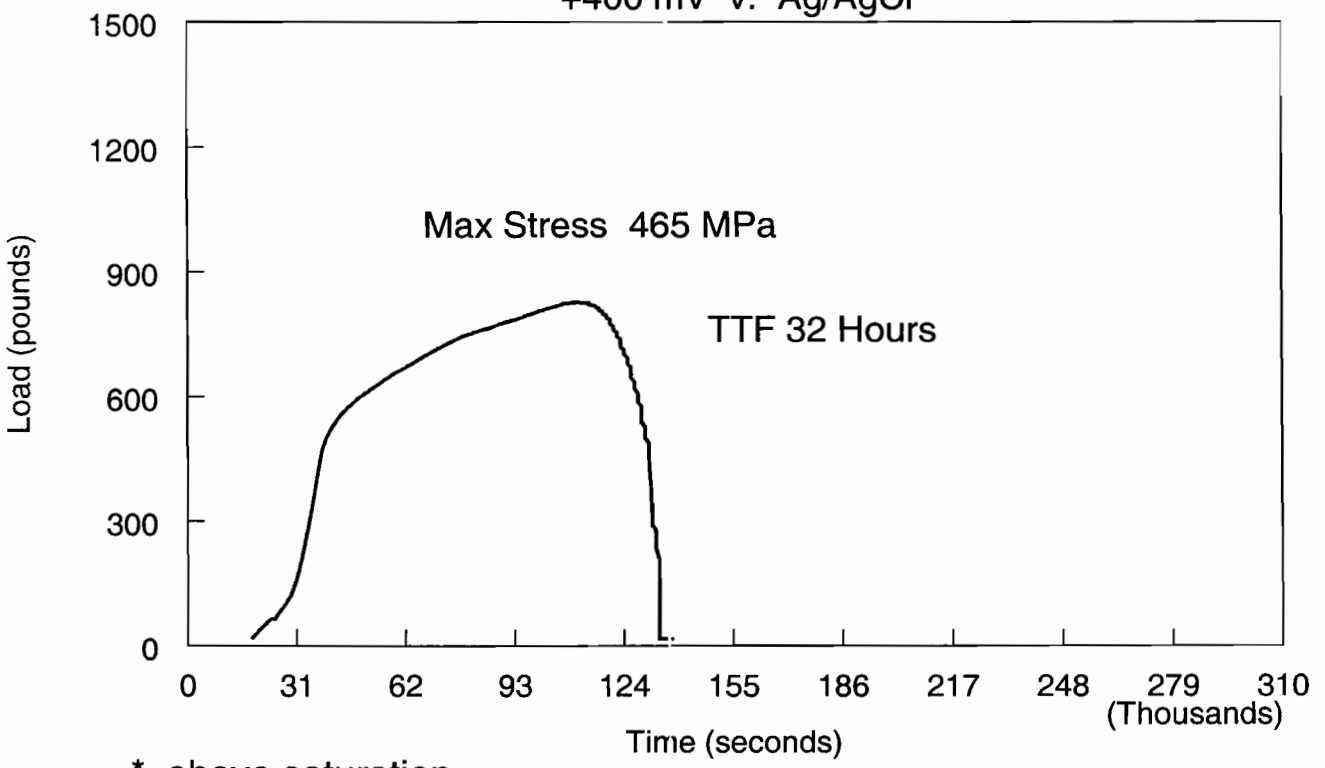
10/25/04

Slow Strain Rate Test

0.5M NaCl; 7.1M* KCl; NaHCO3 as in SCW

SSRMA22_SCW23

+400 mV v. Ag/AgCl



* above saturation

Walter J. Mackerle
10/25/04

SLOW STRAIN RATE TEST

Objective: see page #5 Notebook #695

Specimen: MA Alloy 22 SwRI Drawing # 20-03704-042-001 2277-3-3266 BLD 6/27/06

~~Heat # 2277-8-3266~~

Solution: x 1/2 liter wdm 8.53 4/27/06

NaCl	14.903 g	# 035509	pH ~~8.62~~
$NaHCO_3$	48.20 g	# 028924	not adj
KCl	264.83 g	# 006242	final pH 10.24

Reagents measured with **Model:** ~~Orion~~ **SN:** 2883
Cal: 15 JUL 04 **Due:** 15 JUL 05

Counter Electrode: Pt flag **Reference Electrode:** Ag/AgCl in home w/3M KCl

Gas: N_2 (99.999%) **Ecorr:** −280 mV

Eapplied: +200 mV **Potentiostat:** ~~ESCM-2~~ **SN:** 9209138

Specimen Visual: silver-metallic; looks like ductile failure

$\dot{\epsilon}^{o} = 3.2 \times 10^{-6}\ s^{-1}$

data file: SSRMA22_SCW24

Walter J. Mackerle

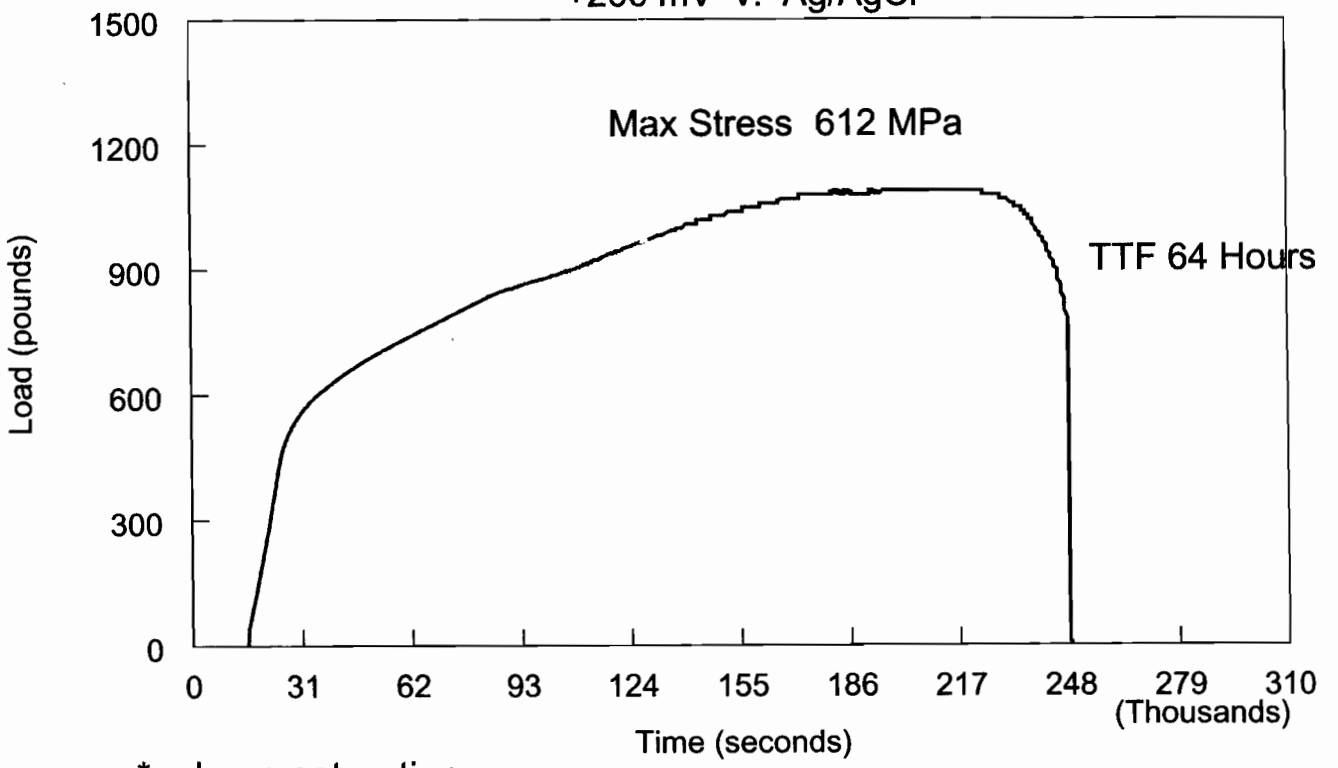
11/5/04 ~~10/5/04~~ wjm

Slow Strain Rate Test

0.5M NaCl; 7.1M* KCl; NaHCO3 as in SCW

SSRMA22_SCW24

+200 mV v. Ag/AgCl



* above saturation

Walter J. Mackowski

11/5/04

SLOW STRAIN RATE TEST

Objective: see page #5 Notebook #695

Specimen: MA Alloy 22 SwRI Drawing # 20-03704-042-001

Heat # ~~2277-8-3266~~ 2277-3-3266 BP 6/27/01

Solution: ∝ 1/2 liter

NaCl	14.924 g	# 035509	pH 8.62
$NaHCO_3$	48.340	# 028924	wt adj:
KCl	264.75	006242	final pH 10.20

Reagents measured with Model: ~~OHAUS~~ SN: 2883
Cal: 15 JUL 04 Due: 15 JUN 05

Counter Electrode: Pt flag **Reference Electrode:** Ag/AgCl in house w/3M KCl

Gas: N_2 (99.995%) **Ecorr:** −296 mV

Eapplied: +100 mV **Potentiostat:** ECS 440-2 **SN:** 9209138

Specimen Visual:

silver-metallic; looks like ductile fracture

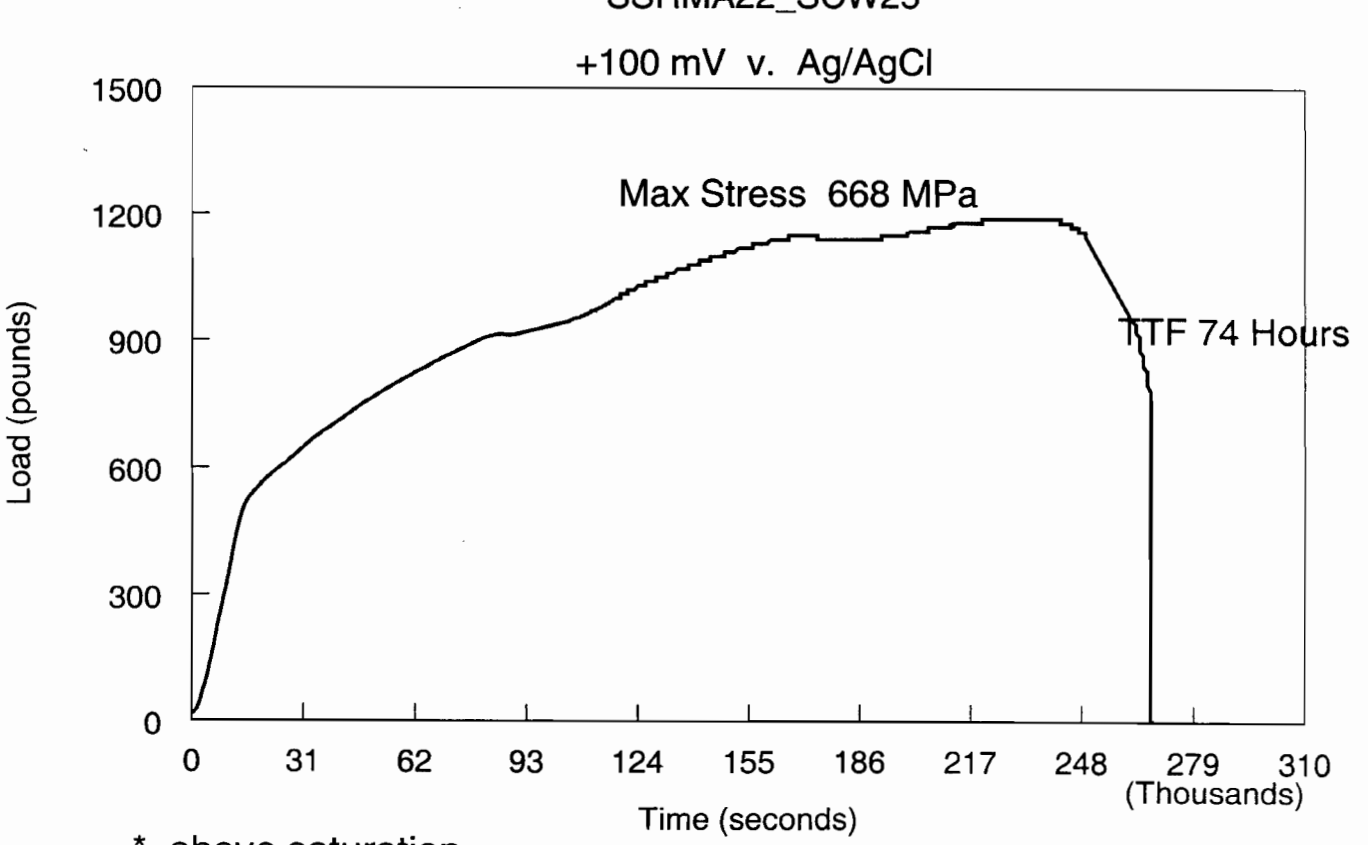
$\epsilon^0 = 3.2 \times 10^{-6}\ s^{-1}$

data file: SSRMA22_SCW25

Walter J. Mackerras
11/12/04

Slow Strain Rate Test

0.5M NaCl; 7.1M* KCl; NaHCO3 as in SCW



* above saturation

Walter J. MacIntyre
11/12/04

SLOW STRAIN RATE TEST

Objective: see page #5 Notebook #695

Specimen: MA Alloy 22 SwRI Drawing # 20-03704-042-001

Solution: ~1/2 liter Heat # ~~2277-8-3266~~ 2277-3-3266 BLO 6/27/01

			pH 8.69
NaCl	14.934 g	# 041475	not adj.
$NaHCO_3$	48.18	# 028924	
KCl	264.80	# 006242, 005593	final pH 10.83

Reagents measured with **Model:** ORION 5 **SN:** 2883
Cal: 15 JUL 04 **Due:** 15 JUL 05

Counter Electrode: Pt flag **Reference Electrode:** Ag/AgCl in house 4/3M KCl

Gas: N_2 (99.999%) **Ecorr:** −355 mV

Eapplied: +300 mV **Potentiostat:** ESC440-2 **SN:** 9209138

Specimen Visual: silver-gray metallic; secondary cracking; looks like brittle fracture

$\dot{\epsilon}^{o} = 3.2 \times 10^{-6}\ s^{-1}$

data file: SSRMA22_SCW26

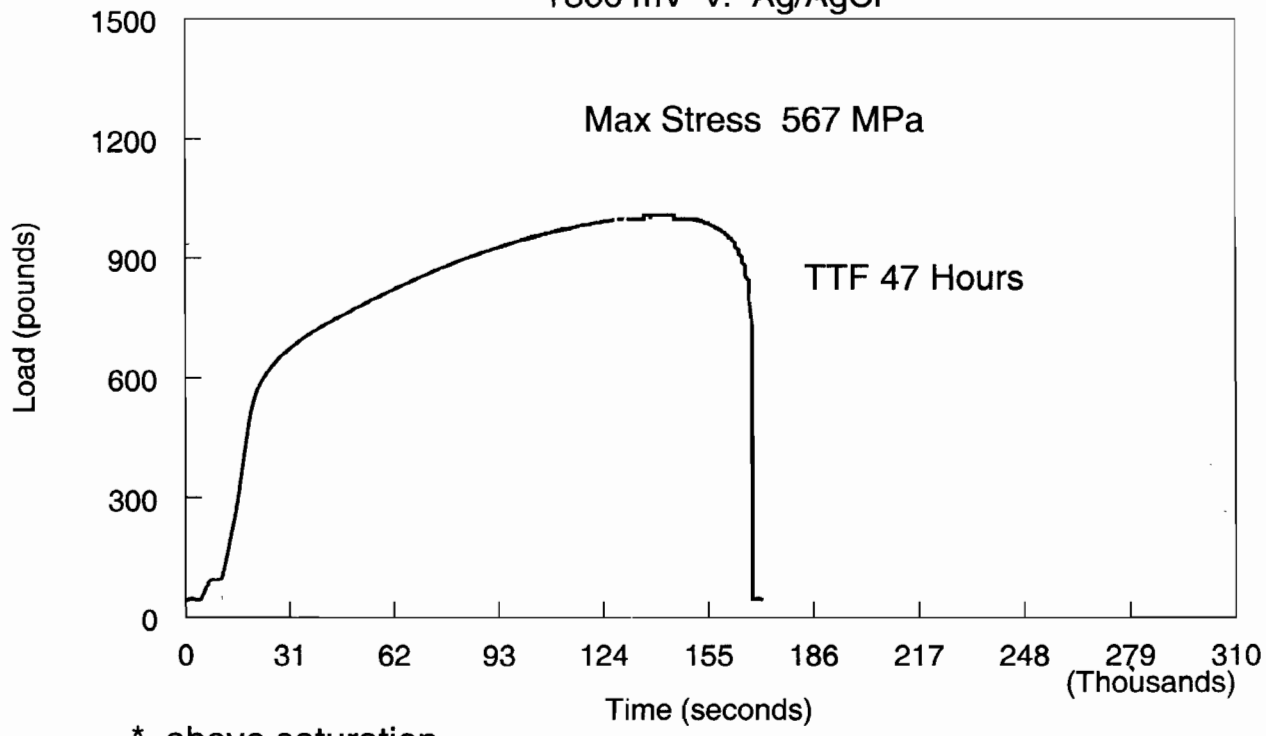
Walter J. Mackowski
11/15/04

Slow Strain Rate Test

0.5M NaCl; 7.1M* KCl; NaHCO3 as in SCW

SSRMA22_SCW26

+300 mV v. Ag/AgCl



* above saturation

Walter J. Mackowski
11/15/04

SLOW STRAIN RATE TEST

Objective: see page #5 Notebook #695

Specimen: MA Alloy 22 SwRI Drawing # 20-03704-042-001

Heat ~~#2277-8-3266~~ 2277-3-3266 JPS 6/27/06

Solution: Glycerin

Reagents measured with **Model:** NA **SN:** NA **Cal:** **Due:**

Counter Electrode: NA **Reference Electrode:** NA

Gas: N_2 (99.999) **Ecorr:** NA

Eapplied: NA **Potentiostat:** NA **SN:** NA

Specimen Visual:

silver metallic, ductile failure

file : SSRMA22_SCW27

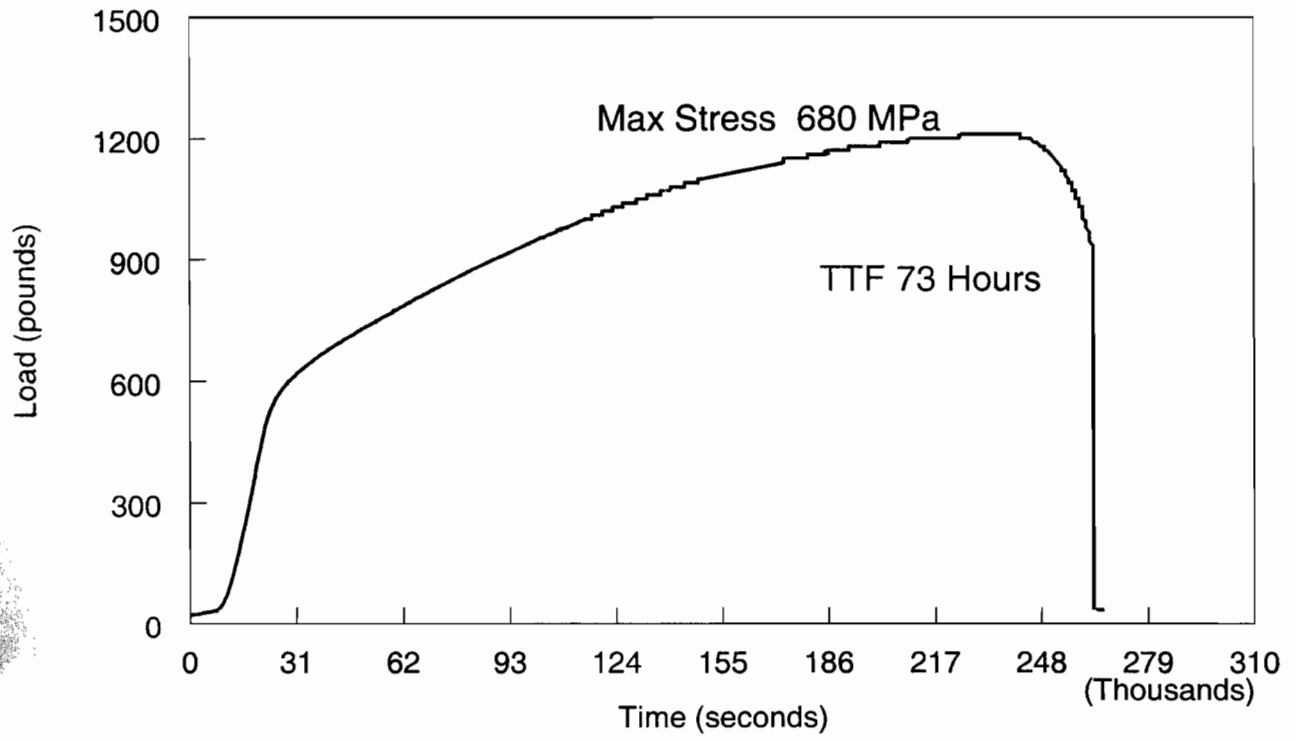
Walter J. Mackowiak

11/23/04

Slow Strain Rate Test

Glycerin @ 95 C

SSRMA22_SCW27



Walter J. Machuraski

11/23/04

SLOW STRAIN RATE TEST

Objective: see page #5 Notebook #695

Specimen: MA Alloy 22 SwRI Drawing # 20-03704-042-001

Heat # ~~2277-8-3266~~ 2277-3-3266 BW 6/27/01

Solution: ~ ½ liter

NaCl	14.92 g	# 041475
$NaHCO_3$	48.13	# 028924
KCl	264.83	# 005573
$NaNO_3$	44.59	030809

pH in 7.41 ↓ w/ adj

pH final 9.56

Reagents measured with **Model:** ORION 5 **SN:** 2683

Cal: 1-5 JUL 04 **Due:** 15 JAN 05

Counter Electrode: Pt flag **Reference Electrode:** $Ag/AgCl$ in house w/ 3M KCl

Gas: N_2 (99.999) **Ecorr:** −326 mV

*__Eapplied:__ +400 mV **Potentiostat:** ~~ESC 440-2~~ **SN:** 920938

wiring BW 6/27/01 ESC 440-2

Specimen Visual:

metallic silver-gray; secondary cracking

brittle failure

$\epsilon^{\circ} = 3.2 \times 10^{-6}\ s^{-1}$

* did not apply extra 15 mV as previously done

data file: SSRMA22_SCW28

Walter J. Mackowiak

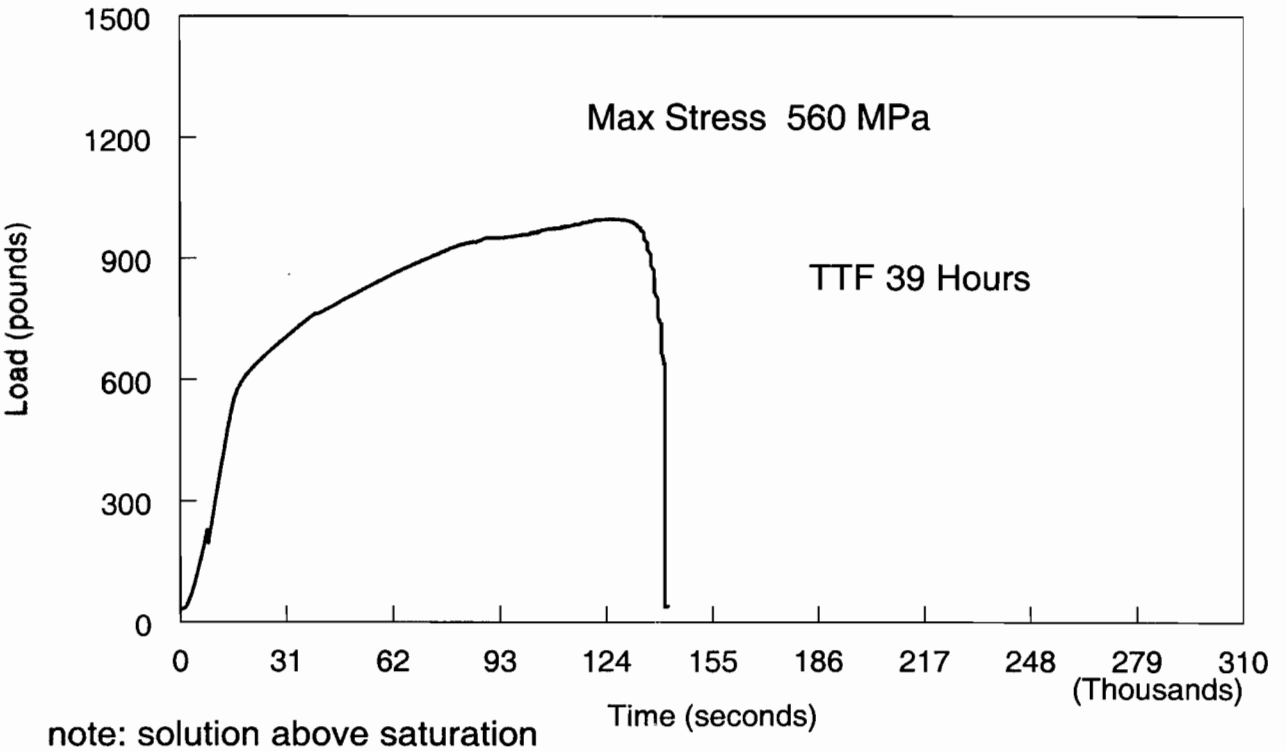
12/13/04

Slow Strain Rate Test

0.5M NaCl; ~~3.6M~~ 7.1M KCl; 0.38M $NaNO_3$; $NaCO_3$ as in SCW

SSRMA22_SCW28

WJM 12/13/04



note: solution above saturation

Walter J. Mackowiak
12/13/04

SLOW STRAIN RATE TEST

Objective: see page #5 Notebook #695

Specimen: MA Alloy 22 SwRI Drawing # 20-03704-042-001

Heat # ~~2277-8-3266~~ 2277-3-3266 DLS 6/27/06

Solution: ~ 1/2 liter

NaCl	14.72 g	# 041475	pH initial 7.87
$NaHCO_3$	46.07	028924	↓ w adj
KCl	123.10	005573	pH final 9.44
$NaNO_3$	44.24	020809	

Reagents measured with **Model:** ORION 5 **SN:** 2683
Cal: 15 JUL 04 **Due:** 15 JAN 05

Counter Electrode: Pt flag **Reference Electrode:** Ag/AgCl in lumi w/3M KCl

Gas: N_2 (99.999) **Ecorr:** −350 mV

*Eapplied: ~~+400 mV~~ +415 mV **Potentiostat:** ECS 440-2 **SN:** 9209136

Specimen Visual: 3 kg 1/2 oz/dw om

grayish; secondary cracking;
little pitting

$\dot{\epsilon}^{o} = 3.2 \times 10^{-6}\ s^{-1}$

* difference in T from RT to 95°C Δ+15 mV

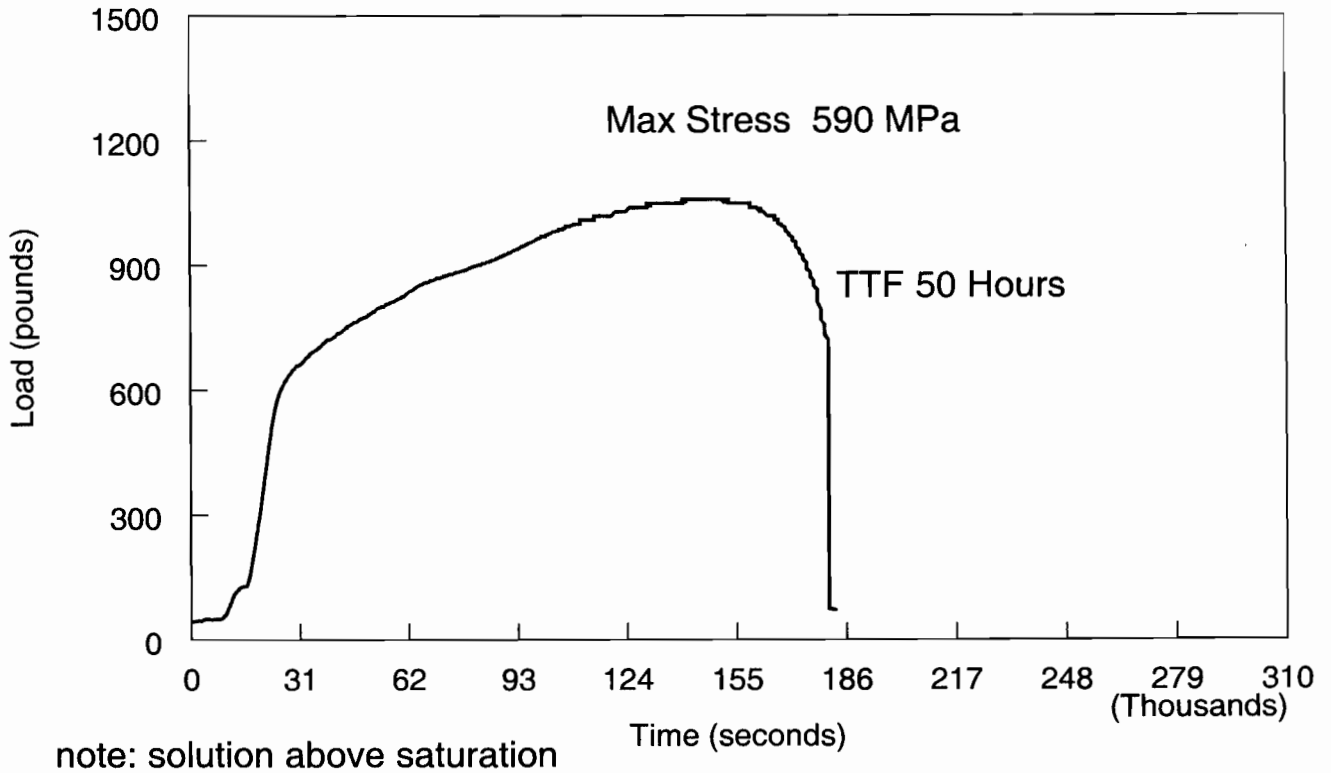
data file: SSRMA22_SCW29

Walter J. Mackerle
12/17/04

Slow Strain Rate Test

0.5M NaCl; 3.3M KCl; 0.38M NaNO3; NaCO3 as in SCW

SSRMA22_SCW29



note: solution above saturation

Walter J. Mackerras

12/17/04

Notebook # 572 P. 63. L. Yang, OLI. speciation calculation.

Calculation Results
Calculation was conducted using OLI StreamAnalyzer 1.2

SCW01

Calculation Summary		Calculation Summary		Calculation Summary		Calculation Summary	
SinglePoint1 Calculation for Work1		SinglePoint_NaOH Calculation for Work1		SinglePoint_NaOH_95oC Calculation for Work1		SinglePoint1 Calculation for Work1	
Automatic Chemistry Model		Automatic Chemistry Model		Automatic Chemistry Model		Automatic Chemistry Model	
Databanks:	Public	Databanks:	Public	Databanks	Public	Databanks	Public
Unit Set: Default		Unit Set: Default		Unit Set: Default		Unit Set: Default	
Isothermal Calculation		Isothermal Calculation		Isothermal Calculation		Isothermal Calculation	
Temperatu	25 °C	Temperatu	25 °C	Temperatu	95 °C	Temperatu	25 °C
Pressure	1 atm	Pressure	1 atm	Pressure	1 atm	Pressure	1 atm

Stream Inflows		Stream Inflows		Stream Inflows		Stream Inflows	
Water	2000 g	Water	2000 g	Water	2000 g	Water	1000 g
Sodium chloride	10.862 g	Sodium chl	10.862 g	Sodium chl	10.862 g	Sodium chl	5.438 g
Potassium chloride	12.956 g	Potassium	12.956 g	Potassium	12.956 g	Potassium	6.479 g
Sodium nitrate	17.503 g	Sodium nitr	17.503 g	Sodium nitr	17.503 g	Sodium nitr	0 g
Sodium sulfate	41.384 g	Sodium sul	41.384 g	Sodium sul	41.384 g	Sodium sul	20.699 g
Sodium bicarbonate	192.684 g	Sodium bic	192.684 g	Sodium bic	192.684 g	Sodium bic	96.339 g
Sodium fluoride	6.185 g	Sodium flu	6.185 g	Sodium flu	6.185 g	Sodium flu	3.088 g
Sodium hydroxide	0 g	Sodium hyr	25 g	Sodium hyr	25 g	Sodium hyr	0 g

Speciation Summary

Total number of species: 113

User Inflows	Related Inflows	Aqueous Species	Vapor Species	Solid Species	Second Liquid Spe
H2O	CO2	H2O	H2O - Vap	K2SO4.KNaSO4	
NaCl	H2CO3	HCO3-1	CO2 - Vap	2Na2SO4.Na2CO3	
KCl	K2SO4.KN	HSO4-1	(HF)2 - Vaj	KHCO3	
NaNO3	2Na2SO4.(	CO2 - Aq	HCl - Vap	KHSO4	
Na2SO4	(HF)2	CO3-2	HF - Vap	K2CO3	
NaHCO3	HCl	Cl-1	HNO3 - Va	K2CO3.1.5H2O	
NaF	HF	Na2F+1	SO3 - Vap	KCl	
NaOH	(HF)6	F-1	H2SO4 - V	KF	
	HNO3	(HF)2 - Aq		KF.2H2O	
	KHCO3	HCl - Aq		KF.4H2O	
	KHSO4	HF2-1		KOH	
	K2CO3	HF - Aq		KOH.2H2O	
	K2CO3.1.5	H+1		KOH.1H2O	
	KF	OH-1		KNO3	
	KF.2H2O	NO3-1		K2SO4	
	KF.4H2O	HNO3 - Aq		K2SO4.1H2O	
	KOH	KHSO4 - Aq		NaHCO3	
	KOH.2H2O	KCl - Aq		NaHSO4	
	KOH.1H2O	K+1		Na2CO3	
	KNO3	KSO4-1		Na2CO3.10H2O	
	K2SO4	NaHCO3 - Aq		Na2CO3.7H2O	
	K2SO4.1H	NaCO3-1		Na2CO3.1H2O	
	NaHSO4	NaF - Aq		NaCl	
	Na2CO3	Na+1		NaF	
	Na2CO3.1	NaNO3 - Aq		NaF.Na2SO4	
	Na2CO3.7	NaSO4-1		NaHF2	
	Na2CO3.1	SO4-2		NaOH	
	NaF.Na2S	SO3 - Aq		NaOH.1H2O	
	NaHF2	H2SO4 - Aq		NaNO3	
	NaOH.1H2O			Na2SO4	
	Na2SO4			Na2SO4	
	Na2SO4.NaHSO4			Na2SO4.NaHSO4	
	Na2SO4.10H2O			Na2SO4.10H2O	
	SO3				
	H2SO4				

Stream Parameters

Stream Amt	2281.6 g	Stream Am	2306.6 g	
Temperatura	25 °C	Temperatu	25 °C	
Pressure	1 atm	Pressure	1 atm	
pH	7.6933 pH	pH	8.9496 pH	
Ionic Strength	1.5667 mol/kg H2O	Ionic Stren	2.0957 mol/kg H2O	
Osmotic Pressure	70.757 atm	Osmotic Pr	73.217 atm	
WaterActivity	0.94956 Activity	WaterActiv	0.94844 Activity	
Electrical Cond, specific	0.080133 1/ohm	Electrical C	0.092008 1/ohm	
Electrical Cond, molar	50.942 cm2/ohm-mol	Electrical C	49.19 cm2/ohm-mol	
Viscosity, absolute	1.3987 cP	Viscosity, a	1.4813 cP	
Viscosity, relative	1.5703 cP/cP H2O	Viscosity, r	1.5631 cP/cP H2O	

	Total	Aqueous	Vapor	Solid	2nd Liquid
	--	g/ml	g/ml	g/ml	g/ml
Density	--	1.0832	0	2.1997	0
	Total	Aqueous	Vapor	Solid	2nd Liquid
	cal	cal	cal	cal	cal
Enthalpy	-8.27E+06	-8.24E+06	0	-28594	0

Total and Phase Flows (Amounts)

	Total	Aqueous	Vapor	Solid	2nd Liquid
	mol	mol	mol	mol	mol
Mole	117.33	117.2	0	0.12605	0
	Total	Aqueous	Vapor	Solid	2nd Liquid
	g	g	g	g	g
Mass	2281.6	2271	0	10.589	0
	Total	Aqueous	Vapor	Solid	2nd Liquid
	L	L	L	L	L
Volume	2.1013	2.0965	0	4.81E-03	0

Scaling Tendencies

solids within temperature ra	Temperature Range		
Sodium bicarbonate	1	0 200.00 °C	inside range
Sodium fluoride	0.10306	0 100.00 °C	inside range
Sodium sulfate decahydrate	0.050002	0 32.400 °C	inside range
Sodium fluoride sulfate	0.033632	20 40.000 °C	inside range
Potassium bicarbonate	0.011273	0 70.000 °C	inside range
Sodium sulfate	8.74E-03	19 241.00 °C	inside range
Sodium carbonate decahyd	4.07E-03	0 32.000 °C	inside range
Potassium nitrate(VI)	3.12E-03	0 110.00 °C	inside range
Sodium chloride	2.49E-03	0 350.00 °C	inside range
Sodium nitrate	1.67E-03	0 300.00 °C	inside range
Potassium sulfate(VI)	9.00E-04	9.7 292.00 °C	inside range
Potassium chloride	6.48E-04	0 200.00 °C	inside range

Speciation Summary					
Total number of species: 113					
User Inflows	Related Inflows	Aqueous Species	Vapor Species	Solid Species	Second Liquid Spe
H2O	CO2	H2O	H2O - Vap	K2SO4.KNaSO4	
NaCl	H2CO3	HCO3-1	CO2 - Vap	2Na2SO4.Na2CO3	
KCl	K2SO4.KN	HSO4-1	(HF)2 - Vaj	KHCO3	
NaNO3	2Na2SO4.(	CO2 - Aq	HCl - Vap	KHSO4	
Na2SO4	(HF)2	CO3-2	HF - Vap	K2CO3	
NaHCO3	HCl	Cl-1	HNO3 - Va	K2CO3.1.5H2O	
NaF	HF	Na2F+1	SO3 - Vap	KCl	
NaOH	(HF)6	F-1	H2SO4 - V	KF	
	HNO3	(HF)2 - Aq		KF.2H2O	
	KHCO3	HCl - Aq		KF.4H2O	
	KHSO4	HF2-1		KOH	
	K2CO3	HF - Aq		KOH.2H2O	
	K2CO3.1.5	H+1		KOH.1H2O	
	KF	OH-1		KNO3	
	KF.2H2O	NO3-1		K2SO4	
	KF.4H2O	HNO3 - Aq		K2SO4.1H2O	
	KOH	KHSO4 - Aq		NaHCO3	
	KOH.2H2O	KCl - Aq		NaHSO4	
	KOH.1H2O	K+1		Na2CO3	
	KNO3	KSO4-1		Na2CO3.10H2O	
	K2SO4	NaHCO3 - Aq		Na2CO3.7H2O	
	K2SO4.1H	NaCO3-1		Na2CO3.1H2O	
	NaHSO4	NaF - Aq		NaCl	
	Na2CO3	Na+1		NaF	
	Na2CO3.1	NaNO3 - Aq		NaF.Na2SO4	
	Na2CO3.7	NaSO4-1		NaHF2	
	Na2CO3.1	SO4-2		NaOH	
	NaF.Na2S	SO3 - Aq		NaOH.1H2O	
	NaHF2	H2SO4 - Aq		NaNO3	
	NaOH.1H2O			Na2SO4	
	Na2SO4			Na2SO4	
	Na2SO4.NaHSO4			Na2SO4.NaHSO4	
	Na2SO4.10H2O			Na2SO4.10H2O	
	SO3				
	H2SO4				

Stream Parameters

Stream Amt	2306.6 g	Stream Am	2306.6 g	
Temperatura	95 °C	Temperatu	95 °C	
Pressure	1 atm	Pressure	1 atm	
pH	8.9657 pH	pH	8.9657 pH	
Ionic Strength	2.0753 mol/kg H2O	Ionic Stren	2.0753 mol/kg H2O	
Osmotic Pressure	33.095 atm	Osmotic Pr	33.095 atm	
WaterActivity	0.96053 Activity	WaterActiv	0.96053 Activity	
Electrical Cond, specific	0.22901 1/ohm	Electrical C	0.22901 1/ohm	
Electrical Cond, molar	127.43 cm2/ohm-mol	Electrical C	127.43 cm2/ohm-mol	
Viscosity, absolute	0.52894 cP	Viscosity, a	0.52894 cP	
Viscosity, relative	1.7804 cP/cP H2O	Viscosity, r	1.7804 cP/cP H2O	

	Total	Aqueous	Vapor	Solid	2nd Liquid
	--	g/ml	g/ml	g/ml	g/ml
Density	--	1.0567	0	0	0
	Total	Aqueous	Vapor	Solid	2nd Liquid
	cal	cal	cal	cal	cal
Enthalpy	-8.20E+06	-8.20E+06	0	0	0

Total and Phase Flows (Amounts)

	Total	Aqueous	Vapor	Solid	2nd Liquid
	mol	mol	mol	mol	mol
Mole	118.33	118.33	0	0	0
	Total	Aqueous	Vapor	Solid	2nd Liquid
	g	g	g	g	g
Mass	2306.6	2306.6	0	0	0
	Total	Aqueous	Vapor	Solid	2nd Liquid
	L	L	L	L	L
Volume	2.1828	2.1828	0	0	0

Scaling Tendencies

solids within Temperature Range			
Sodium bic	0.33407	0 200.00 °C	inside range
Sodium flu	0.080034	0 100.00 °C	inside range
Sodium sul	0.025147	19 241.00 °C	inside range
Sodium car	0.011471	35.37 109.00 °C	inside range
Hexahydrat	8.51E-03	30 150.00 °C	inside range
Sodium chl	3.28E-03	0 350.00 °C	inside range
Sodium nitr	7.44E-04	0 300.00 °C	inside range
Potassium	6.56E-04	0 110.00 °C	inside range
Potassium	3.51E-04	0 200.00 °C	inside range
Potassium	3.39E-04	9.7 292.00 °C	inside range
Glaserite	3.00E-05	35 150.00 °C	inside range
Sodium hyd	5.86E-06	data valid tl	inside range

Speciation Summary					
Total number of species: 113					
User Inflows	Related Inflows	Aqueous Species	Vapor Species	Solid Species	Second Liquid Spe
H2O	CO2	H2O	H2O - Vap	K2SO4.KNaSO4	
NaCl	H2CO3	HCO3-1	CO2 - Vap	2Na2SO4.Na2CO3	
KCl	K2SO4.KN	HSO4-1	(HF)2 - Vaj	KHCO3	
NaNO3	2Na2SO4.(	CO2 - Aq	HCl - Vap	KHSO4	
Na2SO4	(HF)2	CO3-2	HF - Vap	K2CO3	
NaHCO3	HCl	Cl-1	HNO3 - Va	K2CO3.1.5H2O	
NaF	HF	Na2F+1	SO3 - Vap	KCl	
NaOH	(HF)6	F-1	H2SO4 - V	KF	
	HNO3	(HF)2 - Aq		KF.2H2O	
	KHCO3	HCl - Aq		KF.4H2O	
	KHSO4	HF2-1		KOH	
	K2CO3	HF - Aq		KOH.2H2O	
	K2CO3.1.5	H+1		KOH.1H2O	
	KF	OH-1		KNO3	
	KF.2H2O	NO3-1		K2SO4	
	KF.4H2O	HNO3 - Aq		K2SO4.1H2O	
	KOH	KHSO4 - Aq		NaHCO3	
	KOH.2H2O	KCl - Aq		NaHSO4	
	KOH.1H2O	K+1		Na2CO3	
	KNO3	KSO4-1		Na2CO3.10H2O	
	K2SO4	NaHCO3 - Aq		Na2CO3.7H2O	
	K2SO4.1H	NaCO3-1		Na2CO3.1H2O	
	NaHSO4	NaF - Aq		NaCl	
	Na2CO3	Na+1		NaF	
	Na2CO3.1	NaNO3 - Aq		NaF.Na2SO4	
	Na2CO3.7	NaSO4-1		NaHF2	
	Na2CO3.1	SO4-2		NaOH	
	NaF.Na2S	SO3 - Aq		NaOH.1H2O	
	NaHF2	H2SO4 - Aq		NaNO3	
	NaOH.1H2O			Na2SO4	
	Na2SO4			Na2SO4	
	Na2SO4.NaHSO4			Na2SO4.NaHSO4	
	Na2SO4.10H2O			Na2SO4.10H2O	
	SO3				
	H2SO4				

Stream Parameters

Stream Amt	1132 g	Stream Am	1132 g	
Temperatura	25 °C	Temperatu	25 °C	
Pressure	1 atm	Pressure	1 atm	
pH	7.6995 pH	pH	7.6995 pH	
Ionic Strength	1.5086 mol/kg H2O	Ionic Stren	1.5086 mol/kg H2O	
Osmotic Pressure	68.237 atm	Osmotic Pr	68.237 atm	
WaterActivity	0.95133 Activity	WaterActiv	0.95133 Activity	
Electrical Cond, specific	0.076339 1/ohm	Electrical C	0.076339 1/ohm	
Electrical Cond, molar	51.657 cm2/ohm-mol	Electrical C	51.657 cm2/ohm-mol	
Viscosity, absolute	1.4067 cP	Viscosity, a	1.4067 cP	
Viscosity, relative	1.5793 cP/cP H2O	Viscosity, r	1.5793 cP/cP H2O	

	Total	Aqueous	Vapor	Solid	2nd Liquid
	--	g/ml	g/ml	g/ml	g/ml
Density	--	1.0801	0	2.1997	0
	Total	Aqueous	Vapor	Solid	2nd Liquid
	cal	cal	cal	cal	cal
Enthalpy	-4.12E+06	-4.12E+06	0	-5550.8	0

Total and Phase Flows (Amounts)

	Total	Aqueous	Vapor	Solid	2nd Liquid
	mol	mol	mol	mol	mol
Mole	58.503	58.479	0	0.02447	0
	Total	Aqueous	Vapor	Solid	2nd Liquid
	g	g	g	g	g
Mass	1132	1130	0	2.0557	0
	Total	Aqueous	Vapor	Solid	2nd Liquid
	L	L	L	L	L
Volume	1.0471	1.0462	0	9.35E-04	0

Scaling Tendencies

solids within Temperature Range			
Sodium bic	1	0 200.00 °C	inside range
Sodium flu	0.099617	0 100.00 °C	inside range
Sodium sul	0.048379	0 32.400 °C	inside range
Sodium flu	0.030885	20 40.000 °C	inside range
Potassium	0.012045	0 70.000 °C	inside range
Sodium sul	8.31E-03	19 241.00 °C	inside range
Sodium car	4.03E-03	0 32.000 °C	inside range
Sodium chl	2.37E-03	0 350.00 °C	inside range
Potassium	9.76E-04	9.7 292.00 °C	inside range
Potassium	6.61E-04	0 200.00 °C	inside range
Potassium	3.29E-06	17.7 40.200 °C	inside range
Sodium hyd	9.56E-07	data valid tl	inside range

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Potassium fluoride dihydrat	3 17E-06	17.7	40.200 °C	inside range
Sodium hydrogen difluoride	9 93E-07	data valid t		inside range
Potassium carbonate 1.5 hy	2.16E-09	0	80.000 °C	inside range
Potassium bisulfate(VI)	1.44E-10	data valid t		inside range
Sodium bisulfate	2.63E-11	data valid t		inside range
Potassium hydroxide dihydr	1.13E-11	0	33.000 °C	inside range
Sodium hydroxide monohyc	5.65E-12	12	80.000 °C	inside range
Sodium sulfate bisulfate	2.27E-13	0	82.500 °C	inside range
Potassium hydroxide	4.09E-19	data valid t		inside range

Species Output (True Species)

	Total g	Aqueous mol/kg H2O	Vapor mol	Solid mol	2nd Liquid n/a	
H2O	2000.7	55.508	0	0	0	0
KCl	4.82E-03	3.23E-05	0	0	0	0
NaNO3	0.6372	3.75E-03	0	0	0	0
NaHCO3	33.205	0.13466	0	0.12605	0	0
NaF	1.4019	0.016688	0	0	0	0
CO2	1.6507	0.018748	0	0	0	0
(HF)2	1.51E-15	1.88E-17	0	0	0	0
HCl	8.21E-14	1.13E-15	0	0	0	0
HF	3.40E-05	8.50E-07	0	0	0	0
HNO3	5.44E-09	4.32E-11	0	0	0	0
KHSO4	2.02E-09	7.42E-12	0	0	0	0
SO3	1.60E-28	9.97E-31	0	0	0	0
H2SO4	1.44E-24	7.31E-27	0	0	0	0
HCO3-1	111.26	0.91139	0	0	0	0
HSO4-1	3.41E-06	1.76E-06	0	0	0	0
CO3-2	1.846	0.01371	0	0	0	0
Cl-1	12.748	0.17973	0	0	0	0
Na2F+1	0.045669	3.51E-04	0	0	0	0
F-1	2.1508	0.056587	0	0	0	0
HF2-1	1.06E-06	1.35E-08	0	0	0	0
H+1	5.30E-08	2.63E-08	0	0	0	0
OH-1	2.04E-05	5.99E-07	0	0	0	0
NO3-1	12.304	0.099184	0	0	0	0
K+1	6.5103	0.083228	0	0	0	0
KSO4-1	0.97465	3.60E-03	0	0	0	0
NaCO3-1	0.83665	5.04E-03	0	0	0	0
Na+1	64.642	1.4054	0	0	0	0
NaSO4-1	18.582	0.078015	0	0	0	0
SO4-2	12.302	0.064007	0	0	0	0

Molecular Output (Apparent Species)

	Total g	Aqueous mol/kg H2O	Vapor mol	Solid mol	2nd Liquid n/a	
H2O	1981.9	54.988	0	0	0	0
NaHCO3	10.589	0	0	0.12605	0	0
NaOH	131 57	1 6441	0	0	0	0
CO2	95.396	1 0834	0	0	0	0
HCl	13.113	0 17976	0	0	0	0
HF	2.947	0.073626	0	0	0	0
HNO3	12.976	0.10293	0	0	0	0
KOH	9.7504	0.086864	0	0	0	0
SO3	23.326	0.14562	0	0	0	0

Element Balance

	Total mol	Aqueous mol	Vapor mol	Solid mol	2nd Liquid n/a	
C(+4)	0	1.0834	0	0.12605	0	0
CL(-1)	0	0.17976	0	0	0	0
F(-1)	0	0.073627	0	0	0	0
H(+1)	0	112 06	0	0.12605	0	0
K(+1)	0	0.086865	0	0	0	0
N(+5)	0	0 10293	0	0	0	0
NA(+1)	0	1.6442	0	0 12605	0	0
O(-2)	0	59.631	0	0 37815	0	0
S(+6)	0	0.14563	0	0	0	0

Species Activity Coefficients

H2O	0.94958	Activity
HCO3-1	0.54981	Act-Coef
HSO4-1	0.66433	Act-Coef
CO2 - Aq	1.2563	Act-Coef
CO3-2	0.084729	Act-Coef
Cl-1	0.85548	Act-Coef
Na2F+1	0.51974	Act-Coef
F-1	0.69329	Act-Coef
(HF)2 - Aq	1.256	Act-Coef
HCl - Aq	1.256	Act-Coef
HF2-1	0 66433	Act-Coef
HF - Aq	1.2977	Act-Coef
H+1	0.77084	Act-Coef
OH-1	0.79377	Act-Coef
NO3-1	0.59918	Act-Coef
HNO3 - Aq	1 3897	Act-Coef
KHSO4 - Aq	1.256	Act-Coef
KCl - Aq	1 256	Act-Coef
K+1	0.49674	Act-Coef
KSO4-1	0.52692	Act-Coef
NaHCO3 - Aq	1.256	Act-Coef
NaCO3-1	0.65528	Act-Coef
NaF - Aq	1.256	Act-Coef
Na+1	0.57331	Act-Coef
NaNO3 - Aq	0 7339	Act-Coef
NaSO4-1	0.52061	Act-Coef
SO4-2	0.094569	Act-Coef
SO3 - Aq	1.256	Act-Coef
H2SO4 - Aq	1.256	Act-Coef
H2O - Vap	1	Fug-Coef
CO2 - Vap	1	Fug-Coef
(HF)2 - Vap	1	Fug-Coef
HCl - Vap	1	Fug-Coef
HF - Vap	1	Fug-Coef
HNO3 - Vap	1	Fug-Coef
SO3 - Vap	1	Fug-Coef
H2SO4 - Vap	1	Fug-Coef

Species K(eq)-Values

H2O	1.01E-14	mol^0
H2O - Vap	31.857	mol^0
HCO3-1	4.70E-11	mol^0
HSO4-1	0.010515	mol^0
CO2 - Aq	4.54E-07	mol^0
CO2 - Vap	0 03392	mol^0
Na2F+1	92.494	mol^0
K2SO4.KNaSO4	9.29E-05	mol^0
2NaZSO4.Na2CO3	3.44E-03	mol^0

Potassium	3.15E-06	17.7	40.200 °C	inside range
Sodium hyc	5.88E-08	data valid t		inside range
Potassium	3.22E-08	0	80.000 °C	inside range
Potassium	2.13E-10	0	33.000 °C	inside range
Sodium hyc	1.20E-10	12	60.000 °C	inside range
Potassium	6.84E-12	data valid t		inside range
Sodium bis	1.41E-12	data valid t		inside range
Sodium sul	1.38E-14	0	82.500 °C	inside range
Potassium	7.70E-18	data valid t		inside range

Species Output (True Species)

	Total g	Aqueous mol/kg H2O	Vapor mol	Solid mol	2nd Liquid n/a	
H2O	2011.3	55.508	0	0	0	0
KCl	4.68E-03	3.12E-05	0	0	0	0
NaNO3	0.76484	4.47E-03	0	0	0	0
NaHCO3	16.841	0.11151	0	0	0	0
NaF	1.4667	0.017367	0	0	0	0
CO2	0.064911	7.33E-04	0	0	0	0
(HF)2	3.93E-18	4.88E-20	0	0	0	0
HCl	4.23E-15	5.76E-17	0	0	0	0
HF	1.68E-06	4.17E-08	0	0	0	0
HNO3	2.68E-10	2.12E-12	0	0	0	0
KHSO4	8.96E-11	3.28E-13	0	0	0	0
SO3	3.77E-31	2.34E-33	0	0	0	0
H2SO4	3.38E-27	1.71E-29	0	0	0	0
HCO3-1	67.952	0.71667	0	0	0	0
HSO4-1	1.57E-07	8.03E-10	0	0	0	0
CO3-2	27.765	0.23004	0	0	0	0
Cl-1	12.748	0.17878	0	0	0	0
Na2F+1	0.063074	4.83E-04	0	0	0	0
F-1	2.1165	0.055389	0	0	0	0
HF2-1	5.36E-06	6.83E-10	0	0	0	0
H+1	3.05E-09	1.50E-09	0	0	0	0
OH-1	3.59E-04	1.05E-05	0	0	0	0
NO3-1	12.211	0.097914	0	0	0	0
K+1	6.5366	0.083146	0	0	0	0
KSO4-1	0.87737	3.23E-03	0	0	0	0
NaCO3-1	13.597	0.081449	0	0	0	0
Na+1	79.382	1.7168	0	0	0	0
NaSO4-1	18.294	0.076398	0	0	0	0
SO4-2	12.604	0.065232	0	0	0	0

Molecular Output (Apparent Species)

	Total g	Aqueous mol/kg H2O	Vapor mol	Solid mol	2nd Liquid n/a	
H2O	1981.9	54.697	0	0	0	0
NaOH	161.61	2.0089	0	0	0	0
CO2	100.94	1 1404	0	0	0	0
HCl	13 113	0.17881	0	0	0	0
HF	2.947	0.073238	0	0	0	0
HNO3	12.976	0.10239	0	0	0	0
KOH	9.7504	0.086406	0	0	0	0
SO3	23.326	0.14486	0	0	0	0

Element Balance

	Total mol	Aqueous mol	Vapor mol	Solid mol	2nd Liquid n/a	
C(+4)	0	1.1404	0	0	0	0
CL(-1)	0	0.17881	0	0	0	0
F(-1)	0	0.073239	0	0	0	0
H(+1)	0	111 84	0	0	0	0
K(+1)	0	0.086406	0	0	0	0
N(+5)	0	0 10239	0	0	0	0
NA(+1)	0	2.0089	0	0	0	0
O(-2)	0	59.815	0	0	0	0
S(+6)	0	0.14486	0	0	0	0

Species Activity Coefficients

H2O	0.94844	Activity
HCO3-1	0.53033	Act-Coef
HSO4-1	0.66088	Act-Coef
CO2 - Aq	1 352	Act-Coef
CO3-2	0.069093	Act-Coef
Cl-1	0.85476	Act-Coef
Na2F+1	0.49643	Act-Coef
F-1	0.57735	Act-Coef
(HF)2 - Aq	1.352	Act-Coef
HCl - Aq	1.352	Act-Coef
HF2-1	0.66088	Act-Coef
HF - Aq	1.3963	Act-Coef
H+1	0.74728	Act-Coef
OH-1	0.81546	Act-Coef
NO3-1	0.58876	Act-Coef
HNO3 - Aq	1 5248	Act-Coef
KHSO4 - A	1.352	Act-Coef
KCl - Aq	1.352	Act-Coef
K+1	0.52207	Act-Coef
KSO4-1	0.50497	Act-Coef
NaHCO3 -	1.352	Act-Coef
NaCO3-1	0 65232	Act-Coef
NaF - Aq	1.352	Act-Coef
Na+1	0.55197	Act-Coef
NaNO3 - A	0.70123	Act-Coef
NaSO4-1	0.51296	Act-Coef
SO4-2	0.078137	Act-Coef
SO3 - Aq	1.352	Act-Coef
H2SO4 - A	1.352	Act-Coef
H2O - Vap	1	Fug-Coef
CO2 - Vap	1	Fug-Coef
(HF)2 - Vap	1	Fug-Coef
HCl - Vap	1	Fug-Coef
HF - Vap	1	Fug-Coef
HNO3 - Va	1	Fug-Coef
SO3 - Vap	1	Fug-Coef
H2SO4 - V	1	Fug-Coef

Species K(eq)-Values

H2O	1.01E-14	mol^0
H2O - Vap	31.857	mol^0
HCO3-1	4 70E-11	mol^0
HSO4-1	0.010515	mol^0
CO2 - Aq	4.54E-07	mol^0
CO2 - Vap	0.03392	mol^0
Na2F+1	92 494	mol^0
K2SO4.KN	9.29E-05	mol^0
2Na2SO4.I	3.44E-03	mol^0
(HF)2 - Aq	51387	mol^0

Potassium	5.49E-10	33	143.00 °C	inside range
Potassium	1.81E-11	data valid t		inside range
Sodium bis	1 35E-11	data valid t		inside range
Potassium	3 46E-14	data valid t		inside range

Species Output (True Species)

	Total g	Aqueous mol/kg H2O	Vapor mol	Solid mol	2nd Liquid n/a	
H2O	2011.3	55.508	0	0	0	0
NaNO3	2.2963	0.013444	0	0	0	0
NaHCO3	52.45	0.31043	0	0	0	0
NaF	1.3188	0.015616	0	0	0	0
CO2	0.06841	6.60E-04	0	0	0	0
(HF)2	8.47E-16	1.05E-17	0	0	0	0
HCl	3.10E-13	4.22E-15	0	0	0	0
HF	7.37E-06	1.83E-07	0	0	0	0
HNO3	1.42E-09	1.12E-11	0	0	0	0
KHSO4	3.32E-09	1.21E-11	0	0	0	0
SO3	1.71E-29	1.06E-31	0	0	0	0
H2SO4	3.82E-26	1.94E-28	0	0	0	0
HCO3-1	63.625	0.51645	0	0	0	0
HSO4-1	2.04E-06	1.05E-08	0	0	0	0
CO3-2	33.892	0.28081	0	0	0	0
Cl-1	12.739	0.17886	0	0	0	0
Na2F+1	0.14671	1.12E-03	0	0	0	0
F-1	2.1589	0.056501	0	0	0	0
HF2-1	4.83E-07	6.15E-09	0	0	0	0
H+1	4.25E-09	2.10E-09	0	0	0	0
OH-1	0.01905	5.57E-04	0	0	0	0
NO3-1	11.092	0.088945	0	0	0	0
K+1	6.2239	0.079147	0	0	0	0
KSO4-1	1.9301	7.10E-03	0	0	0	0
NaCO3-1	5.0192	0.030067	0	0	0	0
Na+1	74.297	1.6068	0	0	0	0
NaSO4-1	7.2614	0.030325	0	0	0	0
SO4-2	20.757	0.10743	0	0	0	0

Molecular Output (Apparent Species)

	Total g	Aqueous mol/kg H2O	Vapor mol	Solid mol	2nd Liquid n/a	
H2O	1981 9	54 696	0	0	0	0
NaOH	161.61	2.0089	0	0	0	0
CO2	100.94	1 1404	0	0	0	0
HCl	13.113	0 17881	0	0	0	0
HF	2 947	0.073239	0	0	0	0
HNO3	12.976	0.10239	0	0	0	0
KOH	9 7504	0.086407	0	0	0	0
SO3	23 326	0.14486	0	0	0	0

Element Balance

	Total mol	Aqueous mol	Vapor mol	Solid mol	2nd Liquid n/a	
C(+4)	0	1.1404	0	0	0	0
CL(-1)	0	0.17882	0	0	0	0
F(-1)	0	0.073239	0	0	0	0
H(+1)	0	111.85	0	0	0	0
K(+1)	0	0.086407	0	0	0	0
N(+5)	0	0.10239	0	0	0	0
NA(+1)	0	2.0089	0	0	0	0
O(-2)	0	59.816	0	0	0	0
S(+6)	0	0.14486	0	0	0	0

Species Activity Coefficients

H2O	0.95053	Activity
HCO3-1	0.50917	Act-Coef
HSO4-1	0.58463	Act-Coef
CO2 - Aq	1.3311	Act-Coef
CO3-2	0.056753	Act-Coef
Cl-1	0 78422	Act-Coef
Na2F+1	0 44915	Act-Coef
F-1	0 53578	Act-Coef
(HF)2 - Aq	1.3465	Act-Coef
HCl - Aq	1.3465	Act-Coef
HF2-1	0.58463	Act-Coef
HF - Aq	1.4076	Act-Coef
H+1	0.65002	Act-Coef
OH-1	0.5746	Act-Coef
NO3-1	0.57239	Act-Coef
HNO3 - Aq	1.5497	Act-Coef
KHSO4 - A	1.3465	Act-Coef
KCl - Aq	1 3465	Act-Coef
K+1	0.52585	Act-Coef
KSO4-1	0.45475	Act-Coef
NaHCO3 -	1.3465	Act-Coef
NaCO3-1	0.57744	Act-Coef
NaF - Aq	1.3465	Act-Coef
Na+1	0.51745	Act-Coef
NaNO3 - A	0 68945	Act-Coef
NaSO4-1	1.6006	Act-Coef
SO4-2	0.04891	Act-Coef
SO3 - Aq	1.3465	Act-Coef
H2SO4 - A	1 3465	Act-Coef
H2O - Vap	1	Fug-Coef
CO2 - Vap	1	Fug-Coef
(HF)2 - Vap	1	Fug-Coef
HCl - Vap	1	Fug-Coef
HF - Vap	1	Fug-Coef
HNO3 - Va	1	Fug-Coef
SO3 - Vap	1	Fug-Coef
H2SO4 - V	1	Fug-Coef

Species K(eq)-Values

H2O	4.59E-13	mol^0
H2O - Vap	1.2097	mol^0
HCO3-1	8.22E-11	mol^0
HSO4-1	1 17E-03	mol^0
CO2 - Aq	4.31E-07	mol^0
CO2 - Vap	0.011137	mol^0
Na2F+1	34.675	mol^0
K2SO4.KN	5.51E-05	mol^0
2Na2SO4.I	1.71E-05	mol^0
(HF)2 - Aq	4686.1	mol^0
(HF)2 - Va	499.84	mol^0
HCl - Aq	33570	mol^0
HCl - Vap	0.12142	mol^0
HF2-1	2 1685	mol^0
HF - Aq	1.60E-04	mol^0

Potassium	2.39E-09	0	80.000 °C	inside range
Potassium	1.50E-10	data valid t		inside range
Sodium bis	2.58E-11	data valid t		inside range
Potassium	1.18E-11	0	33.000 °C	inside range
Sodium hyc	5.51E-12	12	60.000 °C	inside range
Sodium sul	2.11E-13	0	82.500 °C	inside range
Potassium	4.25E-19	data valid t		inside range

Species Output (True Species)

	Total g	Aqueous mol/kg H2O	Vapor mol	Solid mol	2nd Liquid n/a	
H2O	1000.3	55.508	0	0	0	0
KCl	2.46E-03	3.30E-05	0	0	0	0
NaHCO3	13.378	0 13473	0	0.02447	0	0
NaF	0.87845	0.016153	0	0	0	0
CO2	0 84971	0.019301	0	0	0	0
(HF)2	7.48E-16	1.87E-17	0	0	0	0
HCl	4.04E-14	1.11E-15	0	0	0	0
HF	1.75E-06	8.75E-07	0	0	0	0
KHSO4	1.06E-09	7 77E-12	0	0	0	0
SO3	8.04E-29	1 00E-30	0	0	0	0
H2SO4	7.24E-25	7.38E-27	0	0	0	0
HCO3-1	57 902	0.94861	0	0	0	0
HSO4-1	1.75E-06	1.80E-08	0	0	0	0
CO3-2	0.85107	0.014177	0	0	0	0
Cl-1	6.3788	0.17986	0	0	0	0
Na2F+1	0.021013	3.23E-04	0	0	0	0
F-1	1.0841	0.057042	0	0	0	0
HF2-1	5.31E-07	1.36E-08	0	0	0	0
H+1	2.70E-08	2.68E-08	0	0	0	0
OH-1	1.04E-05	6 14E-07	0	0	0	0
K+1	3.248	0.063043	0	0	0	0
KSO4-1	0 51393	3.80E-03	0	0	0	0
NaCO3-1	0.4254	5 12E-03	0	0	0	0
Na+1	30.959	1.3462	0	0	0	0
NaSO4-1	9.1725	0.077016	0	0	0	0
SO4-2	6.2323	0.064854	0	0	0	0

Molecular Output (Apparent Species)

	Total g	Aqueous mol/kg H2O	Vapor mol	Solid mol	2nd Liquid n/a	
H2O	992.81	55.09	0	0	0	0
NaHCO3	2.0557	0	0	0.02447	0	0
NaOH	63.21	1 5798	0	0	0	0
CO2	49 393	1 1219	0	0	0	0
HCl	6.5813	0 17989	0	0	0	0
HF	1.4714	0.073519	0	0	0	0
KOH	4.876	0.086878	0	0	0	0
SO3	11.667	0.14567	0	0	0	0

Element Balance

	Total mol	Aqueous mol	Vapor mol	Solid mol	2nd Liquid n/a	
C(+4)	0	1 1219	0	0.02447	0	0
CL(-1)	0	0.17989	0	0	0	0
F(-1)	0	0.073519	0	0	0	0
H(+1)	0	112.1	0	0.02447	0	0
K(+1)	0	0.086877	0	0	0	0
N(+5)	0	0	0	0	0	0
NA(+1)	0	1.5798	0	0.02447	0	0
O(-2)	0	59 437	0	0 07341	0	0
S(+6)	0	0.14567	0	0	0	0

Species Activity Coefficients

H2O	0.95133	Activity
HCO3-1	0.55188	Act-Coef
HSO4-1	0.66264	Act-Coef
CO2 - Aq	1.2547	Act-Coef
CO3-2	0 086819	Act-Coef
Cl-1	0.65286	Act-Coef
Na2F+1	0.52261	Act-Coef
F-1	0.59442	Act-Coef
(HF)2 - Aq	1.2544	Act-Coef
HCl - Aq	1.2544	Act-Coef
HF2-1	0.66264	Act-Coef
HF - Aq	1.2544	Act-Coef
H+1	0.74494	Act-Coef
OH-1	0.78651	Act-Coef
NO3-1	0 59927	Act-Coef
HNO3 - Aq	1.3637	Act-Coef
KHSO4 - A	1.2544	Act-Coef
KCl - Aq	1.2544	Act-Coef
K+1	0.51123	Act-Coef
KSO4-1	0.52987	Act-Coef
NaHCO3 -	1.2544	Act-Coef
NaCO3-1	0 65356	Act-Coef
NaF - Aq	1.2544	Act-Coef
Na+1	0.5729	Act-Coef
NaNO3 - A	0.74577	Act-Coef
NaSO4-1	0.52327	Act-Coef
SO4-2	0.096765	Act-Coef
SO3 - Aq	1.2544	Act-Coef
H2SO4 - A	1.2544	Act-Coef
H2O - Vap	1	Fug-Coef
CO2 - Vap	1	Fug-Coef
(HF)2 - Vap	1	Fug-Coef
HCl - Vap	1	Fug-Coef
HF - Vap	1	Fug-Coef
HNO3 - Va	1	Fug-Coef
SO3 - Vap	1	Fug-Coef
H2SO4 - V	1	Fug-Coef

Species K(eq)-Values

H2O	1.01E-14	mol^0
H2O - Vap	31.857	mol^0
HCO3-1	4.70E-11	mol^0
HSO4-1	0.010515	mol^0
CO2 - Aq	4.54E-07	mol^0
CO2 - Vap	0.03392	mol^0
Na2F+1	92.494	mol^0
K2SO4.KN	9.29E-05	mol^0
2Na2SO4.I	3.44E-03	mol^0
(HF)2 - Aq	61387	mol^0
(HF)2 - Va	19124	mol^0
HCl - Aq	1.69E+06	mol^0
HCl - Vap	0.92796	mol^0
HF2-1	4 1247	mol^0
HF - Aq	6.17E-04	mol^0

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(HF)2 - Aq	51387 mol^0
(HF)2 - Vap	19124 mol^0
HCl - Aq	1.69E+06 mol^0
HCl - Vap	0.92796 mol^0
HF2-1	4.1247 mol^0
HF - Aq	6.17E-04 mol^0
HF - Vap	19019 mol^0
HNO3 - Aq	20.065 mol^0
HNO3 - Vap	1.40E+05 mol^0
KHCO3	1.8452 mol^0
KHSO4 - Aq	51.933 mol^0
KHSO4	3.3683 mol^0
K2CO3	54473 mol^0
K2CO3.1.5H2O	859.86 mol^0
KCl - Aq	120.41 mol^0
KCl	7.5444 mol^0
KF	7251.8 mol^0
KF.2H2O	395.96 mol^0
KF.4H2O	63.719 mol^0
KOH	4.83E+10 mol^0
KOH.2H2O	1572.6 mol^0
KOH.1H2O	17545 mol^0
KNO3	0.78972 mol^0
K2SO4	0.011589 mol^0
KSO4-1	0.13228 mol^0
K2SO4.1H2O	0.010377 mol^0
NaHCO3 - Aq	2.389 mol^0
NaHCO3	0.40374 mol^0
NaHSO4	356.65 mol^0
Na2CO3	7.3005 mol^0
Na2CO3.10H2O	0.11036 mol^0
Na2CO3.7H2O	0.22354 mol^0
NaCO3-1	0.28348 mol^0
Na2CO3.1H2O	1.0111 mol^0
NaCl	38.197 mol^0
NaF - Aq	1.2906 mol^0
NaF	0.2625 mol^0
NaF.Na2SO4	3.16E-03 mol^0
NaHF2	7.28E-03 mol^0
NaOH	8.05E+06 mol^0
NaOH.1H2O	64322 mol^0
NaNO3 - Aq	17.412 mol^0
NaNO3	28.746 mol^0
Na2SO4	0.44942 mol^0
Na2SO4	1.90E-07 mol^0
Na2SO4.NaHSO4	162.44 mol^0
Na2SO4.10H2O	0.046844 mol^0
NaSO4-1	0.12009 mol^0
SO3 - Aq	7726 mol^0
SO3 - Vap	1.64E+09 mol^0
H2SO4 - Aq	2.57E+10 mol^0
H2SO4 - Vap	3.86E+05 mol^0

Species Mobilities

HCO3-1	2.48E-04 m2/ohm-mol
HSO4-1	2.85E-04 m2/ohm-mol
CO3-2	4.12E-04 m2/ohm-mol
Cl-1	4.25E-04 m2/ohm-mol
Na2F+1	3.34E-04 m2/ohm-mol
F-1	3.06E-04 m2/ohm-mol
HF2-1	4.17E-04 m2/ohm-mol
H+1	1.95E-03 m2/ohm-mol
OH-1	1.10E-03 m2/ohm-mol
NO3-1	3.97E-04 m2/ohm-mol
K+1	4.07E-04 m2/ohm-mol
KSO4-1	2.13E-04 m2/ohm-mol
NaCO3-1	1.84E-04 m2/ohm-mol
Na+1	2.79E-04 m2/ohm-mol
NaSO4-1	1.95E-04 m2/ohm-mol
SO4-2	4.48E-04 m2/ohm-mol

Species Self Diffusivities

H2O	2.24E-09 m2/s
HCO3-1	1.09E-09 m2/s
HSO4-1	1.24E-09 m2/s
CO2 - Aq	1.86E-09 m2/s
CO3-2	9.10E-10 m2/s
Cl-1	1.83E-09 m2/s
Na2F+1	1.45E-09 m2/s
F-1	1.35E-09 m2/s
(HF)2 - Aq	1.12E-09 m2/s
HCl - Aq	1.96E-09 m2/s
HF2-1	1.80E-09 m2/s
HF - Aq	1.23E-10 m2/s
H+1	7.89E-09 m2/s
OH-1	4.54E-09 m2/s
NO3-1	1.71E-09 m2/s
HNO3 - Aq	1.83E-09 m2/s
KHSO4 - Aq	1.44E-09 m2/s
KCl - Aq	1.54E-09 m2/s
K+1	1.76E-09 m2/s
KSO4-1	9.33E-10 m2/s
NaHCO3 - Aq	9.56E-10 m2/s
NaCO3-1	8.14E-10 m2/s
NaF - Aq	1.07E-09 m2/s
Na+1	1.23E-09 m2/s
NaNO3 - Aq	1.15E-09 m2/s
NaSO4-1	8.58E-10 m2/s
SO4-2	9.82E-10 m2/s
SO3 - Aq	1.04E-10 m2/s
H2SO4 - Aq	1.03E-09 m2/s

(HF)2 - Vaj	19124 mol^0
HCl - Aq	1.69E+06 mol^0
HCl - Vap	0.92796 mol^0
HF2-1	4.1247 mol^0
HF - Aq	6.17E-04 mol^0
HF - Vap	19019 mol^0
HNO3 - Aq	20.065 mol^0
HNO3 - Va	1.40E+05 mol^0
KHCO3	1.8452 mol^0
KHSO4 - A	51.933 mol^0
KHSO4	3.3683 mol^0
K2CO3	54473 mol^0
K2CO3.1.5	859.86 mol^0
KCl - Aq	120.41 mol^0
KCl	7.5444 mol^0
KF	7251.8 mol^0
KF.2H2O	395.96 mol^0
KF.4H2O	63.719 mol^0
KOH	4.83E+10 mol^0
KOH.2H2C	1572.6 mol^0
KOH.1H2C	17545 mol^0
KNO3	0.78972 mol^0
K2SO4	0.011589 mol^0
KSO4-1	0.13228 mol^0
K2SO4.1H	0.010377 mol^0
NaHCO3 -	2.389 mol^0
NaHCO3	0.40374 mol^0
NaHSO4	356.65 mol^0
Na2CO3	7.3005 mol^0
Na2CO3.1(	0.11036 mol^0
Na2CO3.7I	0.22354 mol^0
NaCO3-1	0.28348 mol^0
Na2CO3.1I	1.0111 mol^0
NaCl	38.197 mol^0
NaF - Aq	1.2906 mol^0
NaF	0.2625 mol^0
NaF.Na2S(	3.16E-03 mol^0
NaHF2	7.28E-03 mol^0
NaOH	8.05E+06 mol^0
NaOH.1H2	64322 mol^0
NaNO3 - A	17.412 mol^0
NaNO3	28.746 mol^0
Na2SO4	0.44942 mol^0
Na2SO4	1.90E-07 mol^0
Na2SO4.N	162.44 mol^0
Na2SO4.1(	0.046844 mol^0
NaSO4-1	0.12009 mol^0
SO3 - Aq	7726 mol^0
SO3 - Vap	1.64E+09 mol^0
H2SO4 - A	2.57E+10 mol^0
H2SO4 - V	3.86E+05 mol^0

Species Mobilities

HCO3-1	2.24E-04 m2/ohm-mol
HSO4-1	2.58E-04 m2/ohm-mol
CO3-2	3.72E-04 m2/ohm-mol
Cl-1	3.84E-04 m2/ohm-mol
Na2F+1	3.02E-04 m2/ohm-mol
F-1	2.77E-04 m2/ohm-mol
HF2-1	3.77E-04 m2/ohm-mol
H+1	1.76E-03 m2/ohm-mol
OH-1	9.91E-04 m2/ohm-mol
NO3-1	3.59E-04 m2/ohm-mol
K+1	3.68E-04 m2/ohm-mol
KSO4-1	1.92E-04 m2/ohm-mol
NaCO3-1	1.66E-04 m2/ohm-mol
Na+1	2.52E-04 m2/ohm-mol
NaSO4-1	1.76E-04 m2/ohm-mol
SO4-2	4.04E-04 m2/ohm-mol

Species Self Diffusivities

H2O	2.11E-09 m2/s
HCO3-1	1.02E-09 m2/s
HSO4-1	1.16E-09 m2/s
CO2 - Aq	1.76E-09 m2/s
CO3-2	8.55E-10 m2/s
Cl-1	1.72E-09 m2/s
Na2F+1	1.36E-09 m2/s
F-1	1.27E-09 m2/s
(HF)2 - Aq	1.06E-09 m2/s
HCl - Aq	1.85E-09 m2/s
HF2-1	1.69E-09 m2/s
HF - Aq	1.16E-10 m2/s
H+1	7.48E-09 m2/s
OH-1	4.28E-09 m2/s
NO3-1	1.61E-09 m2/s
HNO3 - Aq	1.72E-09 m2/s
KHSO4 - A	1.35E-09 m2/s
KCl - Aq	1.48E-09 m2/s
K+1	1.66E-09 m2/s
KSO4-1	8.74E-10 m2/s
NaHCO3 -	9.00E-10 m2/s
NaCO3-1	7.64E-10 m2/s
NaF - Aq	1.00E-09 m2/s
Na+1	1.16E-09 m2/s
NaNO3 - A	1.09E-09 m2/s
NaSO4-1	8.04E-10 m2/s
SO4-2	9.20E-10 m2/s
SO3 - Aq	9.80E-11 m2/s
H2SO4 - A	9.65E-10 m2/s

HF - Vap	379.93 mol^0
HNO3 - Aq	4.002 mol^0
HNO3 - Va	920.44 mol^0
KHCO3	7.7419 mol^0
KHSO4 - A	15.597 mol^0
KHSO4	14.067 mol^0
K2CO3	2670 mol^0
K2CO3.1.5	2055.7 mol^0
KCl - Aq	26.986 mol^0
KCl	16.596 mol^0
KF	54667 mol^0
KF.2H2O	1732.1 mol^0
KF.4H2O	6.69E+09 mol^0
KOH	3.85E+08 mol^0
KOH.2H2C	7614.8 mol^0
KOH.1H2C	23065 mol^0
KNO3	3.2319 mol^0
K2SO4	0.02685 mol^0
KSO4-1	0.067733 mol^0
K2SO4.1H	0.087869 mol^0
NaHCO3 -	0.52509 mol^0
NaHCO3	0.65701 mol^0
NaHSO4	376.35 mol^0
Na2CO3	1.316 mol^0
Na2CO3.1(	0.23607 mol^0
Na2CO3.7I	1.3745 mol^0
NaCO3-1	0.7632 mol^0
Na2CO3.1I	0.91296 mol^0
NaCl	35.518 mol^0
NaF - Aq	1.197 mol^0
NaF	0.31449 mol^0
NaF.Na2S(	3.16E-03 mol^0
NaHF2	0.051038 mol^0
NaOH	1.94E+05 mol^0
NaOH.1H2	16297 mol^0
NaNO3 - A	4.5667 mol^0
NaNO3	56.88 mol^0
Na2SO4	0.14445 mol^0
Na2SO4	2.13E-03 mol^0
Na2SO4.N	155.29 mol^0
Na2SO4.1(	26.308 mol^0
NaSO4-1	0.090006 mol^0
SO3 - Aq	1922.2 mol^0
SO3 - Vap	76679 mol^0
H2SO4 - A	3.19E+10 mol^0
H2SO4 - V	248.07 mol^0

Species Mobilities

HCO3-1	5.87E-04 m2/ohm-mol
HSO4-1	6.27E-04 m2/ohm-mol
CO3-2	1.04E-03 m2/ohm-mol
Cl-1	9.36E-04 m2/ohm-mol
Na2F+1	8.42E-04 m2/ohm-mol
F-1	7.37E-04 m2/ohm-mol
HF2-1	1.05E-03 m2/ohm-mol
H+1	2.90E-03 m2/ohm-mol
OH-1	2.02E-03 m2/ohm-mol
NO3-1	8.40E-04 m2/ohm-mol
K+1	8.74E-04 m2/ohm-mol
KSO4-1	4.96E-04 m2/ohm-mol
NaCO3-1	4.57E-04 m2/ohm-mol
Na+1	6.70E-04 m2/ohm-mol
NaSO4-1	4.64E-04 m2/ohm-mol
SO4-2	1.06E-03 m2/ohm-mol

Species Self Diffusivities

H2O	7.22E-09 m2/s
HCO3-1	3.60E-09 m2/s
HSO4-1	3.81E-09 m2/s
CO2 - Aq	6.28E-09 m2/s
CO3-2	3.19E-09 m2/s
Cl-1	5.64E-09 m2/s
Na2F+1	5.08E-09 m2/s
F-1	4.53E-09 m2/s
(HF)2 - Aq	3.77E-09 m2/s
HCl - Aq	6.00E-09 m2/s
HF2-1	6.31E-09 m2/s
HF - Aq	4.36E-10 m2/s
H+1	1.69E-08 m2/s
OH-1	1.18E-08 m2/s
NO3-1	5.07E-09 m2/s
HNO3 - Aq	5.38E-09 m2/s
KHSO4 - A	5.07E-09 m2/s
KCl - Aq	4.75E-09 m2/s
K+1	5.30E-09 m2/s
KSO4-1	3.03E-09 m2/s
NaHCO3 -	3.19E-09 m2/s
NaCO3-1	2.82E-09 m2/s
NaF - Aq	3.59E-09 m2/s
Na+1	4.14E-09 m2/s
NaNO3 - A	3.76E-09 m2/s
NaSO4-1	2.84E-09 m2/s
SO4-2	3.24E-09 m2/s
SO3 - Aq	3.67E-10 m2/s
H2SO4 - A	3.39E-09 m2/s

HF - Vap	19019 mol^0
HNO3 - Aq	20.065 mol^0
HNO3 - Va	1.40E+05 mol^0
KHCO3	1.8452 mol^0
KHSO4 - A	51.933 mol^0
KHSO4	3.3683 mol^0
K2CO3	54473 mol^0
K2CO3.1.5	859.86 mol^0
KCl - Aq	120.41 mol^0
KCl	7.5444 mol^0
KF	7251.8 mol^0
KF.2H2O	395.96 mol^0
KF.4H2O	63.719 mol^0
KOH	4.83E+10 mol^0
KOH.2H2C	1572.6 mol^0
KOH.1H2C	17545 mol^0
KNO3	0.78972 mol^0
K2SO4	0.011589 mol^0
KSO4-1	0.13228 mol^0
K2SO4.1H	0.010377 mol^0
NaHCO3 -	2.389 mol^0
NaHCO3	0.40374 mol^0
NaHSO4	356.65 mol^0
Na2CO3	7.3005 mol^0
Na2CO3.1(	0.11036 mol^0
Na2CO3.7I	0.22354 mol^0
NaCO3-1	0.28348 mol^0
Na2CO3.1I	1.0111 mol^0
NaCl	38.197 mol^0
NaF - Aq	1.2906 mol^0
NaF	0.2625 mol^0
NaF.Na2S(	3.16E-03 mol^0
NaHF2	7.28E-03 mol^0
NaOH	8.05E+06 mol^0
NaOH.1H2	64322 mol^0
NaNO3 - A	17.412 mol^0
NaNO3	28.746 mol^0
Na2SO4	0.44942 mol^0
Na2SO4	1.90E-07 mol^0
Na2SO4.N	162.44 mol^0
Na2SO4.1(	0.046844 mol^0
NaSO4-1	0.12009 mol^0
SO3 - Aq	7726 mol^0
SO3 - Vap	1.64E+09 mol^0
H2SO4 - A	2.57E+10 mol^0
H2SO4 - V	3.86E+05 mol^0

Species Mobilities

HCO3-1	2.49E-04 m2/ohm-mol
HSO4-1	2.86E-04 m2/ohm-mol
CO3-2	4.13E-04 m2/ohm-mol
Cl-1	4.27E-04 m2/ohm-mol
Na2F+1	3.35E-04 m2/ohm-mol
F-1	3.07E-04 m2/ohm-mol
HF2-1	4.19E-04 m2/ohm-mol
H+1	1.95E-03 m2/ohm-mol
OH-1	1.10E-03 m2/ohm-mol
K+1	4.09E-04 m2/ohm-mol
KSO4-1	2.13E-04 m2/ohm-mol
NaCO3-1	1.85E-04 m2/ohm-mol
Na+1	2.80E-04 m2/ohm-mol
NaSO4-1	1.95E-04 m2/ohm-mol
SO4-2	4.49E-04 m2/ohm-mol

Species Self Diffusivities

H2O	2.25E-09 m2/s
HCO3-1	1.09E-09 m2/s
HSO4-1	1.25E-09 m2/s
CO2 - Aq	1.87E-09 m2/s
CO3-2	9.14E-10 m2/s
Cl-1	1.84E-09 m2/s
Na2F+1	1.45E-09 m2/s
F-1	1.35E-09 m2/s
(HF)2 - Aq	1.13E-09 m2/s
HCl - Aq	1.97E-09 m2/s
HF2-1	1.81E-09 m2/s
HF - Aq	1.24E-10 m2/s
H+1	7.88E-09 m2/s
OH-1	4.54E-09 m2/s
NO3-1	1.72E-09 m2/s
HNO3 - Aq	1.84E-09 m2/s
KHSO4 - A	1.45E-09 m2/s
KCl - Aq	1.55E-09 m2/s
K+1	1.77E-09 m2/s
KSO4-1	9.37E-10 m2/s
NaHCO3 -	9.62E-10 m2/s
NaCO3-1	8.18E-10 m2/s
NaF - Aq	1.08E-09 m2/s
Na+1	1.23E-09 m2/s
NaNO3 - A	1.17E-09 m2/s
NaSO4-1	8.62E-10 m2/s
SO4-2	9.87E-10 m2/s
SO3 - Aq	1.05E-10 m2/s
H2SO4 - A	1.03E-09 m2/s

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Calculation Summary

SinglePoint_NaOH Calculation for Work1

Automatic Chemistry Model
Databanks:
Public

Unit Set: Default

Isothermal Calculation
Temperatu 25 °C
Pressure 1 atm

Stream Inflows

Water	1000 g
Sodium chl	5.438 g
Potassium	6.479 g
Sodium nitr	0 g
Sodium sul	20.699 g
Sodium bic	96.339 g
Sodium flu	3.088 g
Sodium hyc	9 g

Speciation Summary

Total number of species: 113

User Inflows	Related Inflows	Aqueous Species	Vapor Species	Solid Species	Second Liquid Spe
H2O	CO2	H2O	H2O - Vap	K2SO4.KNaSO4	
NaCl	H2CO3	HCO3-1	CO2 - Vap	2Na2SO4.Na2CO3	
KCl	K2SO4.KN	HSO4-1	(HF)2 - Vap	KHCO3	
NaNO3	2Na2SO4.I	CO2 - Aq	HCl - Vap	KHSO4	
Na2SO4	(HF)2	CO3-2	HF - Vap	K2CO3	
NaHCO3	HCl	Cl-1	HNO3 - Va	K2CO3.1.5H2O	
NaF	HF	Na2F+1	SO3 - Vap	KCl	
NaOH	(HF)6	F-1	H2SO4 - V	KF	
	HNO3	(HF)2 - Aq		KF.2H2O	
	KHCO3	HCl - Aq		KF.4H2O	
	KHSO4	HF2-1		KOH	
	K2CO3	HF - Aq		KOH.2H2O	
	K2CO3.1.5	H+1		KOH.1H2O	
	KF	OH-1		KNO3	
	KF.2H2O	NO3-1		K2SO4	
	KF.4H2O	HNO3 - Aq		K2SO4.1H2O	
	KOH	KHSO4 - Aq		NaHCO3	
	KOH.2H2C	KCl - Aq		NaHSO4	
	KOH.1H2C	K+1		Na2CO3	
	KNO3	KSO4-1		Na2CO3.10H2O	
	K2SO4	NaHCO3 - Aq		Na2CO3.7H2O	
	K2SO4.1H	NaCO3-1		Na2CO3.1H2O	
	NaHSO4	NaF - Aq		NaCl	
	Na2CO3	Na+1		NaF	
	Na2CO3.1(	NaNO3 - Aq		NaF.Na2SO4	
	Na2CO3.7I	NaSO4-1		NaHF2	
	Na2CO3.1I	SO4-2		NaOH	
	NaF.Na2S(	SO3 - Aq		NaOH.1H2O	
	NaHF2	H2SO4 - Aq		NaNO3	
	NaOH.1H2O			Na2SO4	
	Na2SO4			Na2SO4	
	Na2SO4.NaHSO4			Na2SO4.NaHSO4	
	Na2SO4.10H2O			Na2SO4.10H2O	
	SO3				
	H2SO4				

Stream Parameters

Stream Am	1141	g
Temperatu	25	°C
Pressure	1	atm
pH	8.7918	pH
Ionic Stren	1.8686	mol/kg H2O
Osmotic Pr	68.794	atm
WaterActiv	0.95132	Activity
Electrical C	0.084842	1/ohm
Electrical C	50.094	cm2/ohm-mol
Viscosity, d	1.4549	cP
Viscosity, r	1.6334	cP/cP H2O

	Total	Aqueous	Vapor	Solid	2nd Liquid
	--	g/ml	g/ml	g/ml	g/ml
Density	--	1.0912	0	0	0
	Total	Aqueous	Vapor	Solid	2nd Liquid
	cal	cal	cal	cal	cal
Enthalpy	-4.15E+06	-4.15E+06	0	0	0

Total and Phase Flows (Amounts)

	Total	Aqueous	Vapor	Solid	2nd Liquid
	mol	mol	mol	mol	mol
Mole	56.923	56.923	0	0	0
	Total	Aqueous	Vapor	Solid	2nd Liquid
	g	g	g	g	g
Mass	1141	1141	0	0	0
	Total	Aqueous	Vapor	Solid	2nd Liquid
	L	L	L	L	L
Volume	1.0457	1.0457	0	0	0

Scaling Tendencies

solids with Temperature Range

Sodium bic	0.91833	0	200.00 °C	inside range
Sodium flu	0.10781	0	100.00 °C	inside range
Sodium sul	0.05269	0	32.400 °C	inside range
Sodium car	0.051344	0	32.000 °C	inside range
Sodium flu	0.036404	20	40.000 °C	inside range
Potassium	0.010188	0	70.000 °C	inside range
Sodium sul	9.05E-03	19	241.00 °C	inside range
Sodium chl	2.64E-03	0	350.00 °C	inside range
Potassium	9.02E-04	9.7	292.00 °C	inside range
Potassium	6.78E-04	0	200.00 °C	inside range
Potassium	3.28E-06	17.7	40.200 °C	inside range
Sodium hyc	8.07E-08	data valid t		inside range

Calculation Summary

SinglePoint_NaOH_95oC Calculation for Work1

Automatic Chemistry Model
Databanks:
Public

Unit Set: Default

Isothermal Calculation
Temperatu 95 °C
Pressure 1 atm

Stream Inflows

Water	1000 g
Sodium chl	5.438 g
Potassium	6.479 g
Sodium nitr	0 g
Sodium sul	20.699 g
Sodium bic	96.339 g
Sodium flu	3.088 g
Sodium hyc	9 g

Speciation Summary

Total number of species: 113

User Inflows	Related Inflows	Aqueous Species	Vapor Species	Solid Species	Second Liquid Spe
H2O	CO2	H2O	H2O - Vap	K2SO4.KNaSO4	
NaCl	H2CO3	HCO3-1	CO2 - Vap	2Na2SO4.Na2CO3	
KCl	K2SO4.KN	HSO4-1	(HF)2 - Vap	KHCO3	
NaNO3	2Na2SO4.I	CO2 - Aq	HCl - Vap	KHSO4	
Na2SO4	(HF)2	CO3-2	HF - Vap	K2CO3	
NaHCO3	HCl	Cl-1	HNO3 - Va	K2CO3.1.5H2O	
NaF	HF	Na2F+1	SO3 - Vap	KCl	
NaOH	(HF)6	F-1	H2SO4 - V	KF	
	HNO3	(HF)2 - Aq		KF.2H2O	
	KHCO3	HCl - Aq		KF.4H2O	
	KHSO4	HF2-1		KOH	
	K2CO3	HF - Aq		KOH.2H2O	
	K2CO3.1.5	H+1		KOH.1H2O	
	KF	OH-1		KNO3	
	KF.2H2O	NO3-1		K2SO4	
	KF.4H2O	HNO3 - Aq		K2SO4.1H2O	
	KOH	KHSO4 - Aq		NaHCO3	
	KOH.2H2C	KCl - Aq		NaHSO4	
	KOH.1H2C	K+1		Na2CO3	
	KNO3	KSO4-1		Na2CO3.10H2O	
	K2SO4	NaHCO3 - Aq		Na2CO3.7H2O	
	K2SO4.1H	NaCO3-1		Na2CO3.1H2O	
	NaHSO4	NaF - Aq		NaCl	
	Na2CO3	Na+1		NaF	
	Na2CO3.1(	NaNO3 - Aq		NaF.Na2SO4	
	Na2CO3.7I	NaSO4-1		NaHF2	
	Na2CO3.1I	SO4-2		NaOH	
	NaF.Na2S(	SO3 - Aq		NaOH.1H2O	
	NaHF2	H2SO4 - Aq		NaNO3	
	NaOH.1H2O			Na2SO4	
	Na2SO4			Na2SO4	
	Na2SO4.NaHSO4			Na2SO4.NaHSO4	
	Na2SO4.10H2O			Na2SO4.10H2O	
	SO3				
	H2SO4				

Stream Parameters

Stream Am	1141	g
Temperatu	95	°C
Pressure	1	atm
pH	8.7029	pH
Ionic Stren	1.8158	mol/kg H2O
Osmotic Pr	77.557	atm
WaterActiv	0.95365	Activity
Electrical C	0.20873	1/ohm
Electrical C	128.09	cm2/ohm-mol
Viscosity, d	0.51849	cP
Viscosity, r	1.7452	cP/cP H2O

	Total	Aqueous	Vapor	Solid	2nd Liquid
	--	g/ml	g/ml	g/ml	g/ml
Density	--	1.0499	0	0	0
	Total	Aqueous	Vapor	Solid	2nd Liquid
	cal	cal	cal	cal	cal
Enthalpy	-4.08E+06	-4.08E+06	0	0	0

Total and Phase Flows (Amounts)

	Total	Aqueous	Vapor	Solid	2nd Liquid
	mol	mol	mol	mol	mol
Mole	56.79	56.79	0	0	0
	Total	Aqueous	Vapor	Solid	2nd Liquid
	g	g	g	g	g
Mass	1141	1141	0	0	0
	Total	Aqueous	Vapor	Solid	2nd Liquid
	L	L	L	L	L
Volume	1.0869	1.0869	0	0	0

Scaling Tendencies

solids with Temperature Range

Sodium bic	0.34409	0	200.00 °C	inside range
Sodium flu	0.073725	0	100.00 °C	inside range
Sodium sul	0.022515	19	241.00 °C	inside range
Sodium car	7.31E-03	35.37	109.00 °C	inside range
Hexaedlur	4.33E-03	30	150.00 °C	inside range
Sodium chl	2.98E-03	0	350.00 °C	inside range
Potassium	3.75E-04	9.7	292.00 °C	inside range
Potassium	3.55E-04	0	200.00 °C	inside range
Glaserite	3.31E-05	35	150.00 °C	inside range
Sodium hyc	6.07E-08	data valid t		inside range
Potassium	3.79E-10	33	143.00 °C	inside range
Potassium	2.92E-11	data valid t		inside range

SCW04

Calculation Summary

SinglePoint1 Calculation for Work1

Automatic Chemistry Model
Databanks
Public

Unit Set: Default

Isothermal Calculation
Temperatu 25 °C
Pressure 1 atm

Stream Inflows

Water	1000 g
Sodium chl	5.43 g
Potassium	6.48 g
Sodium nitr	8.749 g
Sodium sul	0 g
Sodium bic	96.341 g
Sodium flu	3.109 g
Sodium hyc	0 g

Speciation Summary

Total number of species 113

User Inflows	Related Inflows	Aqueous Species	Vapor Species	Solid Species	Second Liquid Spe
H2O	CO2	H2O	H2O - Vap	K2SO4.KNaSO4	
NaCl	H2CO3	HCO3-1	CO2 - Vap	2Na2SO4.Na2CO3	
KCl	K2SO4.KN	HSO4-1	(HF)2 - Vap	KHCO3	
NaNO3	2Na2SO4.I	CO2 - Aq	HCl - Vap	KHSO4	
Na2SO4	(HF)2	CO3-2	HF - Vap	K2CO3	
NaHCO3	HCl	Cl-1	HNO3 - Va	K2CO3.1.5H2O	
NaF	HF	Na2F+1	SO3 - Vap	KCl	
NaOH	(HF)6	F-1	H2SO4 - V	KF	
	HNO3	(HF)2 - Aq		KF.2H2O	
	KHCO3	HCl - Aq		KF.4H2O	
	KHSO4	HF2-1		KOH	
	K2CO3	HF - Aq		KOH.2H2O	
	K2CO3.1.5	H+1		KOH.1H2O	
	KF	OH-1		KNO3	
	KF.2H2O	NO3-1		K2SO4	
	KF.4H2O	HNO3 - Aq		K2SO4.1H2O	
	KOH	KHSO4 - Aq		NaHCO3	
	KOH.2H2C	KCl - Aq		NaHSO4	
	KOH.1H2C	K+1		Na2CO3	
	KNO3	KSO4-1		Na2CO3.10H2O	
	K2SO4	NaHCO3 - Aq		Na2CO3.7H2O	
	K2SO4.1H	NaCO3-1		Na2CO3.1H2O	
	NaHSO4	NaF - Aq		NaCl	
	Na2CO3	Na+1		NaF	
	Na2CO3.1(	NaNO3 - Aq		NaF.Na2SO4	
	Na2CO3.7I	NaSO4-1		NaHF2	
	Na2CO3.1I	SO4-2		NaOH	
	NaF.Na2S(	SO3 - Aq		NaOH.1H2O	
	NaHF2	H2SO4 - Aq		NaNO3	
	NaOH.1H2O			Na2SO4	
	Na2SO4			Na2SO4	
	Na2SO4.NaHSO4			Na2SO4.NaHSO4	
	Na2SO4.10H2O			Na2SO4.10H2O	
	SO3				
	H2SO4				

Stream Parameters

Stream Am	1120.1	g
Temperatu	25	°C
Pressure	1	atm
pH	7.7199	pH
Ionic Stren	1.3556	mol/kg H2O
Osmotic Pr	67.783	atm
WaterActiv	0.95154	Activity
Electrical C	0.074641	1/ohm
Electrical C	51.954	cm2/ohm-mol
Viscosity, d	1.3685	cP
Viscosity, r	1.5364	cP/cP H2O

	Total	Aqueous	Vapor	Solid	2nd Liquid
	--	g/ml	g/ml	g/ml	g/ml
Density	--	1.0702	0	0	0
	Total	Aqueous	Vapor	Solid	2nd Liquid
	cal	cal	cal	cal	cal
Enthalpy	-4.09E+06	-4.09E+06	0	0	0

Total and Phase Flows (Amounts)

	Total	Aqueous	Vapor	Solid	2nd Liquid
	mol	mol	mol	mol	mol
Mole	58.373	58.373	0	0	0
	Total	Aqueous	Vapor	Solid	2nd Liquid
	g	g	g	g	g
Mass	1120.1	1120.1	0	0	0
	Total	Aqueous	Vapor	Solid	2nd Liquid
	L	L	L	L	L
Volume	1.0466	1.0466	0	0	0

Scaling Tendencies

solids with Temperature Range

Sodium bic	0.98994	0	200.00 °C	inside range
Sodium flu	0.097127	0	100.00 °C	inside range
Potassium	0.013043	0	70.000 °C	inside range
Sodium car	3.99E-03	0	32.000 °C	inside range
Potassium	3.37E-03	0	110.00 °C	inside range
Sodium chl	2.18E-03	0	350.00 °C	inside range
Sodium nitr	1.54E-03	0	300.00 °C	inside range
Potassium	6.64E-04	0	200.00 °C	inside range
Potassium	3.51E-06	17.7	40.200 °C	inside range
Sodium hyc	9.09E-07	data valid t		inside range
Potassium	2.84E-09	0	80.000 °C	inside range
Potassium	1.29E-11	0	33.000 °C	inside range

Calculation Summary

SinglePoint_NaOH Calculation for Work1

Automatic Chemistry Model
Databanks:
Public

Unit Set: Default

Isothermal Calculation
Temperatu 25 °C
Pressure 1 atm

Stream Inflows

Water	1000 g
Sodium chl	5.43 g
Potassium	6.48 g
Sodium nitr	8.749 g
Sodium sul	0 g
Sodium bic	96.341 g
Sodium flu	3.109 g
Sodium hyc	9 g

Speciation Summary

Total number of species: 113

User Inflows	Related Inflows	Aqueous Species	Vapor Species	Solid Species	Second Liquid Spe
H2O	CO2	H2O	H2O - Vap	K2SO4.KNaSO4	
NaCl	H2CO3	HCO3-1	CO2 - Vap	2Na2SO4.Na2CO3	
KCl	K2SO4.KN	HSO4-1	(HF)2 - Vap	KHCO3	
NaNO3	2Na2SO4.I	CO2 - Aq	HCl - Vap	KHSO4	
Na2SO4	(HF)2	CO3-2	HF - Vap	K2CO3	
NaHCO3	HCl	Cl-1	HNO3 - Va	K2CO3.1.5H2O	
NaF	HF	Na2F+1	SO3 - Vap	KCl	
NaOH	(HF)6	F-1	H2SO4 - V	KF	
	HNO3	(HF)2 - Aq		KF.2H2O	
	KHCO3	HCl - Aq		KF.4H2O	
	KHSO4	HF2-1		KOH	
	K2CO3	HF - Aq		KOH.2H2O	
	K2CO3.1.5	H+1		KOH.1H2O	
	KF	OH-1		KNO3	
	KF.2H2O	NO3-1		K2SO4	
	KF.4H2O	HNO3 - Aq		K2SO4.1H2O	
	KOH	KHSO4 - Aq		NaHCO3	
	KOH.2H2C	KCl - Aq		NaHSO4	
	KOH.1H2C	K+1		Na2CO3	
	KNO3	KSO4-1		Na2CO3.10H2O	
	K2SO4	NaHCO3 - Aq		Na2CO3.7H2O	
	K2SO4.1H	NaCO3-1		Na2CO3.1H2O	
	NaHSO4	NaF - Aq		NaCl	
	Na2CO3	Na+1		NaF	
	Na2CO3.1(	NaNO3 - Aq		NaF.Na2SO4	
	Na2CO3.7I	NaSO4-1		NaHF2	
	Na2CO3.1I	SO4-2		NaOH	
	NaF.Na2S(	SO3 - Aq		NaOH.1H2O	
	NaHF2	H2SO4 - Aq		NaNO3	
	NaOH.1H2O			Na2SO4	
	Na2SO4			Na2SO4	
	Na2SO4.NaHSO4			Na2SO4.NaHSO4	
	Na2SO4.10H2O			Na2SO4.10H2O	
	SO3				
	H2SO4				

Stream Parameters

Stream Am	1129.1	g
Temperatu	25	°C
Pressure	1	atm
pH	8.8146	pH
Ionic Stren	1.6915	mol/kg H2O
Osmotic Pr	66.471	atm
WaterActiv	0.95283	Activity
Electrical C	0.082646	1/ohm
Electrical C	49.969	cm2/ohm-mol
Viscosity, d	1.4047	cP
Viscosity, r	1.5771	cP/cP H2O

	Total	Aqueous	Vapor	Solid	2nd Liquid
	--	g/ml	g/ml	g/ml	g/ml
Density	--	1.0803	0	0	0
	Total	Aqueous	Vapor	Solid	2nd Liquid
	cal	cal	cal	cal	cal
Enthalpy	-4.11E+06	-4.11E+06	0	0	0

Total and Phase Flows (Amounts)

	Total	Aqueous	Vapor	Solid	2nd Liquid
	mol	mol	mol	mol	mol
Mole	58.769	58.769	0	0	0
	Total	Aqueous	Vapor	Solid	2nd Liquid
	g	g	g	g	g
Mass	1129.1	1129.1	0	0	0
	Total	Aqueous	Vapor	Solid	2nd Liquid
	L	L	L	L	L
Volume	1.0452	1.0452	0	0	0

Scaling Tendencies

solids with Temperature Range

Sodium bic	0.88195	0	200.00 °C	inside range
Sodium flu	0.10425	0	100.00 °C	inside range
Sodium car	0.050008	0	32.000 °C	inside range
Potassium	0.010779	0	70.000 °C	inside range
Potassium	3.40E-03	0	110.00 °C	inside range
Sodium chl	2.41E-03	0	350.00 °C	inside range
Sodium nitr	1.67E-03	0	300.00 °C	inside range
Potassium	6.80E-04	0	200.00 °C	inside range
Potassium	3.50E-06	17.7	40.200 °C	inside range
Sodium hyc	7.56E-08	data valid t		inside range
Potassium	3.02E-06	0	80.000 °C	inside range
Potassium	1.67E-10	0	33.000 °C	inside range

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Potassium	2.59E-06	0	60.000 °C	inside range
Potassium	1.51E-10	0	33.000 °C	inside range
Sodium hyd	7.65E-11	12	60.000 °C	inside range
Potassium	1.09E-11	data valid t		inside range
Sodium bis	2.02E-12	data valid t		inside range
Sodium sul	1.81E-14	0	82.500 °C	inside range
Potassium	5.43E-18	data valid t		inside range

Species Output (True Species)

	Total g	Aqueous mol/kg H2(	Vapor mol	Solid mol	2nd Liquid n/a	
H2O	1004.1	55.508	0	0	0	0
KCl	2.41E-03	3.22E-05	0	0	0	0
NaHCO3	9.9271	0.11789	0	0	0	0
NaF	0.70102	0.016626	0	0	0	0
CO2	0.05368	1.21E-03	0	0	0	0
(HF)2	4.34E-18	1.08E-19	0	0	0	0
HCl	3.09E-15	8.45E-17	0	0	0	0
HF	1.30E-06	6.49E-08	0	0	0	0
KHSO4	7.30E-11	5.34E-13	0	0	0	0
SO3	4.34E-31	5.40E-33	0	0	0	0
H2SO4	3.91E-27	3.97E-29	0	0	0	0
HCO3-1	48.886	0.79793	0	0	0	0
HSO4-1	1.23E-07	1.27E-09	0	0	0	0
CO3-2	10.046	0.16672	0	0	0	0
Cl-1	6.3788	0.17919	0	0	0	0
Na2F+1	0.026422	4.06E-04	0	0	0	0
F-1	1.0723	0.056213	0	0	0	0
HF2-1	4.04E-08	1.03E-09	0	0	0	0
H+1	2.23E-09	2.20E-09	0	0	0	0
OH-1	1.28E-04	7.49E-06	0	0	0	0
K+1	3.259	0.083016	0	0	0	0
KSO4-1	0.47586	3.51E-03	0	0	0	0
NaCO3-1	4.8825	0.058587	0	0	0	0
Na+1	35.844	1.5528	0	0	0	0
NaSO4-1	9.0788	0.075948	0	0	0	0
SO4-2	6.335	0.065678	0	0	0	0

Molecular Output (Apparent Species)

	Total g	Aqueous mol/kg H2(	Vapor mol	Solid mol	2nd Liquid n/a	
H2O	992.81	54.885	0	0	0	0
NaOH	73.189	1.8224	0	0	0	0
CO2	50.47	1.1421	0	0	0	0
HCl	6.5613	0.17922	0	0	0	0
HF	1.4714	0.073246	0	0	0	0
KOH	4.876	0.086554	0	0	0	0
SO3	11.667	0.14513	0	0	0	0

Element Balance

	Total mol	Aqueous mol	Vapor mol	Solid mol	2nd Liquid n/a	
C(+4)	0	1.1421	0	0	0	0
CL(-1)	0	0.17923	0	0	0	0
F(-1)	0	0.073246	0	0	0	0
H(+1)	0	111.93	0	0	0	0
K(+1)	0	0.086555	0	0	0	0
N(+5)	0	0	0	0	0	0
NA(+1)	0	1.8224	0	0	0	0
O(-2)	0	59.514	0	0	0	0
S(+6)	0	0.14513	0	0	0	0

Species Activity Coefficients

H2O	0.96132	Activity
HCO3-1	0.53687	Act-Coef
HSO4-1	0.65793	Act-Coef
CO2 - Aq	1.3187	Act-Coef
CO3-2	0.074726	Act-Coef
Cl-1	0.6501	Act-Coef
Na2F+1	0.50667	Act-Coef
F-1	0.58166	Act-Coef
(HF)2 - Aq	1.3187	Act-Coef
HCl - Aq	1.3187	Act-Coef
HF2-1	0.65793	Act-Coef
HF - Aq	1.3187	Act-Coef
H+1	0.7339	Act-Coef
OH-1	0.79774	Act-Coef
NO3-1	0.59021	Act-Coef
HNO3 - Aq	1.4521	Act-Coef
KHSO4 - A	1.3187	Act-Coef
KCl - Aq	1.3187	Act-Coef
K+1	0.52861	Act-Coef
KSO4-1	0.51343	Act-Coef
NaHCO3 -	1.3187	Act-Coef
NaCO3-1	0.64926	Act-Coef
NaF - Aq	1.3187	Act-Coef
Na+1	0.5574	Act-Coef
NaNO3 - A	0.72388	Act-Coef
NaSO4-1	0.51498	Act-Coef
SO4-2	0.082629	Act-Coef
SO3 - Aq	1.3187	Act-Coef
H2SO4 - A	1.3187	Act-Coef
H2O - Vap	1	Fug-Coef
CO2 - Vap	1	Fug-Coef
(HF)2 - Vaj	1	Fug-Coef
HCl - Vap	1	Fug-Coef
HF - Vap	1	Fug-Coef
HNO3 - Va	1	Fug-Coef
SO3 - Vap	1	Fug-Coef
H2SO4 - V	1	Fug-Coef

Species K(eq)-Values

H2O	1.01E-14	mol*0
H2O - Vap	31.857	mol*0
HCO3-1	4.70E-11	mol*0
HSO4-1	0.010515	mol*0
CO2 - Aq	4.54E-07	mol*0
CO2 - Vap	0.03392	mol*0
Na2F+1	92.484	mol*0
K2SO4.KN	9.29E-05	mol*0
2Na2SO4.I	3.44E-03	mol*0
(HF)2 - Aq	51387	mol*0
(HF)2 - Vaj	19124	mol*0
HCl - Aq	1.69E+06	mol*0
HCl - Vap	0.92796	mol*0
HF2-1	4.1247	mol*0
HF - Aq	6.17E-04	mol*0
HF - Vap	19019	mol*0

Sodium bis	1.98E-11	data valid t		inside range
Potassium	2.38E-14	data valid t		inside range

Species Output (True Species)

	Total g	Aqueous mol/kg H2(	Vapor mol	Solid mol	2nd Liquid n/a	
H2O	1004.1	55.508	0	0	0	0
KCl	0.012513	1.67E-04	0	0	0	0
NaHCO3	27.82	0.32982	0	0	0	0
NaF	0.62556	0.014838	0	0	0	0
CO2	0.050094	1.13E-03	0	0	0	0
(HF)2	9.74E-16	2.42E-17	0	0	0	0
HCl	2.35E-13	6.42E-15	0	0	0	0
HF	5.93E-06	2.95E-07	0	0	0	0
KHSO4	2.76E-09	2.02E-11	0	0	0	0
SO3	2.08E-29	2.57E-31	0	0	0	0
H2SO4	4.64E-26	4.71E-28	0	0	0	0
HCO3-1	35.923	0.58635	0	0	0	0
HSO4-1	1.65E-05	1.70E-08	0	0	0	0
CO3-2	12.265	0.20355	0	0	0	0
Cl-1	6.374	0.17906	0	0	0	0
Na2F+1	0.059196	9.07E-04	0	0	0	0
F-1	1.0989	0.057501	0	0	0	0
HF2-1	3.70E-07	9.45E-09	0	0	0	0
H+1	3.05E-09	3.01E-09	0	0	0	0
OH-1	6.55E-03	3.84E-04	0	0	0	0
K+1	3.0898	0.07868	0	0	0	0
KSO4-1	1.0461	7.71E-03	0	0	0	0
NaCO3-1	1.7758	0.021307	0	0	0	0
Na+1	32.893	1.4249	0	0	0	0
NaSO4-1	3.5538	0.02973	0	0	0	0
SO4-2	10.388	0.1077	0	0	0	0

Molecular Output (Apparent Species)

	Total g	Aqueous mol/kg H2(	Vapor mol	Solid mol	2nd Liquid n/a	
H2O	992.81	54.886	0	0	0	0
NaOH	73.189	1.8224	0	0	0	0
CO2	50.47	1.1421	0	0	0	0
HCl	6.5613	0.17923	0	0	0	0
HF	1.4714	0.073246	0	0	0	0
KOH	4.876	0.086555	0	0	0	0
SO3	11.667	0.14513	0	0	0	0

Element Balance

	Total mol	Aqueous mol	Vapor mol	Solid mol	2nd Liquid n/a	
C(+4)	0	1.1422	0	0	0	0
CL(-1)	0	0.17923	0	0	0	0
F(-1)	0	0.073247	0	0	0	0
H(+1)	0	111.93	0	0	0	0
K(+1)	0	0.086555	0	0	0	0
N(+5)	0	0	0	0	0	0
NA(+1)	0	1.8224	0	0	0	0
O(-2)	0	59.515	0	0	0	0
S(+6)	0	0.14513	0	0	0	0

Species Activity Coefficients

H2O	0.96365	Activity
HCO3-1	0.51699	Act-Coef
HSO4-1	0.58419	Act-Coef
CO2 - Aq	1.2903	Act-Coef
CO3-2	0.061796	Act-Coef
Cl-1	0.79218	Act-Coef
Na2F+1	0.45916	Act-Coef
F-1	0.54087	Act-Coef
(HF)2 - Aq	1.3054	Act-Coef
HCl - Aq	1.3054	Act-Coef
HF2-1	0.58419	Act-Coef
HF - Aq	1.3054	Act-Coef
H+1	0.65821	Act-Coef
OH-1	0.57505	Act-Coef
NO3-1	0.57196	Act-Coef
HNO3 - Aq	1.4659	Act-Coef
KHSO4 - A	1.3054	Act-Coef
KCl - Aq	1.3054	Act-Coef
K+1	0.52765	Act-Coef
KSO4-1	0.46498	Act-Coef
NaHCO3 -	1.3054	Act-Coef
NaCO3-1	0.57687	Act-Coef
NaF - Aq	1.3054	Act-Coef
Na+1	0.52337	Act-Coef
NaNO3 - A	0.71065	Act-Coef
NaSO4-1	1.6297	Act-Coef
SO4-2	0.054297	Act-Coef
SO3 - Aq	1.3054	Act-Coef
H2SO4 - A	1.3054	Act-Coef
H2O - Vap	1	Fug-Coef
CO2 - Vap	1	Fug-Coef
(HF)2 - Vaj	1	Fug-Coef
HCl - Vap	1	Fug-Coef
HF - Vap	1	Fug-Coef
HNO3 - Va	1	Fug-Coef
SO3 - Vap	1	Fug-Coef
H2SO4 - V	1	Fug-Coef

Species K(eq)-Values

H2O	4.59E-13	mol*0
H2O - Vap	1.2097	mol*0
HCO3-1	8.22E-11	mol*0
HSO4-1	1.17E-03	mol*0
CO2 - Aq	4.31E-07	mol*0
CO2 - Vap	0.011137	mol*0
Na2F+1	34.875	mol*0
K2SO4.KN	5.51E-05	mol*0
2Na2SO4.I	1.71E-05	mol*0
(HF)2 - Aq	4686.1	mol*0
(HF)2 - Vaj	499.84	mol*0
HCl - Aq	33570	mol*0
HCl - Vap	0.12142	mol*0
HF2-1	2.1685	mol*0
HF - Aq	1.60E-04	mol*0
HF - Vap	379.93	mol*0
HNO3 - Aq	4.002	mol*0
HNO3 - Va	920.44	mol*0
KHCO3	7.7419	mol*0
KHSO4 - A	15.597	mol*0
KHSO4	14.067	mol*0

Sodium hyd	5.51E-12	12	60.000 °C	inside range
Potassium	4.65E-19	data valid t		inside range

Species Output (True Species)

	Total g	Aqueous mol/kg H2(	Vapor mol	Solid mol	2nd Liquid n/a	
H2O	1000.4	55.508	0	0	0	0
KCl	2.54E-03	3.40E-05	0	0	0	0
NaNO3	0.28499	3.35E-03	0	0	0	0
NaHCO3	11.483	0.13664	0	0	0	0
NaF	0.67773	0.016135	0	0	0	0
CO2	0.86188	0.019577	0	0	0	0
(HF)2	7.29E-16	1.82E-17	0	0	0	0
HCl	3.81E-14	1.04E-15	0	0	0	0
HF	1.69E-05	8.46E-07	0	0	0	0
HNO3	2.68E-09	4.26E-11	0	0	0	0
HCO3-1	59.246	0.97062	0	0	0	0
CO3-2	0.85769	0.014268	0	0	0	0
Cl-1	6.3744	0.17974	0	0	0	0
Na2F+1	0.01924	2.96E-04	0	0	0	0
F-1	1.0944	0.057567	0	0	0	0
HF2-1	5.27E-07	1.35E-08	0	0	0	0
H+1	2.35E-08	2.34E-08	0	0	0	0
OH-1	1.10E-06	6.46E-07	0	0	0	0
NO3-1	6.1747	0.099548	0	0	0	0
K+1	3.3971	0.086856	0	0	0	0
NaCO3-1	0.43918	5.29E-03	0	0	0	0
Na+1	28.844	1.2542	0	0	0	0

Molecular Output (Apparent Species)

	Total g	Aqueous mol/kg H2(	Vapor mol	Solid mol	2nd Liquid n/a	
H2O	993.57	55.132	0	0	0	0
NaOH	58.665	1.4182	0	0	0	0
CO2	50.471	1.1464	0	0	0	0
HCl	6.5568	0.17977	0	0	0	0
HF	1.4814	0.074018	0	0	0	0
HNO3	6.4863	0.1029	0	0	0	0
KOH	4.8767	0.086889	0	0	0	0

Element Balance

	Total mol	Aqueous mol	Vapor mol	Solid mol	2nd Liquid n/a	
C(+4)	0	1.1464	0	0	0	0
CL(-1)	0	0.17977	0	0	0	0
F(-1)	0	0.074019	0	0	0	0
H(+1)	0	112.12	0	0	0	0
K(+1)	0	0.08689	0	0	0	0
N(+5)	0	0.1029	0	0	0	0
NA(+1)	0	1.4162	0	0	0	0
O(-2)	0	59.237	0	0	0	0
S(+6)	0	0	0	0	0	0

Species Activity Coefficients

H2O	0.95154	Activity
HCO3-1	0.55977	Act-Coef
HSO4-1	0.66656	Act-Coef
CO2 - Aq	1.2247	Act-Coef
CO3-2	0.093705	Act-Coef
Cl-1	0.62958	Act-Coef
Na2F+1	0.53082	Act-Coef
F-1	0.60187	Act-Coef
(HF)2 - Aq	1.2244	Act-Coef
HCl - Aq	1.2244	Act-Coef
HF2-1	0.66656	Act-Coef
HF - Aq	1.2652	Act-Coef
H+1	0.81627	Act-Coef
OH-1	0.78382	Act-Coef
NO3-1	0.60411	Act-Coef
HNO3 - Aq	1.3421	Act-Coef
KHSO4 - A	1.2244	Act-Coef
KCl - Aq	1.2244	Act-Coef
K+1	0.50996	Act-Coef
KSO4-1	0.53871	Act-Coef
NaHCO3 -	1.2244	Act-Coef
NaCO3-1	0.6566	Act-Coef
NaF - Aq	1.2244	Act-Coef
Na+1	0.58652	Act-Coef
NaNO3 - A	0.758	Act-Coef
NaSO4-1	0.52959	Act-Coef
SO4-2	0.1045	Act-Coef
SO3 - Aq	1.2244	Act-Coef
H2SO4 - A	1.2244	Act-Coef
H2O - Vap	1	Fug-Coef
CO2 - Vap	1	Fug-Coef
(HF)2 - Vaj	1	Fug-Coef
HCl - Vap	1	Fug-Coef
HF - Vap	1	Fug-Coef
HNO3 - Va	1	Fug-Coef
SO3 - Vap	1	Fug-Coef
H2SO4 - V	1	Fug-Coef

Species K(eq)-Values

H2O	1.01E-14	mol*0
H2O - Vap	31.857	mol*0
HCO3-1	4.70E-11	mol*0
HSO4-1	0.010515	mol*0
CO2 - Aq	4.54E-07	mol*0
CO2 - Vap	0.03392	mol*0
Na2F+1	92.484	mol*0
K2SO4.KN	9.29E-05	mol*0
2Na2SO4.I	3.44E-03	mol*0
(HF)2 - Aq	51387	mol*0
(HF)2 - Vaj	19124	mol*0
HCl - Aq	1.69E+06	mol*0
HCl - Vap	0.92796	mol*0
HF2-1	4.1247	mol*0
HF - Aq	6.17E-04	mol*0
HF - Vap	19019	mol*0
HNO3 - Aq	20.065	mol*0
HNO3 - Va	1.40E+05	mol*0
KHCO3	1.8452	mol*0
KHSO4 - A	51.933	mol*0
KHSO4	3.3683	mol*0
K2CO3	54473	mol*0
K2CO3.1.5	859.86	mol*0
KCl - Aq	120.41	mol*0
KCl	7.5444	mol*0

Sodium hyd	7.65E-11	12	60.000 °C	inside range
Potassium	5.98E-18	data valid t		inside range

Species Output (True Species)

	Total g	Aqueous mol/kg H2(	Vapor mol	Solid mol	2nd Liquid n/a	
H2O	1004.1	55.508	0	0	0	0
KCl	2.49E-03	3.32E-05	0	0	0	0
NaNO3	0.31805	3.73E-03	0	0	0	0
NaHCO3	9.8009	0.11619	0	0	0	0
NaF	0.69685	0.016629	0	0	0	0
CO2	0.053008	1.20E-03	0	0	0	0
(HF)2	4.19E-18	1.04E-19	0	0	0	0
HCl	2.91E-15	7.94E-17	0	0	0	0
HF	1.26E-06	6.26E-08	0	0	0	0
HNO3	1.99E-10	3.15E-12	0	0	0	0
HCO3-1	48.981	0.79948	0	0	0	0
CO3-2	10.003	0.16602	0	0	0	0
Cl-1	6.3744	0.17907	0	0	0	0
Na2F+1	0.023658	3.66E-04	0	0	0	0
F-1	1.0645	0.05685	0	0	0	0
HF2-1	3.99E-08	1.02E-09	0	0	0	0
H+1	1.96E-09	1.94E-09	0	0	0	0
OH-1	1.36E-04	7.99E-06	0	0	0	0
NO3-1	6.1506	0.098792	0	0	0	0
K+1	3.3971	0.086835	0	0	0	0
NaCO3-1	4.8401	0.059278	0	0	0	0
Na+1	33.208	1.4386	0	0	0	0

Molecular Output (Apparent Species)

	Total g	Aqueous mol/kg H2(	Vapor mol	Solid mol	2nd Liquid n/a	
H2O	993.57	54.926	0	0	0	0
NaOH	65.665	1.6351	0	0	0	0
CO2	50.471	1.1422	0	0	0	0
HCl	6.5568	0.1791	0	0	0	0
HF	1.4814	0.073744	0	0	0	0
HNO3	6.4863	0.10252	0	0	0	0
KOH	4.8767	0.086567	0	0	0	0

Element Balance

	Total mol	Aqueous mol	Vapor mol	Solid mol	2nd Liquid n/a	
C(+4)	0	1.1422	0	0	0	0
CL(-1)	0	0.1791	0	0	0	0
F(-1)	0	0.073744	0	0	0	0
H(+1)	0	111.93	0	0	0	0
K(+1)	0	0.086568	0	0	0	0
N(+5)	0	0.10252	0	0	0	0
NA(+1)	0	1.6351	0	0	0	0
O(-2)	0	59.241	0	0	0	0
S(+6)	0	0	0	0	0	0

Species Activity Coefficients

H2O	0.95283	Activity
HCO3-1	0.54322	Act-Coef
HSO4-1	0.65858	Act-Coef
CO2 - Aq	1.2828	Act-Coef
CO3-2	0.080168	Act-Coef
Cl-1	0.62602	Act-Coef
Na2F+1	0.51399	Act-Coef
F-1	0.58707	Act-Coef
(HF)2 - Aq	1.2828	Act-Coef
HCl - Aq	1.2828	Act-Coef
HF2-1	0.65858	Act-Coef
HF - Aq	1.3252	Act-Coef
H+1	0.79046	Act-Coef
OH-1	0.78913	Act-Coef
NO3-1	0.59281	Act-Coef
HNO3 - Aq	1.4222	Act-Coef
KHSO4 - A	1.2828	Act-Coef
KCl - Aq	1.2828	Act-Coef
K+1	0.52922	Act-Coef
KSO4-1	0.52127	Act-Coef
NaHCO3 -	1.2828	Act-Coef
NaCO3-1	0.64939	Act-Coef
NaF - Aq	1.2828	Act-Coef
Na+1	0.56993	Act-Coef
NaNO3 - A	0.73998	Act-Coef
NaSO4-1	0.51829	Act-Coef
SO4-2	0.088784	Act-Coef
SO3 - Aq	1.2828	Act-Coef
H2SO4 - A	1.2828	Act-Coef
H2O - Vap	1	Fug-Coef
CO2 - Vap	1	Fug-Coef
(HF)2 - Vaj	1	Fug-Coef
HCl - Vap	1	Fug-Coef
HF - Vap	1	Fug-Coef
HNO3 - Va	1	Fug-Coef
SO3 - Vap	1	Fug-Coef
H2SO4 - V	1	Fug-Coef

Species K(eq)-Values

H2O	1.01E-14	mol*0
H2O - Vap	31.857	mol*0
HCO3-1	4.70E-11	mol*0
HSO4-1	0.010515	mol*0
CO2 - Aq	4.54E-07	mol*0
CO2 - Vap	0.03392	mol*0
Na2F+1	92.484	mol*0
K2SO4.KN	9.29E-05	mol*0
2Na2SO4.I	3.44E-03	mol*0
(HF)2 - Aq	51387	mol*0
(HF)2 - Vaj	19124	mol*0
HCl - Aq	1.69E+06	mol*0
HCl - Vap	0.92796	mol*0
HF2-1	4.1247	mol*0
HF - Aq	6.17E-04	mol*0
HF - Vap	19019	mol*0
HNO3 - Aq	20.065	mol*0
HNO3 - Va	1.40E+05	mol*0
KHCO3	1.8452	mol*0
KHSO4 - A	51.933	mol*0
KHSO4	3.3683	mol*0
K2CO3	54473	mol*0
K2CO3.1.5	859.86	mol*0
KCl - Aq	120.41	mol*0
KCl	7.5444	mol*0

Species Output (True Species)

H2O
KCl
NaNO3
NaHCO3
NaF
CO2
(HF)2
HCl
HF
HNO3
HCO3-1
CO3-2
Cl-1
Na2F+1
F-1
HF2-1
H+1
OH-1
NO3-1
K+1
NaCO3-1
Na+1

Molecular Output (Apparent Species)

H2O
NaOH
CO2
HCl
HF
HNO3
KOH

Element Balance

C(+4)
CL(-1)
F(-1)
H(+1)
K(+1)
N(+5)
NA(+1)
O(-2)
S(+6)

Species Activity Coefficients

H2O
HCO3-1
HSO4-1
CO2 - Aq
CO3-2
Cl-1
Na2F+1
F-1
(HF)2 - Aq
HCl - Aq
HF2-1
HF - Aq
H+1
OH-1
NO3-1
HNO3 - Aq
KHSO4 - A
KCl - Aq
K+1
KSO4-1
NaHCO3 -
NaCO3-1
NaF - Aq
Na+1
NaNO3 - A
NaSO4-1
SO4-2
SO3 - Aq
H2SO4 - A
H2O - Vap
CO2 - Vap
(HF)2 - Vaj
HCl - Vap
HF - Vap
HNO3 - Va
SO3 - Vap
H2SO4 - V

Species K(eq)-Values

H2O
H2O - Vap
HCO3-1
HSO4-1
CO2 - Aq
CO2 - Vap
Na2F+1
K2SO4.KN
2Na2SO4.I
(HF)2 - Aq
(HF)2 - Vaj
HCl - Aq
HCl - Vap
HF2-1
HF - Aq
HF - Vap
HNO3 - Aq
HNO3 - Va
KHCO3
KHSO4 - A
KHSO4
K2CO3
K2CO3.1.5
KCl - Aq
KCl
KF
KF.2H2O
KF.4H2O
KOH

K. J. Chiles

12/19/04

HNO3 - Aq	20.055 mol*0
HNO3 - Va	1.40E+05 mol*0
KHCO3	1.8452 mol*0
KHSO4 - A	51.933 mol*0
KHSO4	3.3683 mol*0
K2CO3	54473 mol*0
K2CO3.1.5	859.86 mol*0
KCl - Aq	120.41 mol*0
KCl	7.5444 mol*0
KF	7251.8 mol*0
KF.2H2O	396.96 mol*0
KF.4H2O	63.719 mol*0
KOH	4.83E+10 mol*0
KOH.2H2C	1572.6 mol*0
KOH.1H2C	17545 mol*0
KNO3	0.78972 mol*0
K2SO4	0.011589 mol*0
KSO4-1	0.13228 mol*0
K2SO4.1H	0.010377 mol*0
NaHCO3 -	2.389 mol*0
NaHCO3	0.40374 mol*0
NaHSO4	356.65 mol*0
Na2CO3	7.3005 mol*0
Na2CO3.1+	0.11036 mol*0
Na2CO3.7	0.22354 mol*0
NaCO3-1	0.26348 mol*0
Na2CO3.1	1.0111 mol*0
NaCl	38.197 mol*0
NaF - Aq	1.2906 mol*0
NaF	0.2625 mol*0
NaF.Na2Si	3.16E-03 mol*0
NaHF2	7.28E-03 mol*0
NaOH	8.05E+06 mol*0
NaOH.1H2	64322 mol*0
NaNO3 - A	17.412 mol*0
NaNO3	28.746 mol*0
Na2SO4	0.44942 mol*0
Na2SO4	1.90E-07 mol*0
Na2SO4.N	162.44 mol*0
Na2SO4.1(	0.046844 mol*0
NaSO4-1	0.12009 mol*0
SO3 - Aq	7726 mol*0
SO3 - Vap	1.64E+09 mol*0
H2SO4 - A	2.57E+10 mol*0
H2SO4 - V	3.86E+05 mol*0

Species Mobilities

HCO3-1	2.31E-04 m2/ohm-mol
HSO4-1	2.66E-04 m2/ohm-mol
CO3-2	3.85E-04 m2/ohm-mol
Cl-1	3.97E-04 m2/ohm-mol
Na2F+1	3.12E-04 m2/ohm-mol
F-1	2.86E-04 m2/ohm-mol
HF2-1	3.90E-04 m2/ohm-mol
H+1	1.82E-03 m2/ohm-mol
OH-1	1.02E-03 m2/ohm-mol
K+1	3.81E-04 m2/ohm-mol
KSO4-1	1.99E-04 m2/ohm-mol
NaCO3-1	1.72E-04 m2/ohm-mol
Na+1	2.60E-04 m2/ohm-mol
NaSO4-1	1.82E-04 m2/ohm-mol
SO4-2	4.18E-04 m2/ohm-mol

Species Self Diffusivities

H2O	2.15E-09 m2/s
HCO3-1	1.05E-09 m2/s
HSO4-1	1.19E-09 m2/s
CO2 - Aq	1.80E-09 m2/s
CO3-2	8.75E-10 m2/s
Cl-1	1.76E-09 m2/s
Na2F+1	1.39E-09 m2/s
F-1	1.30E-09 m2/s
(HF)2 - Aq	1.08E-09 m2/s
HCl - Aq	1.89E-09 m2/s
HF2-1	1.73E-09 m2/s
HF - Aq	1.19E-10 m2/s
H+1	7.62E-09 m2/s
OH-1	4.37E-09 m2/s
NO3-1	1.65E-09 m2/s
HNO3 - Aq	1.76E-09 m2/s
KHSO4 - A	1.39E-09 m2/s
KCl - Aq	1.51E-09 m2/s
K+1	1.70E-09 m2/s
KSO4-1	8.96E-10 m2/s
NaHCO3 -	9.22E-10 m2/s
NaCO3-1	7.83E-10 m2/s
NaF - Aq	1.03E-09 m2/s
Na+1	1.19E-09 m2/s
NaNO3 - A	1.12E-09 m2/s
NaSO4-1	8.24E-10 m2/s
SO4-2	9.43E-10 m2/s
SO3 - Aq	1.00E-10 m2/s
H2SO4 - A	9.89E-10 m2/s

K2CO3	2670 mol*0
K2CO3.1.5	2055.7 mol*0
KCl - Aq	26.986 mol*0
KCl	16.596 mol*0
KF	54867 mol*0
KF.2H2O	1732.1 mol*0
KF.4H2O	6.69E+09 mol*0
KOH	3.85E+08 mol*0
KOH.2H2C	7614.8 mol*0
KOH.1H2C	23085 mol*0
KNO3	3.2319 mol*0
K2SO4	0.02686 mol*0
KSO4-1	0.087733 mol*0
K2SO4.1H	0.087869 mol*0
NaHCO3 -	0.52509 mol*0
NaHCO3	0.85701 mol*0
NaHSO4	376.35 mol*0
Na2CO3	1.316 mol*0
Na2CO3.1+	0.23607 mol*0
Na2CO3.7	1.3745 mol*0
NaCO3-1	0.7632 mol*0
Na2CO3.1	0.91296 mol*0
NaCl	36.518 mol*0
NaF - Aq	1.197 mol*0
NaF	0.31449 mol*0
NaF.Na2Si	3.16E-03 mol*0
NaHF2	0.051036 mol*0
NaOH	1.94E+06 mol*0
NaOH.1H2	16297 mol*0
NaNO3 - A	4.5867 mol*0
NaNO3	56.86 mol*0
Na2SO4	0.14445 mol*0
Na2SO4	2.13E-03 mol*0
Na2SO4.N	156.99 mol*0
Na2SO4 1(	26.308 mol*0
NaSO4-1	0.090006 mol*0
SO3 - Aq	1922.2 mol*0
SO3 - Vap	78679 mol*0
H2SO4 - A	3.19E+10 mol*0
H2SO4 - V	248.07 mol*0

Species Mobilities

HCO3-1	6.09E-04 m2/ohm-mol
HSO4-1	6.50E-04 m2/ohm-mol
CO3-2	1.08E-03 m2/ohm-mol
Cl-1	9.72E-04 m2/ohm-mol
Na2F+1	8.74E-04 m2/ohm-mol
F-1	7.65E-04 m2/ohm-mol
HF2-1	1.09E-03 m2/ohm-mol
H+1	3.01E-03 m2/ohm-mol
OH-1	2.10E-03 m2/ohm-mol
K+1	9.07E-04 m2/ohm-mol
KSO4-1	5.15E-04 m2/ohm-mol
NaCO3-1	4.75E-04 m2/ohm-mol
Na+1	6.95E-04 m2/ohm-mol
NaSO4-1	4.82E-04 m2/ohm-mol
SO4-2	1.10E-03 m2/ohm-mol

Species Self Diffusivities

H2O	7.34E-09 m2/s
HCO3-1	3.66E-09 m2/s
HSO4-1	3.86E-09 m2/s
CO2 - Aq	6.36E-09 m2/s
CO3-2	3.25E-09 m2/s
Cl-1	5.75E-09 m2/s
Na2F+1	5.17E-09 m2/s
F-1	4.61E-09 m2/s
(HF)2 - Aq	3.83E-09 m2/s
HCl - Aq	6.10E-09 m2/s
HF2-1	6.43E-09 m2/s
HF - Aq	4.43E-10 m2/s
H+1	1.72E-08 m2/s
OH-1	1.21E-08 m2/s
NO3-1	5.17E-09 m2/s
HNO3 - Aq	5.48E-09 m2/s
KHSO4 - A	5.16E-09 m2/s
KCl - Aq	4.81E-09 m2/s
K+1	5.40E-09 m2/s
KSO4-1	3.09E-09 m2/s
NaHCO3 -	3.24E-09 m2/s
NaCO3-1	2.87E-09 m2/s
NaF - Aq	3.65E-09 m2/s
Na+1	4.21E-09 m2/s
NaNO3 - A	3.83E-09 m2/s
NaSO4-1	2.90E-09 m2/s
SO4-2	3.31E-09 m2/s
SO3 - Aq	3.74E-10 m2/s
H2SO4 - A	3.46E-09 m2/s

KF	7251.8 mol*0
KF.2H2O	396.96 mol*0
KF.4H2O	63.719 mol*0
KOH	4.83E+10 mol*0
KOH.2H2C	1572.6 mol*0
KOH.1H2C	17545 mol*0
KNO3	0.78972 mol*0
K2SO4	0.011589 mol*0
KSO4-1	0.13228 mol*0
K2SO4.1H	0.010377 mol*0
NaHCO3 -	2.389 mol*0
NaHCO3	0.40374 mol*0
NaHSO4	356.65 mol*0
Na2CO3	7.3005 mol*0
Na2CO3.1+	0.11036 mol*0
Na2CO3.7	0.22354 mol*0
NaCO3-1	0.26348 mol*0
Na2CO3.1	1.0111 mol*0
NaCl	38.197 mol*0
NaF - Aq	1.2906 mol*0
NaF	0.2625 mol*0
NaF.Na2Si	3.16E-03 mol*0
NaHF2	7.28E-03 mol*0
NaOH	8.05E+06 mol*0
NaOH.1H2	64322 mol*0
NaNO3 - A	17.412 mol*0
NaNO3	28.746 mol*0
Na2SO4	0.44942 mol*0
Na2SO4	1.90E-07 mol*0
Na2SO4.N	162.44 mol*0
Na2SO4.1(	0.046844 mol*0
NaSO4-1	0.12009 mol*0
SO3 - Aq	7726 mol*0
SO3 - Vap	1.64E+09 mol*0
H2SO4 - A	2.57E+10 mol*0
H2SO4 - V	3.86E+05 mol*0

Species Mobilities

HCO3-1	2.80E-04 m2/ohm-mol
CO3-2	4.32E-04 m2/ohm-mol
Cl-1	4.46E-04 m2/ohm-mol
Na2F+1	3.50E-04 m2/ohm-mol
F-1	3.21E-04 m2/ohm-mol
HF2-1	4.38E-04 m2/ohm-mol
H+1	2.04E-03 m2/ohm-mol
OH-1	1.15E-03 m2/ohm-mol
NO3-1	4.17E-04 m2/ohm-mol
K+1	4.27E-04 m2/ohm-mol
NaCO3-1	1.93E-04 m2/ohm-mol
Na+1	2.92E-04 m2/ohm-mol

Species Self Diffusivities

H2O	2.33E-09 m2/s
HCO3-1	1.13E-09 m2/s
HSO4-1	1.29E-09 m2/s
CO2 - Aq	1.94E-09 m2/s
CO3-2	9.48E-10 m2/s
Cl-1	1.90E-09 m2/s
Na2F+1	1.51E-09 m2/s
F-1	1.39E-09 m2/s
(HF)2 - Aq	1.17E-09 m2/s
HCl - Aq	2.05E-09 m2/s
HF2-1	1.87E-09 m2/s
HF - Aq	1.29E-10 m2/s
H+1	8.08E-09 m2/s
OH-1	4.88E-09 m2/s
NO3-1	1.78E-09 m2/s
HNO3 - Aq	1.91E-09 m2/s
KHSO4 - A	1.51E-09 m2/s
KCl - Aq	1.58E-09 m2/s
K+1	1.83E-09 m2/s
KSO4-1	9.74E-10 m2/s
NaHCO3 -	9.99E-10 m2/s
NaCO3-1	8.49E-10 m2/s
NaF - Aq	1.12E-09 m2/s
Na+1	1.27E-09 m2/s
NaNO3 - A	1.22E-09 m2/s
NaSO4-1	8.95E-10 m2/s
SO4-2	1.03E-09 m2/s
SO3 - Aq	1.09E-10 m2/s
H2SO4 - A	1.08E-09 m2/s

KF	7251.8 mol*0
KF.2H2O	396.96 mol*0
KF.4H2O	63.719 mol*0
KOH	4.83E+10 mol*0
KOH.2H2C	1572.6 mol*0
KOH.1H2C	17545 mol*0
KNO3	0.78972 mol*0
K2SO4	0.011589 mol*0
KSO4-1	0.13228 mol*0
K2SO4.1H	0.010377 mol*0
NaHCO3 -	2.389 mol*0
NaHCO3	0.40374 mol*0
NaHSO4	356.65 mol*0
Na2CO3	7.3005 mol*0
Na2CO3.1+	0.11036 mol*0
Na2CO3.7	0.22354 mol*0
NaCO3-1	0.26348 mol*0
Na2CO3.1	1.0111 mol*0
NaCl	38.197 mol*0
NaF - Aq	1.2906 mol*0
NaF	0.2625 mol*0
NaF.Na2Si	3.16E-03 mol*0
NaHF2	7.28E-03 mol*0
NaOH	8.05E+06 mol*0
NaOH.1H2	64322 mol*0
NaNO3 - A	17.412 mol*0
NaNO3	28.746 mol*0
Na2SO4	0.44942 mol*0
Na2SO4	1.90E-07 mol*0
Na2SO4.N	162.44 mol*0
Na2SO4.1(	0.046844 mol*0
NaSO4-1	0.12009 mol*0
SO3 - Aq	7726 mol*0
SO3 - Vap	1.64E+09 mol*0
H2SO4 - A	2.57E+10 mol*0
H2SO4 - V	3.86E+05 mol*0

Species Mobilities

HCO3-1	2.41E-04 m2/ohm-mol
CO3-2	4.01E-04 m2/ohm-mol
Cl-1	4.14E-04 m2/ohm-mol
Na2F+1	3.25E-04 m2/ohm-mol
F-1	2.98E-04 m2/ohm-mol
HF2-1	4.07E-04 m2/ohm-mol
H+1	1.90E-03 m2/ohm-mol
OH-1	1.07E-03 m2/ohm-mol
NO3-1	3.87E-04 m2/ohm-mol
K+1	3.97E-04 m2/ohm-mol
NaCO3-1	1.79E-04 m2/ohm-mol
Na+1	2.72E-04 m2/ohm-mol

Species Self Diffusivities

H2O	2.24E-09 m2/s
HCO3-1	1.09E-09 m2/s
HSO4-1	1.24E-09 m2/s
CO2 - Aq	1.86E-09 m2/s
CO3-2	9.09E-10 m2/s
Cl-1	1.83E-09 m2/s
Na2F+1	1.45E-09 m2/s
F-1	1.34E-09 m2/s
(HF)2 - Aq	1.12E-09 m2/s
HCl - Aq	1.97E-09 m2/s
HF2-1	1.79E-09 m2/s
HF - Aq	1.23E-10 m2/s
H+1	7.84E-09 m2/s
OH-1	4.52E-09 m2/s
NO3-1	1.71E-09 m2/s
HNO3 - Aq	1.83E-09 m2/s
KHSO4 - A	1.44E-09 m2/s
KCl - Aq	1.54E-09 m2/s
K+1	1.76E-09 m2/s
KSO4-1	9.33E-10 m2/s
NaHCO3 -	9.58E-10 m2/s
NaCO3-1	8.14E-10 m2/s
NaF - Aq	1.07E-09 m2/s
Na+1	1.23E-09 m2/s
NaNO3 - A	1.17E-09 m2/s
NaSO4-1	8.58E-10 m2/s
SO4-2	9.82E-10 m2/s
SO3 - Aq	1.04E-10 m2/s
H2SO4 - A	1.03E-09 m2/s

KOH.2H2C
KOH.1H2C
KNO3
K2SO4
KSO4-1
K2SO4.1H
NaHCO3 -
NaHCO3
NaHSO4
Na2CO3
Na2CO3.1+
Na2CO3.7
NaCO3-1
Na2CO3.1
NaCl
NaF - Aq
NaF
NaF.Na2Si
NaHF2
NaOH
NaOH.1H2
NaNO3 - A
NaNO3
Na2SO4
Na2SO4
Na2SO4.N
Na2SO4.1(
NaSO4-1
SO3 - Aq
SO3 - Vap
H2SO4 - A
H2SO4 - V

Species Mc

HCO3-1
CO3-2
Cl-1
Na2F+1
F-1
HF2-1
H+1
OH-1
NO3-1
K+1
NaCO3-1
Na+1

Species Se

H2O
HCO3-1
HSO4-1
CO2 - Aq
CO3-2
Cl-1
Na2F+1
F-1
(HF)2 - Aq
HCl - Aq
HF2-1
HF - Aq
H+1
OH-1
NO3-1
HNO3 - Aq
KHSO4 - A
KCl - Aq
K+1
KSO4-1
NaHCO3 -
NaCO3-1
NaF - Aq
Na+1
NaNO3 - A
NaSO4-1
SO4-2
SO3 - Aq
H2SO4 - A

K. T. Chiang

12/14/04

SCW05

Summary

t_NaOH_95oC Calculation for Work1

Chemistry Model
Databanks:
Public

efault

Calculation
Temperatu 95 °C
Pressure 1 atm

lows

1000	g
5.43	g
6.46	g
8.749	g
0	g
96.341	g
3.109	g
9	g

Summary

er of species. 113

Related Inflows	Aqueous Species	Vapor Species	Solid Species	Second Liquid Spe
CO2	H2O	H2O - Vap	K2SO4.KNaSO4	
H2CO3	HCO3-1	CO2 - Vap	2Na2SO4 Na2CO3	
K2SO4.KN	HSO4-1	(HF)2 - Va	KHCO3	
2Na2SO4.I	CO2 - Aq	HCl - Vap	KHSO4	
(HF)2	CO3-2	HF - Vap	K2CO3	
HCl	Cl-1	HNO3 - Va	K2CO3.1 5H2O	
HF	Na2F+1	SO3 - Vap	KCl	
(HF)6	F-1	H2SO4 - V	KF	
HNO3	(HF)2 - Aq		KF.2H2O	
KHCO3	HCl - Aq		KF.4H2O	
KHSO4	HF2-1		KOH	
K2CO3	HF - Aq		KOH.2H2O	
K2CO3 1.5	H+1		KOH.1H2O	
KF	OH-1		KNO3	
KF 2H2O	NO3-1		K2SO4	
KF 4H2O	HNO3 - Aq		K2SO4.1H2O	
KOH	KHSO4 - Aq		NaHCO3	
KOH.2H2C	KCl - Aq		NaHSO4	
KOH.1H2C	K+1		Na2CO3	
KNO3	KSO4-1		Na2CO3 10H2O	
K2SO4	NaHCO3 - Aq		Na2CO3.7H2O	
K2SO4.1H	NaCO3-1		Na2CO3 1H2O	
NaHSO4	NaF - Aq		NaCl	
Na2CO3	Na+1		NaF	
Na2CO3.1	NaNO3 - Aq		NaF.Na2SO4	
Na2CO3.7	NaSO4-1		NaHF2	
Na2CO3.1	SO4-2		NaOH	
NaF.Na2S	SO3 - Aq		NaOH.1H2O	
NaHF2	H2SO4 - Aq		NaNO3	
NaOH.1H2O			Na2SO4	
Na2SO4			Na2SO4	
Na2SO4.NaHSO4			Na2SO4.NaHSO4	
Na2SO4.10H2O			Na2SO4 10H2O	
SO3				
H2SO4				

rameters

1129.1	g
95	°C
1	atm
8.736	pH
1.5541	mol/kg H2O
73.526	atm
0.95592	Activity
0.19702	1/ohm
123.7	cm2/ohm-mol
0.49813	cP
1.6766	cP/cP H2O

Total	Aqueous	Vapor	Solid	2nd Liquid
--	g/ml	g/ml	g/ml	g/ml
--	1.0403	0	0	0

Total	Aqueous	Vapor	Solid	2nd Liquid
cal	cal	cal	cal	cal
-4.04E+06	-4.04E+06	0	0	0

hase Flows (Amounts)

Total	Aqueous	Vapor	Solid	2nd Liquid
mol	mol	mol	mol	mol
58.594	58.594	0	0	0

Total	Aqueous	Vapor	Solid	2nd Liquid
g	g	g	g	g
1129.1	1129.1	0	0	0

Total	Aqueous	Vapor	Solid	2nd Liquid
L	L	L	L	L
1.0854	1.0854	0	0	0

ndencies

Temperature Range			
0.32549	0	200.00 °C	inside range
0.069785	0	100.00 °C	inside range
6.85E-03	35.37	109.00 °C	inside range
2.22E-03	0	350.00 °C	inside range
7.56E-04	0	110.00 °C	inside range
6.35E-04	0	300.00 °C	inside range
3.21E-04	0	200.00 °C	inside range
7.31E-08	data valid tl	inside range	
4.57E-10	33	143.00 °C	inside range
2.87E-14	data valid tl	inside range	

Calculation Summary

SinglePoint1 Calculation for Work1

Automatic Chemistry Model
Databanks
Public

Unit Set: Default

Isothermal Calculation
Temperatu 25 °C
Pressure 1 atm

Stream Inflows

Water	1000	g
Sodium chl	5.34	g
Potassium	6.46	g
Sodium nit	8.754	g
Sodium sul	30.693	g
Sodium bic	96.352	g
Sodium flu	0	g
Sodium hy	0	g

Speciation Summary

Total number of species: 113

User Inflows	Related Inflows	Aqueous Species	Vapor Species	Solid Species	Second Liquid Spe
H2O	CO2	H2O	H2O - Vap	K2SO4.KNaSO4	
NaCl	H2CO3	HCO3-1	CO2 - Vap	2Na2SO4.Na2CO3	
KCl	K2SO4.KN	HSO4-1	(HF)2 - Va	KHCO3	
NaNO3	2Na2SO4.I	CO2 - Aq	HCl - Vap	KHSO4	
Na2SO4	(HF)2	CO3-2	HF - Vap	K2CO3	
NaHCO3	HCl	Cl-1	HNO3 - Va	K2CO3.1.5H2O	
NaF	HF	Na2F+1	SO3 - Vap	KCl	
NaOH	(HF)6	F-1	H2SO4 - V	KF	
	HNO3	(HF)2 - Aq		KF.2H2O	
	KHCO3	HCl - Aq		KF.4H2O	
	KHSO4	HF2-1		KOH	
	K2CO3	HF - Aq		KOH.2H2O	
	K2CO3.1.5	H+1		KOH 1H2O	
	KF	OH-1		KNO3	
	KF.2H2O	NO3-1		K2SO4	
	KF.4H2O	HNO3 - Aq		K2SO4.1H2O	
	KOH	KHSO4 - Aq		NaHCO3	
	KOH.2H2C	KCl - Aq		NaHSO4	
	KOH.1H2C	K+1		Na2CO3	
	KNO3	KSO4-1		Na2CO3.10H2O	
	K2SO4	NaHCO3 - Aq		Na2CO3 7H2O	
	K2SO4.1H	NaCO3-1		Na2CO3 1H2O	
	NaHSO4	NaF - Aq		NaCl	
	Na2CO3	Na+1		NaF	
	Na2CO3.1	NaNO3 - Aq		NaF.Na2SO4	
	Na2CO3 7	NaSO4-1		NaHF2	
	Na2CO3.1	SO4-2		NaOH	
	NaF Na2S	SO3 - Aq		NaOH.1H2O	
	NaHF2	H2SO4 - Aq		NaNO3	
	NaOH.1H2O			Na2SO4	
	Na2SO4			Na2SO4	
	Na2SO4.NaHSO4			Na2SO4.NaHSO4	
	Na2SO4 10H2O			Na2SO4 10H2O	
	SO3				
	H2SO4				

Stream Parameters

Stream Am	1147.6	g
Temperatu	25	°C
Pressure	1	atm
pH	7 6877	pH
Ionic Stren	1.6325	mol/kg H2O
Osmotic Pr	70.241	atm
WaterActiv	0.94991	Activity
Electrical C	0.080823	1/ohm
Electrical C	51.589	cm2/ohm-mol
Viscosity, a	1 3937	cP
Viscosity, r	1 5647	cP/cP H2O

	Total	Aqueous	Vapor	Solid	2nd Liquid
	--	g/ml	g/ml	g/ml	g/ml
Density	--	1.0878	0	2.1997	0

	Total	Aqueous	Vapor	Solid	2nd Liquid
	cal	cal	cal	cal	cal
Enthalpy	-4.15E+06	-4.13E+06	0	-16443	0

Total and Phase Flows (Amounts)

	Total	Aqueous	Vapor	Solid	2nd Liquid
	mol	mol	mol	mol	mol
Mole	58.695	58.622	0	0.072489	0

	Total	Aqueous	Vapor	Solid	2nd Liquid
	g	g	g	g	g
Mass	1147.6	1141.5	0	6.0696	0

	Total	Aqueous	Vapor	Solid	2nd Liquid
	L	L	L	L	L
Volume	1 0522	1 0494	0	2.77E-03	0

Scaling Tendencies

solids withi	Temperature Range			
Sodium bic	1	0	200.00 °C	inside range
Sodium sul	0.075015	0	32.400 °C	inside range
Sodium sul	0.013072	19	241.00 °C	inside range
Potassium	0.010681	0	70.000 °C	inside range
Sodium ca	4.10E-03	0	32.000 °C	inside range
Potassium	3.00E-03	0	110.00 °C	inside range
Sodium chl	2.54E-03	0	350.00 °C	inside range
Sodium nit	1.69E-03	0	300.00 °C	inside range
Potassium	1.21E-03	9.7	292.00 °C	inside range
Potassium	6.29E-04	0	200.00 °C	inside range
Potassium	1.94E-09	0	80.000 °C	inside range
Potassium	2.03E-10	data valid tl	inside range	

Calculation Summary

SinglePoint_NaOH Calculation for Work1

Automatic Chemistry Model
Databanks.
Public

Unit Set: Default

Isothermal Calculation
Temperatu 25 °C
Pressure 1 atm

Stream Inflows

Water	1000	g
Sodium chl	5.34	g
Potassium	6 46	g
Sodium nit	8.754	g
Sodium sul	30.693	g
Sodium bic	96.352	g
Sodium flu	0	g
Sodium hy	9	g

Speciation Summary

Total number of species: 113

User Inflows	Related Inflows	Aqueous Species	Vapor Species	Solid Species	Second Liquid Spe
H2O	CO2	H2O	H2O - Vap	K2SO4.KNaSO4	
NaCl	H2CO3	HCO3-1	CO2 - Vap	2Na2SO4.Na2CO3	
KCl	K2SO4.KN	HSO4-1	(HF)2 - Va	KHCO3	
NaNO3	2Na2SO4 I	CO2 - Aq	HCl - Vap	KHSO4	
Na2SO4	(HF)2	CO3-2	HF - Vap	K2CO3	
NaHCO3	HCl	Cl-1	HNO3 - Va	K2CO3 1 5H2O	
NaF	HF	Na2F+1	SO3 - Vap	KCl	
NaOH	(HF)6	F-1	H2SO4 - V	KF	
	HNO3	(HF)2 - Aq		KF 2H2O	
	KHCO3	HCl - Aq		KF.4H2O	
	KHSO4	HF2-1		KOH	
	K2CO3	HF - Aq		KOH.2H2O	
	K2CO3 1.5	H+1		KOH.1H2O	
	KF	OH-1		KNO3	
	KF.2H2O	NO3-1		K2SO4	
	KF 4H2O	HNO3 - Aq		K2SO4 1H2O	
	KOH	KHSO4 - Aq		NaHCO3	
	KOH.2H2C	KCl - Aq		NaHSO4	
	KOH 1H2C	K+1		Na2CO3	
	KNO3	KSO4-1		Na2CO3.10H2O	
	K2SO4	NaHCO3 - Aq		Na2CO3 7H2O	
	K2SO4 1H	NaCO3-1		Na2CO3 1H2O	
	NaHSO4	NaF - Aq		NaCl	
	Na2CO3	Na+1		NaF	
	Na2CO3 1	NaNO3 - Aq		NaF Na2SO4	
	Na2CO3.7	NaSO4-1		NaHF2	
	Na2CO3 1	SO4-2		NaOH	
	NaF.Na2S	SO3 - Aq		NaOH 1H2O	
	NaHF2	H2SO4 - Aq		NaNO3	
	NaOH.1H2O			Na2SO4	
	Na2SO4			Na2SO4	
	Na2SO4.NaHSO4			Na2SO4.NaHSO4	
	Na2SO4.10H2O			Na2SO4 10H2O	
	SO3				
	H2SO4				

Stream Parameters

Stream Am	1156.6	g
Temperatu	25	°C
Pressure	1	atm
pH	8 7726	pH
Ionic Stren	2.0332	mol/kg H2O
Osmotic Pr	73.214	atm
WaterActiv	0.94824	Activity
Electrical C	0.090062	1/ohm
Electrical C	50.627	cm2/ohm-mol
Viscosity, a	1 4558	cP
Viscosity, r	1.6344	cP/cP H2O

	Total	Aqueous	Vapor	Solid	2nd Liquid
	--	g/ml	g/ml	g/ml	g/ml
Density	--	1 1008	0	0	0

	Total	Aqueous	Vapor	Solid	2nd Liquid
	cal	cal	cal	cal	cal
Enthalpy	-4 18E+06	-4 18E+06	0	0	0

Total and Phase Flows (Amounts)

	Total	Aqueous	Vapor	Solid	2nd Liquid
	mol	mol	mol	mol	mol
Mole	59 156	59 156	0	0	0

	Total	Aqueous	Vapor	Solid	2nd Liquid
	g	g	g	g	g
Mass	1156.6	1156.6	0	0	0

	Total	Aqueous	Vapor	Solid	2nd Liquid
	L	L	L	L	L
Volume	1.0507	1.0507	0	0	0

Scaling Tendencies

solids withi	Temperature Range			
Sodium bic	0.97363	0	200.00 °C	inside range
Sodium sul	0.082144	0	32.400 °C	inside range
Sodium ca	0.054338	0	32.000 °C	inside range
Sodium sul	0.014568	19	241 00 °C	inside range
Potassium	9.41E-03	0	70.000 °C	inside range
Potassium	3.02E-03	0	110.00 °C	inside range
Sodium chl	2.88E-03	0	350.00 °C	inside range
Sodium nit	1 88E-03	0	300.00 °C	inside range
Potassium	1 10E-03	9.7	292.00 °C	inside range
Potassium	6 44E-04	0	200.00 °C	inside range
Potassium	2.14E-08	0	80.000 °C	inside range
Potassium	1.34E-10	0	33.000 °C	inside range

Calculation Summary

SinglePoint_NaOH_95oC Calculation for Work1

Automatic Chemistry Model
Databanks
Public

Unit Set: Default

Isothermal Calculation
Temperatu 95 °C
Pressure 1 atm

Stream Inflows

Water	1000	g
Sodium chl	5.34	g
Potassium	6.46	g
Sodium nit	8.754	g
Sodium sul	30.693	g
Sodium bic	96.352	g
Sodium flu	0	g
Sodium hy	9	g

Speciation Summary

Total number of species. 113

User Inflows	Related Inflows	Aqueous Species	Vapor Species	Solid Species	Second Liquid Spe
H2O	CO2	H2O	H2O - Vap	K2SO4.KNaSO4	
NaCl	H2CO3	HCO3-1	CO2 - Vap	2Na2SO4.Na2CO3	
KCl	K2SO4.KN	HSO4-1	(HF)2 - Va	KHCO3	
NaNO3	2Na2SO4.I	CO2 - Aq	HCl - Vap	KHSO4	
Na2SO4	(HF)2	CO3-2	HF - Vap	K2CO3	
NaHCO3	HCl	Cl-1	HNO3 - Va	K2CO3.1.5H2O	
NaF	HF	Na2F+1	SO3 - Vap	KCl	
NaOH	(HF)6	F-1	H2SO4 - V	KF	
	HNO3	(HF)2 - Aq		KF.2H2O	
	KHCO3	HCl - Aq		KF.4H2O	
	KHSO4	HF2-1		KOH	
	K2CO3	HF - Aq		KOH.2H2O	
	K2CO3 1.5	H+1		KOH.1H2O	
	KF	OH-1		KNO3	
	KF.2H2O	NO3-1		K2SO4	
	KF 4H2O	HNO3 - Aq		K2SO4.1H2O	
	KOH	KHSO4 - Aq		NaHCO3	
	KOH.2H2C	KCl - Aq		NaHSO4	
	KOH 1H2C	K+1		Na2CO3	
	KNO3	KSO4-1		Na2CO3.10H2O	
	K2SO4	NaHCO3 - Aq		Na2CO3 7H2O	
	K2SO4 1H	NaCO3-1		Na2CO3.1H2O	
	NaHSO4	NaF - Aq		NaCl	
	Na2CO3	Na+1		NaF	
	Na2CO3 1	NaNO3 - Aq		NaF.Na2SO4	
	Na2CO3.7	NaSO4-1		NaHF2	
	Na2CO3.1	SO4-2		NaOH	
	NaF.Na2S	SO3 - Aq		NaOH.1H2O	
	NaHF2	H2SO4 - Aq		NaNO3	
	NaOH 1H2O			Na2SO4	
	Na2SO4			Na2SO4	
	Na2SO4.NaHSO4			Na2SO4.NaHSO4	
	Na2SO4.10H2O			Na2SO4.10H2O	
	SO3				
	H2SO4				

Stream Parameters

Stream Am	1156.6	g
Temperatu	95	°C
Pressure	1	atm
pH	8.689	pH
Ionic Stren	2.0068	mol/kg H2O
Osmotic Pr	82.853	atm
WaterActiv	0.95045	Activity
Electrical C	0.22258	1/ohm
Electrical C	130.26	cm2/ohm-mol
Viscosity, a	0.50444	cP
Viscosity, r	1.6979	cP/cP H2O

	Total	Aqueous	Vapor	Solid	2nd Liquid
	--	g/ml	g/ml	g/ml	g/ml
Density	--	1.0574	0	0	0

	Total	Aqueous	Vapor	Solid	2nd Liquid
	cal	cal	cal	cal	cal
Enthalpy	-4.10E+06	-4.10E+06	0	0	0

Total and Phase Flows (Amounts)

	Total	Aqueous	Vapor	Solid	2nd Liquid
	mol	mol	mol	mol	mol
Mole	59.029	59.029	0	0	0

	Total	Aqueous	Vapor	Solid	2nd Liquid
	g	g	g	g	g
Mass	1156.6	1156.6	0	0	0

	Total	Aqueous	Vapor	Solid	2nd Liquid
	L	L	L	L	L
Volume	1.0938	1.0938	0	0	0

Scaling Tendencies

solids withi	Temperature Range			
Sodium bic	0.36048	0	200.00 °C	inside range
Sodium sul	0.036258	19	241.00 °C	inside range
Hexasodiu	0.012342	30	150.00 °C	inside range
Sodium ca	8.00E-03	35.37	109.00 °C	inside range
Sodium chl	3.56E-03	0	350.00 °C	inside range
Sodium nit	7.27E-04	0	300.00 °C	inside range
Potassium	6.12E-04	0	110.00 °C	inside range
Potassium	4.46E-04	9.7	292.00 °C	inside range
Potassium	3.64E-04	0	200.00 °C	inside range
Glaserite	5.44E-05	35	150.00 °C	inside range
Potassium	3.39E-10	33	143.00 °C	inside range
Potassium	3.65E-11	data valid tl	inside range	

Calculation Summary

SinglePoint1 Calculatio

Automatic Chemistry M
Databanks:

Unit Set: Default

Isothermal Calculation
Temperatu
Pressure

Stream Inflows

Water	1000
Sodium chl	0
Potassium	6.46
Sodium nit	8.758
Sodium sul	20.697
Sodium bic	96.349
Sodium flu	3.098
Sodium hy	0

Speciation Summary

Total number of specie

User Inflows	Related Inflows
H2O	CO2
NaCl	H2CO3
KCl	K2SO4.KN
NaNO3	2Na2SO4.I
Na2SO4	(HF)2
NaHCO3	HCl
NaF	HF
NaOH	(HF)6
	HNO3
	KHCO3
	KHSO4
	K2CO3
	K2CO3.1.5
	KF
	KF 2H2O
	KF 4H2O
	KOH
	KOH.2H2C
	KOH.1H2C
	KNO3
	K2SO4
	K2SO4.1H
	NaHSO4
	Na2CO3
	Na2CO3 1
	Na2CO3 7
	Na2CO3.1
	NaF.Na2S
	NaHF2
	NaOH.1H2
	Na2SO4
	Na2SO4.N
	Na2SO4.1
	SO3
	H2SO4

Stream Parameters

Stream Am	1135.4
Temperatu	25
Pressure	1
pH	7.7015
Ionic Stren	1.5114
Osmotic Pr	65.355
WaterActiv	0.95329
Electrical C	0.075461
Electrical C	50 799
Viscosity, a	1.4049
Viscosity, r	1.5773

	Total
	--
Density	--

	Total
	cal
Enthalpy	-4.13E+06

Total and Phase Flows

	Total
	mol
Mole	58.517

	Total
	g
Mass	1135.4

	Total
	L
Volume	1.0485

Scaling Tendencies

solids withi	Temperatu
Sodium bic	1
Sodium flu	0.099442
Sodium sul	0.047832
Sodium flu	0.029861
Potassium	0.01176
Sodium sul	8.04E-03
Sodium ca	4.12E-03
Potassium	3.12E-03
Sodium nit	1.59E-03
Sodium chl	1.14E-03
Potassium	9.01E-04
Potassium	3.10E-04

K. T. Chiang
12/19/04

utput (True Species)

Total g	Aqueous mol/kg H2O	Vapor mol	Solid mol	2nd Liquid n/a
1004.1	55.508	0	0	0
0.011714	1.56E-04	0	0	0
0.90594	0.010616	0	0	0
27.247	0.32303	0	0	0
0.61309	0.014542	0	0	0
0.049522	1.12E-03	0	0	0
9.25E-16	2.30E-17	0	0	0
1.83E-13	5.00E-15	0	0	0
5.61E-06	2.79E-07	0	0	0
1.09E-09	1.72E-11	0	0	0
36.344	0.59322	0	0	0
12.244	0.2032	0	0	0
6.37	0.17895	0	0	0
0.050001	7.66E-04	0	0	0
1.1147	0.058436	0	0	0
3.63E-07	9.28E-09	0	0	0
2.74E-09	2.71E-09	0	0	0
7.02E-03	4.11E-04	0	0	0
5.7217	0.091904	0	0	0
3.3923	0.086412	0	0	0
1.8012	0.021613	0	0	0
29.172	1.2638	0	0	0

Output (Apparent Species)

Total g	Aqueous mol/kg H2O	Vapor mol	Solid mol	2nd Liquid n/a
993.57	54.928	0	0	0
85.665	1.6351	0	0	0
50.471	1.1422	0	0	0
5.5585	0.1791	0	0	0
1.4814	0.073744	0	0	0
6.4863	0.10252	0	0	0
4.8767	0.086568	0	0	0

Balance

Total mol	Aqueous mol	Vapor mol	Solid mol	2nd Liquid n/a
0	1.1422	0	0	0
0	0.1791	0	0	0
0	0.073745	0	0	0
0	111.93	0	0	0
0	0.086569	0	0	0
0	0.10252	0	0	0
0	1.6351	0	0	0
0	59.242	0	0	0
0	0	0	0	0

ctivity Coefficients

0.95592	Activity
0.52781	Act-Coef
0.58891	Act-Coef
1.2462	Act-Coef
0.069002	Act-Coef
0.64393	Act-Coef
0.47122	Act-Coef
0.54987	Act-Coef
1.2606	Act-Coef
1.2606	Act-Coef
0.58891	Act-Coef
1.3199	Act-Coef
0.67873	Act-Coef
0.58074	Act-Coef
0.57519	Act-Coef
1.4115	Act-Coef
1.2606	Act-Coef
1.2606	Act-Coef
0.5347	Act-Coef
0.47799	Act-Coef
1.2606	Act-Coef
0.58057	Act-Coef
1.2606	Act-Coef
0.54045	Act-Coef
0.74475	Act-Coef
1.6723	Act-Coef
0.061466	Act-Coef
1.2606	Act-Coef
1.2606	Act-Coef
1	Fug-Coef
1	Fug-Coef
1	Fug-Coef
1	Fug-Coef
1	Fug-Coef
1	Fug-Coef
1	Fug-Coef
1	Fug-Coef

(eq)-Values

4.59E-13	mol^0
1.2097	mol^0
8.22E-11	mol^0
1.17E-03	mol^0
4.31E-07	mol^0
0.011137	mol^0
34.675	mol^0
5.51E-06	mol^0
1.71E-05	mol^0
4686.1	mol^0
499.84	mol^0
33570	mol^0
0.12142	mol^0
2.1685	mol^0
1.60E-04	mol^0
379.93	mol^0
4.002	mol^0
920.44	mol^0
7.7419	mol^0
15.597	mol^0
14.067	mol^0
2670	mol^0
2055.7	mol^0
26.986	mol^0
16.596	mol^0
54867	mol^0
1732.1	mol^0
6.69E+09	mol^0
3.85E+08	mol^0

Sodium bic	3.93E-11	data valid t	inside range
Potassium	1.09E-11	0 33.000 °C	inside range
Sodium hy	5.67E-12	12 60.000 °C	inside range
Sodium sul	5.07E-13	0 82.500 °C	inside range
Potassium	3.89E-19	data valid t	inside range

Species Output (True Species)

	Total g	Aqueous mol/kg H2O	Vapor mol	Solid mol	2nd Liquid n/a
H2O	1000.3	55.508	0	0	0
KCl	2.34E-03	3.14E-05	0	0	0
NaNO3	0.32727	3.85E-03	0	0	0
NaHCO3	17.409	0.1347	0	0.072489	0
CO2	0.82368	0.01871	0	0	0
HCl	4.20E-14	1.15E-15	0	0	0
HNO3	2.74E-09	4.35E-11	0	0	0
KHSO4	1.43E-09	1.05E-11	0	0	0
SO3	1.19E-26	1.48E-30	0	0	0
H2SO4	1.07E-24	1.09E-26	0	0	0
HCO3-1	55.055	0.90198	0	0	0
HSO4-1	2.51E-05	2.58E-06	0	0	0
CO3-2	0.82397	0.013726	0	0	0
Cl-1	6.3104	0.17793	0	0	0
H+1	2.73E-06	2.71E-06	0	0	0
OH-1	1.00E-05	5.91E-07	0	0	0
NO3-1	6.1475	0.099111	0	0	0
K+1	3.1889	0.081533	0	0	0
KSO4-1	0.684	5.05E-03	0	0	0
NaCO3-1	0.41372	4.98E-03	0	0	0
Na+1	33.153	1.4416	0	0	0
NaSO4-1	13.733	0.11532	0	0	0
SO4-2	9.1902	0.095636	0	0	0

Molecular Output (Apparent Species)

	Total g	Aqueous mol/kg H2O	Vapor mol	Solid mol	2nd Liquid n/a
H2O	991.04	54.993	0	0	0
NaHCO3	6.0896	0	0	0.072489	0
NaOH	68.035	1.7004	0	0	0
CO2	47.287	1.0741	0	0	0
HCl	6.4909	0.17796	0	0	0
HNO3	6.49	0.10296	0	0	0
KOH	4.8617	0.086623	0	0	0
SO3	17.3	0.21601	0	0	0

Element Balance

	Total mol	Aqueous mol	Vapor mol	Solid mol	2nd Liquid n/a
C(+4)	0	1.0741	0	0.072489	0
CL(-1)	0	0.17796	0	0	0
F(-1)	0	0	0	0	0
H(+1)	0	112.06	0	0.072489	0
K(+1)	0	0.086623	0	0	0
N(+5)	0	0.10296	0	0	0
NA(+1)	0	1.7004	0	0.072489	0
O(-2)	0	59.885	0	0.21747	0
S(+6)	0	0.21601	0	0	0

Species Activity Coefficients

H2O	0.94991	Activity
HCO3-1	0.54689	Act-Coef
HSO4-1	0.66285	Act-Coef
CO2 - Aq	1.2549	Act-Coef
CO3-2	0.082239	Act-Coef
Cl-1	0.667	Act-Coef
Na2F+1	0.51665	Act-Coef
F-1	0.59048	Act-Coef
(HF)2 - Aq	1.2546	Act-Coef
HCl - Aq	1.2546	Act-Coef
HF2-1	0.66285	Act-Coef
HF - Aq	1.2962	Act-Coef
H+1	0.75673	Act-Coef
OH-1	0.79485	Act-Coef
NO3-1	0.59739	Act-Coef
HNO3 - Aq	1.3913	Act-Coef
KHSO4 - A	1.2546	Act-Coef
KCl - Aq	1.2546	Act-Coef
K+1	0.49004	Act-Coef
KSO4-1	0.52358	Act-Coef
NaHCO3 -	1.2546	Act-Coef
NaCO3-1	0.65405	Act-Coef
NaF - Aq	1.2546	Act-Coef
Na+1	0.56777	Act-Coef
NaNO3 - A	0.72304	Act-Coef
NaSO4-1	0.5183	Act-Coef
SO4-2	0.091698	Act-Coef
SO3 - Aq	1.2546	Act-Coef
H2SO4 - A	1.2546	Act-Coef
H2O - Vap	1	Fug-Coef
CO2 - Vap	1	Fug-Coef
(HF)2 - Vaj	1	Fug-Coef
HCl - Vap	1	Fug-Coef
HF - Vap	1	Fug-Coef
HNO3 - Va	1	Fug-Coef
SO3 - Vap	1	Fug-Coef
H2SO4 - V	1	Fug-Coef

Species K(eq)-Values

H2O	1.01E-14	mol^0
H2O - Vap	31.857	mol^0
HCO3-1	4.70E-11	mol^0
HSO4-1	0.010515	mol^0
CO2 - Aq	4.54E-07	mol^0
CO2 - Vap	0.03392	mol^0
Na2F+1	92.494	mol^0
K2SO4.KN	9.29E-06	mol^0
2Na2SO4 I	3.44E-03	mol^0
(HF)2 - Aq	51387	mol^0
(HF)2 - Vaj	19124	mol^0
HCl - Aq	1.69E+06	mol^0
HCl - Vap	0.92798	mol^0
HF2-1	4.1247	mol^0
HF - Aq	6.17E-04	mol^0
HF - Vap	19019	mol^0
HNO3 - Aq	20.065	mol^0
HNO3 - Va	1.40E+05	mol^0
KHCO3	1.8452	mol^0
KHSO4 - A	51.933	mol^0

Sodium hy	7.83E-11	12 60.000 °C	inside range
Potassium	1.48E-11	data valid t	inside range
Sodium bic	3.16E-12	data valid t	inside range
Sodium sul	4.54E-14	0 82.500 °C	inside range
Potassium	4.86E-18	data valid t	inside range

Species Output (True Species)

	Total g	Aqueous mol/kg H2O	Vapor mol	Solid mol	2nd Liquid n/a
H2O	1004.1	55.508	0	0	0
KCl	2.28E-03	3.04E-05	0	0	0
NaNO3	0.38052	4.46E-03	0	0	0
NaHCO3	10.461	0.12402	0	0	0
CO2	0.055049	1.25E-03	0	0	0
HCl	3.26E-15	8.89E-17	0	0	0
HNO3	2.06E-10	3.26E-12	0	0	0
KHSO4	9.88E-11	7.22E-13	0	0	0
SO3	6.56E-31	8.16E-33	0	0	0
H2SO4	5.88E-27	5.98E-29	0	0	0
HCO3-1	48.504	0.79169	0	0	0
HSO4-1	1.78E-07	1.83E-09	0	0	0
CO3-2	10.017	0.16625	0	0	0
Cl-1	6.3104	0.17727	0	0	0
H+1	2.30E-09	2.27E-09	0	0	0
OH-1	1.20E-04	7.00E-06	0	0	0
NO3-1	6.1066	0.098118	0	0	0
K+1	3.2053	0.081948	0	0	0
KSO4-1	0.62736	4.62E-03	0	0	0
NaCO3-1	4.9245	0.059091	0	0	0
Na+1	38.983	1.6888	0	0	0
NaSO4-1	13.635	0.11407	0	0	0
SO4-2	9.3097	0.096518	0	0	0

Molecular Output (Apparent Species)

	Total g	Aqueous mol/kg H2O	Vapor mol	Solid mol	2nd Liquid n/a
H2O	991.04	54.788	0	0	0
NaOH	79.934	1.9904	0	0	0
CO2	50.477	1.1423	0	0	0
HCl	6.4909	0.1773	0	0	0
HNO3	6.49	0.10258	0	0	0
KOH	4.8617	0.0863	0	0	0
SO3	17.3	0.2152	0	0	0

Element Balance

	Total mol	Aqueous mol	Vapor mol	Solid mol	2nd Liquid n/a
C(+4)	0	1.1423	0	0	0
CL(-1)	0	0.1773	0	0	0
F(-1)	0	0	0	0	0
H(+1)	0	111.93	0	0	0
K(+1)	0	0.086301	0	0	0
N(+5)	0	0.10258	0	0	0
NA(+1)	0	1.9904	0	0	0
O(-2)	0	60.102	0	0	0
S(+6)	0	0.21521	0	0	0

Species Activity Coefficients

H2O	0.94824	Activity
HCO3-1	0.53251	Act-Coef
HSO4-1	0.68155	Act-Coef
CO2 - Aq	1.327	Act-Coef
CO3-2	0.07056	Act-Coef
Cl-1	0.66566	Act-Coef
Na2F+1	0.50059	Act-Coef
F-1	0.57903	Act-Coef
(HF)2 - Aq	1.327	Act-Coef
HCl - Aq	1.327	Act-Coef
HF2-1	0.66155	Act-Coef
HF - Aq	1.3706	Act-Coef
H+1	0.74412	Act-Coef
OH-1	0.81394	Act-Coef
NO3-1	0.59029	Act-Coef
HNO3 - Aq	1.4941	Act-Coef
KHSO4 - A	1.327	Act-Coef
KCl - Aq	1.327	Act-Coef
K+1	0.50452	Act-Coef
KSO4-1	0.50706	Act-Coef
NaHCO3 -	1.327	Act-Coef
NaCO3-1	0.6631	Act-Coef
NaF - Aq	1.327	Act-Coef
Na+1	0.55225	Act-Coef
NaNO3 - A	0.69575	Act-Coef
NaSO4-1	0.51248	Act-Coef
SO4-2	0.077989	Act-Coef
SO3 - Aq	1.327	Act-Coef
H2SO4 - A	1.327	Act-Coef
H2O - Vap	1	Fug-Coef
CO2 - Vap	1	Fug-Coef
(HF)2 - Vaj	1	Fug-Coef
HCl - Vap	1	Fug-Coef
HF - Vap	1	Fug-Coef
HNO3 - Va	1	Fug-Coef
SO3 - Vap	1	Fug-Coef
H2SO4 - V	1	Fug-Coef

Species K(eq)-Values

H2O	1.01E-14	mol^0
H2O - Vap	31.857	mol^0
HCO3-1	4.70E-11	mol^0
HSO4-1	0.010515	mol^0
CO2 - Aq	4.54E-07	mol^0
CO2 - Vap	0.03392	mol^0
Na2F+1	92.494	mol^0
K2SO4.KN	9.29E-06	mol^0
2Na2SO4 I	3.44E-03	mol^0
(HF)2 - Aq	51387	mol^0
(HF)2 - Vaj	19124	mol^0
HCl - Aq	1.69E+06	mol^0
HCl - Vap	0.92798	mol^0
HF2-1	4.1247	mol^0
HF - Aq	6.17E-04	mol^0
HF - Vap	19019	mol^0
HNO3 - Aq	20.065	mol^0
HNO3 - Va	1.40E+05	mol^0
KHCO3	1.8452	mol^0
KHSO4 - A	51.933	mol^0
KHSO4	3.3683	mol^0

Sodium bic	3.01E-11	data valid t	inside range
Potassium	2.14E-14	data valid t	inside range

Species Output (True Species)

	Total g	Aqueous mol/kg H2O	Vapor mol	Solid mol	2nd Liquid n/a
H2O	1004.1	55.508	0	0	0
KCl	0.012732	1.70E-04	0	0	0
NaNO3	1.1279	0.013217	0	0	0
NaHCO3	28.903	0.34266	0	0	0
CO2	0.049783	1.13E-03	0	0	0
HCl	2.65E-13	7.25E-15	0	0	0
HNO3	1.10E-09	1.73E-11	0	0	0
KHSO4	3.61E-09	2.64E-11	0	0	0
SO3	3.01E-29	3.74E-31	0	0	0
H2SO4	6.73E-26	6.83E-28	0	0	0
HCO3-1	35.146	0.57367	0	0	0
HSO4-1	2.34E-06	2.40E-08	0	0	0
CO3-2	12.248	0.20328	0	0	0
Cl-1	6.3054	0.17713	0	0	0
H+1	3.21E-09	3.17E-09	0	0	0
OH-1	6.33E-03	3.71E-04	0	0	0
NO3-1	5.5634	0.089361	0	0	0
K+1	2.9682	0.076119	0	0	0
KSO4-1	1.3588	0.010013	0	0	0
NaCO3-1	1.7986	0.021581	0	0	0
Na+1	36.185	1.5676	0	0	0
NaSO4-1	5.4263	0.045394	0	0	0
SO4-2	15.414	0.1598	0	0	0

Molecular Output (Apparent Species)

	Total g	Aqueous mol/kg H2O	Vapor mol	Solid mol	2nd Liquid n/a
H2O	991.04	54.788	0	0	0
NaOH	79.934	1.9904	0	0	0
CO2	50.477	1.1423	0	0	0
HCl	6.4909	0.1773	0	0	0
HNO3	6.49	0.10258	0	0	0
KOH	4.8617	0.086301	0	0	0
SO3	17.3	0.21521	0	0	0

Element Balance

	Total mol	Aqueous mol	Vapor mol	Solid mol	2nd Liquid n/a
C(+4)	0	1.1423	0	0	0
CL(-1)	0	0.1773	0	0	0
F(-1)	0	0	0	0	0
H(+1)	0	111.93	0	0	0
K(+1)	0	0.086301	0	0	0
N(+5)	0	0.10258	0	0	0
NA(+1)	0	1.9904	0	0	0
O(-2)	0	60.103	0	0	0
S(+6)	0	0.21521	0	0	0

Species Activity Coefficients

H2O	0.95045	Activity
HCO3-1	0.51124	Act-Coef
HSO4-1	0.58487	Act-Coef
CO2 - Aq	1.3012	Act-Coef
CO3-2	0.057985	Act-Coef
Cl-1	0.88377	Act-Coef
Na2F+1	0.45164	Act-Coef
F-1	0.53709	Act-Coef
(HF)2 - Aq	1.3163	Act-Coef
HCl - Aq	1.3163	Act-Coef
HF2-1	0.58487	Act-Coef
HF - Aq	1.3763	Act-Coef
H+1	0.846	Act-Coef
OH-1	0.57491	Act-Coef
NO3-1	0.57309	Act-Coef
HNO3 - Aq	1.5101	Act-Coef
KHSO4 - A	1.3163	Act-Coef
KCl - Aq	1.3163	Act-Coef
K+1	0.50704	Act-Coef
KSO4-1	0.45708	Act-Coef
NaHCO3 -	1.3163	Act-Coef
NaCO3-1	0.57791	Act-Coef
NaF - Aq	1.3163	Act-Coef
Na+1	0.51516	Act-Coef
NaNO3 - A	0.68518	Act-Coef
NaSO4-1	1.5874	Act-Coef
SO4-2	0.050259	Act-Coef
SO3 - Aq	1.3163	Act-Coef
H2SO4 - A	1.3163	Act-Coef
H2O - Vap	1	Fug-Coef
CO2 - Vap	1	Fug-Coef
(HF)2 - Vaj	1	Fug-Coef
HCl - Vap	1	Fug-Coef
HF - Vap	1	Fug-Coef
HNO3 - Va	1	Fug-Coef
SO3 - Vap	1	Fug-Coef
H2SO4 - V	1	Fug-Coef

Species K(eq)-Values

H2O	4.59E-13	mol^0
H2O - Vap	1.2097	mol^0
HCO3-1	8.22E-11	mol^0
HSO4-1	1.17E-03	mol^0
CO2 - Aq	4.31E-07	mol^0
CO2 - Vap	0.011137	mol^0
Na2F+1	34.675	mol^0
K2SO4.KN	5.51E-06	mol^0
2Na2SO4 I	1.71E-05	mol^0
(HF)2 - Aq	4686.1	mol^0
(HF)2 - Vaj	499.84	mol^0
HCl - Aq	33570	mol^0
HCl - Vap	0.12142	mol^0
HF2-1	2.1685	mol^0
HF - Aq	1.60E-04	mol^0
HF - Vap	379.93	mol^0
HNO3 - Aq	4.002	mol^0
HNO3 - Va	920.44	mol^0
KHCO3	7.7419	mol^0
KHSO4 - A	15.597	mol^0
KHSO4	14.067	mol^0
K2CO3	2670	mol^0
K2CO3 1.5	2058.7	mol^0
KCl - Aq	26.986	mol^0

Potassium	3.22E-06
Sodium hy	9.51E-07
Potassium	2.29E-09
Potassium	1.42E-10
Sodium bic	2.49E-11
Potassium	1.16E-11
Sodium hy	5.54E-12
Sodium sul	1.98E-13
Potassium	4.16E-19

Species Output (True S

	Total g
H2O	1000.4
KCl	1.17E-03
NaNO3	0.30226
NaHCO3	13.476
NaF	0.68489
CO2	0.86634
(HF)2	7.52E-16
HCl	1.96E-14
HF	1.71E-05
HNO3	2.72E-09
KHSO4	1.01E-09
SO3	7.84E-29
H2SO4	7.07E-25
HCO3-1	57.82
HSO4-1	1.70E-06
CO3-2	0.85878
Cl-1	3.0715
Na2F+1	0.020914
F-1	1.0857
HF2-1	5.30E-07
H+1	2.64E-08
OH-1	1.05E-05
NO3-1	6.1686
K+1	3.2463
KSO4-1	0.48772
NaCO3-1	0.42724
Na+1	31.061
NaSO4-1	9.3408
SO4-2	6.1138

Molecular Output (App

	Total g
H2O	992.63
NaHCO3	2.0263
NaOH	63.637
CO2	49.414
HCl	3.1594
HF	1.4761
HNO3	6.4929
KOH	4.8617
SO3	11.866

Element Balance

	Total mol
C(+4)	0
CL(-1)	0
F(-1)	0
H(+1)	0
K(+1)	0
N(+5)	0
NA(+1)	0
O(-2)	0
S(+6)	0

Species Activity Coeffic

H2O	0.95329
HCO3-1	0.55447
HSO4-1	0.66284
CO2 - Aq	1.2406
CO3-2	0.086719
Cl-1	0.65349
Na2F+1	0.52246
F-1	0.59441
(HF)2 - Aq	1.2405
HCl - Aq	1.2405
HF2-1	0.66284
HF - Aq	1.2817
H+1	0.78033
OH-1	0.7871
NO3-1	0.59935
HNO3 - Aq	1.3678
KHSO4 - A	1.2405
KCl - Aq	1.2405
K+1	0.49778
KSO4-1	0.52971
NaHCO3 -	1.2405
NaCO3-1	0.65376
NaF - Aq	1.2405
Na+1	0.56934
NaNO3 - A	0.74023
NaSO4-1	0.49632
SO4-2	0.096186
SO3 - Aq	1.2405
H2SO4 - A	1.2405
H2O - Vap	1
CO2 - Vap	1
(HF)2 - Vaj	1
HCl - Vap	1
HF - Vap	1
HNO3 - Va	1
SO3 - Vap	1
H2SO4 - V	1

Species K(eq)-Values

H2O	1.01E-14	
H2O - Vap	31.857	
HCO3-1	4.70E-11	
HSO4-1	0.010515	
CO2 - Aq	4.54E-07	
CO2 - Vap	0.03392	
Na2F+1	92.494	
K2SO4.KN	9.29E-06	
2Na2SO4 I	3.44E-03	

K. J. Chiang

12/19/04

	7614.8 mol^0
	23065 mol^0
	3.2319 mol^0
	0.02685 mol^0
	0.057733 mol^0
	0.087869 mol^0
	0.52509 mol^0
	0.85701 mol^0
	376.35 mol^0
	1.316 mol^0
	0.23607 mol^0
	1.3745 mol^0
	0.7632 mol^0
	0.91296 mol^0
	36.518 mol^0
	1.197 mol^0
	0.31449 mol^0
	3.16E-03 mol^0
	0.051036 mol^0
	1.94E+05 mol^0
	16297 mol^0
	4.5667 mol^0
	56.88 mol^0
	0.14445 mol^0
	2.13E-03 mol^0
	155.99 mol^0
	26.306 mol^0
	0.090006 mol^0
	1922.2 mol^0
	76679 mol^0
	3.19E+10 mol^0
	248.07 mol^0

obilities

	6.51E-04 m2/ohm-mol
	1.15E-03 m2/ohm-mol
	1.04E-03 m2/ohm-mol
	9.34E-04 m2/ohm-mol
	8.18E-04 m2/ohm-mol
	1.17E-03 m2/ohm-mol
	3.22E-03 m2/ohm-mol
	2.24E-03 m2/ohm-mol
	9.32E-04 m2/ohm-mol
	9.70E-04 m2/ohm-mol
	5.07E-04 m2/ohm-mol
	7.43E-04 m2/ohm-mol

al Diffusivities

	7.65E-09 m2/s
	3.82E-09 m2/s
	4.06E-09 m2/s
	6.64E-09 m2/s
	3.40E-09 m2/s
	6.01E-09 m2/s
	5.41E-09 m2/s
	4.80E-09 m2/s
	4.01E-09 m2/s
	6.37E-09 m2/s
	6.71E-09 m2/s
	4.62E-10 m2/s
	1.78E-08 m2/s
	1.26E-08 m2/s
	5.40E-09 m2/s
	5.72E-09 m2/s
	5.40E-09 m2/s
	4.94E-09 m2/s
	5.62E-09 m2/s
	3.24E-09 m2/s
	3.39E-09 m2/s
	3.00E-09 m2/s
	3.82E-09 m2/s
	4.37E-09 m2/s
	4.00E-09 m2/s
	3.04E-09 m2/s
	3.46E-09 m2/s
	3.91E-10 m2/s
	3.62E-09 m2/s

KHSO4	3.3663 mol^0
K2CO3	54473 mol^0
K2CO3 1 E	859.86 mol^0
KCl - Aq	120.41 mol^0
KCl	7.5444 mol^0
KF	7251.8 mol^0
KF.2H2O	395.96 mol^0
KF.4H2O	63.719 mol^0
KOH	4.83E+10 mol^0
KOH.2H2C	1572.6 mol^0
KOH.1H2C	17545 mol^0
KNO3	0.78972 mol^0
K2SO4	0.011589 mol^0
KSO4-1	0.13228 mol^0
K2SO4.1H	0.010377 mol^0
NaHCO3 -	2.389 mol^0
NaHCO3	0.40374 mol^0
NaHSO4	356.65 mol^0
Na2CO3	7.3005 mol^0
Na2CO3.1	0.11036 mol^0
Na2CO3.7	0.22354 mol^0
NaCO3-1	0.28348 mol^0
Na2CO3.1	1.0111 mol^0
NaCl	36.197 mol^0
NaF - Aq	1.2906 mol^0
NaF	0.2625 mol^0
NaF.Na2S	3.16E-03 mol^0
NaHF2	7.28E-03 mol^0
NaOH	8.05E+06 mol^0
NaOH.1H2	64322 mol^0
NaNO3 - A	17.412 mol^0
NaNO3	26.746 mol^0
Na2SO4	0.44942 mol^0
Na2SO4	1.90E-07 mol^0
Na2SO4.N	162.44 mol^0
Na2SO4.1	0.046844 mol^0
NaSO4-1	0.12009 mol^0
SO3 - Aq	7726 mol^0
SO3 - Vap	1.64E+09 mol^0
H2SO4 - A	2.57E+10 mol^0
H2SO4 - V	3.86E+06 mol^0

Species Mobilities

HCO3-1	2.43E-04 m2/ohm-mol
HSO4-1	2.80E-04 m2/ohm-mol
CO3-2	4.04E-04 m2/ohm-mol
Cl-1	4.18E-04 m2/ohm-mol
H+1	1.91E-03 m2/ohm-mol
OH-1	1.08E-03 m2/ohm-mol
NO3-1	3.90E-04 m2/ohm-mol
K+1	4.00E-04 m2/ohm-mol
KSO4-1	2.09E-04 m2/ohm-mol
NaCO3-1	1.81E-04 m2/ohm-mol
Na+1	2.74E-04 m2/ohm-mol
NaSO4-1	1.91E-04 m2/ohm-mol
SO4-2	4.39E-04 m2/ohm-mol

Species Self Diffusivities

H2O	2.22E-09 m2/s
HCO3-1	1.08E-09 m2/s
HSO4-1	1.23E-09 m2/s
CO2 - Aq	1.85E-09 m2/s
CO3-2	9.03E-10 m2/s
Cl-1	1.82E-09 m2/s
Na2F+1	1.44E-09 m2/s
F-1	1.34E-09 m2/s
(HF)2 - Aq	1.12E-09 m2/s
HCl - Aq	1.95E-09 m2/s
HF2-1	1.79E-09 m2/s
HF - Aq	1.23E-10 m2/s
H+1	7.83E-09 m2/s
OH-1	4.50E-09 m2/s
NO3-1	1.70E-09 m2/s
HNO3 - Aq	1.82E-09 m2/s
KHSO4 - A	1.43E-09 m2/s
KCl - Aq	1.53E-09 m2/s
K+1	1.75E-09 m2/s
KSO4-1	9.25E-10 m2/s
NaHCO3 -	9.49E-10 m2/s
NaCO3-1	8.07E-10 m2/s
NaF - Aq	1.06E-09 m2/s
Na+1	1.22E-09 m2/s
NaNO3 - A	1.16E-09 m2/s
NaSO4-1	8.51E-10 m2/s
SO4-2	9.74E-10 m2/s
SO3 - Aq	1.03E-10 m2/s
H2SO4 - A	1.02E-09 m2/s

K2CO3	54473 mol^0
K2CO3 1 E	859.86 mol^0
KCl - Aq	120.41 mol^0
KCl	7.5444 mol^0
KF	7251.8 mol^0
KF.2H2O	395.96 mol^0
KF.4H2O	63.719 mol^0
KOH	4.83E+10 mol^0
KOH.2H2C	1572.6 mol^0
KOH.1H2C	17545 mol^0
KNO3	0.78972 mol^0
K2SO4	0.011589 mol^0
KSO4-1	0.13228 mol^0
K2SO4.1H	0.010377 mol^0
NaHCO3 -	2.389 mol^0
NaHCO3	0.40374 mol^0
NaHSO4	356.65 mol^0
Na2CO3	7.3005 mol^0
Na2CO3.1	0.11036 mol^0
Na2CO3.7	0.22354 mol^0
NaCO3-1	0.28348 mol^0
Na2CO3.1	1.0111 mol^0
NaCl	36.197 mol^0
NaF - Aq	1.2906 mol^0
NaF	0.2625 mol^0
NaF.Na2S	3.16E-03 mol^0
NaHF2	7.28E-03 mol^0
NaOH	8.05E+06 mol^0
NaOH.1H2	64322 mol^0
NaNO3 - A	17.412 mol^0
NaNO3	26.746 mol^0
Na2SO4	0.44942 mol^0
Na2SO4	1.90E-07 mol^0
Na2SO4.N	162.44 mol^0
Na2SO4.1	0.046844 mol^0
NaSO4-1	0.12009 mol^0
SO3 - Aq	7726 mol^0
SO3 - Vap	1.64E+09 mol^0
H2SO4 - A	2.57E+10 mol^0
H2SO4 - V	3.86E+06 mol^0

Species Mobilities

HCO3-1	2.26E-04 m2/ohm-mol
HSO4-1	2.60E-04 m2/ohm-mol
CO3-2	3.75E-04 m2/ohm-mol
Cl-1	3.87E-04 m2/ohm-mol
H+1	1.77E-03 m2/ohm-mol
OH-1	9.99E-04 m2/ohm-mol
NO3-1	3.62E-04 m2/ohm-mol
K+1	3.71E-04 m2/ohm-mol
KSO4-1	1.94E-04 m2/ohm-mol
NaCO3-1	1.68E-04 m2/ohm-mol
Na+1	2.54E-04 m2/ohm-mol
NaSO4-1	1.77E-04 m2/ohm-mol
SO4-2	4.06E-04 m2/ohm-mol

Species Self Diffusivities

H2O	2.14E-09 m2/s
HCO3-1	1.04E-09 m2/s
HSO4-1	1.18E-09 m2/s
CO2 - Aq	1.78E-09 m2/s
CO3-2	8.65E-10 m2/s
Cl-1	1.74E-09 m2/s
Na2F+1	1.38E-09 m2/s
F-1	1.28E-09 m2/s
(HF)2 - Aq	1.07E-09 m2/s
HCl - Aq	1.87E-09 m2/s
HF2-1	1.71E-09 m2/s
HF - Aq	1.18E-10 m2/s
H+1	7.56E-09 m2/s
OH-1	4.33E-09 m2/s
NO3-1	1.63E-09 m2/s
HNO3 - Aq	1.74E-09 m2/s
KHSO4 - A	1.37E-09 m2/s
KCl - Aq	1.49E-09 m2/s
K+1	1.68E-09 m2/s
KSO4-1	8.85E-10 m2/s
NaHCO3 -	9.11E-10 m2/s
NaCO3-1	7.74E-10 m2/s
NaF - Aq	1.02E-09 m2/s
Na+1	1.18E-09 m2/s
NaNO3 - A	1.11E-09 m2/s
NaSO4-1	8.14E-10 m2/s
SO4-2	9.31E-10 m2/s
SO3 - Aq	9.91E-11 m2/s
H2SO4 - A	9.77E-10 m2/s

KCl	16.586 mol^0
KF	54667 mol^0
KF.2H2O	1732.1 mol^0
KF.4H2O	6.89E+09 mol^0
KOH	3.85E+08 mol^0
KOH.2H2C	7614.8 mol^0
KOH.1H2C	23065 mol^0
KNO3	3.2319 mol^0
K2SO4	0.02685 mol^0
KSO4-1	0.057733 mol^0
K2SO4.1H	0.087869 mol^0
NaHCO3 -	0.52509 mol^0
NaHCO3	0.85701 mol^0
NaHSO4	376.35 mol^0
Na2CO3	1.316 mol^0
Na2CO3.1	0.23607 mol^0
Na2CO3.7	1.3745 mol^0
NaCO3-1	0.7632 mol^0
Na2CO3.1	0.91296 mol^0
NaCl	36.518 mol^0
NaF - Aq	1.197 mol^0
NaF	0.31449 mol^0
NaF.Na2S	3.16E-03 mol^0
NaHF2	0.051036 mol^0
NaOH	1.94E+05 mol^0
NaOH.1H2	16297 mol^0
NaNO3 - A	4.5667 mol^0
NaNO3	56.88 mol^0
Na2SO4	0.14445 mol^0
Na2SO4	2.13E-03 mol^0
Na2SO4.N	155.99 mol^0
Na2SO4.1	26.306 mol^0
NaSO4-1	0.090006 mol^0
SO3 - Aq	1922.2 mol^0
SO3 - Vap	76679 mol^0
H2SO4 - A	3.19E+10 mol^0
H2SO4 - V	248.07 mol^0

Species Mobilities

HCO3-1	5.92E-04 m2/ohm-mol
HSO4-1	6.32E-04 m2/ohm-mol
CO3-2	1.05E-03 m2/ohm-mol
Cl-1	9.44E-04 m2/ohm-mol
H+1	2.93E-03 m2/ohm-mol
OH-1	2.04E-03 m2/ohm-mol
NO3-1	8.48E-04 m2/ohm-mol
K+1	8.82E-04 m2/ohm-mol
KSO4-1	5.01E-04 m2/ohm-mol
NaCO3-1	4.61E-04 m2/ohm-mol
Na+1	6.78E-04 m2/ohm-mol
NaSO4-1	4.68E-04 m2/ohm-mol
SO4-2	1.07E-03 m2/ohm-mol

Species Self Diffusivities

H2O	7.27E-09 m2/s
HCO3-1	3.62E-09 m2/s
HSO4-1	3.83E-09 m2/s
CO2 - Aq	6.32E-09 m2/s
CO3-2	3.22E-09 m2/s
Cl-1	5.69E-09 m2/s
Na2F+1	5.11E-09 m2/s
F-1	4.58E-09 m2/s
(HF)2 - Aq	3.79E-09 m2/s
HCl - Aq	6.04E-09 m2/s
HF2-1	6.38E-09 m2/s
HF - Aq	4.39E-10 m2/s
H+1	1.70E-08 m2/s
OH-1	1.19E-08 m2/s
NO3-1	5.10E-09 m2/s
HNO3 - Aq	5.42E-09 m2/s
KHSO4 - A	5.10E-09 m2/s
KCl - Aq	4.78E-09 m2/s
K+1	5.34E-09 m2/s
KSO4-1	3.05E-09 m2/s
NaHCO3 -	3.20E-09 m2/s
NaCO3-1	2.83E-09 m2/s
NaF - Aq	3.61E-09 m2/s
Na+1	4.17E-09 m2/s
NaNO3 - A	3.78E-09 m2/s
NaSO4-1	2.86E-09 m2/s
SO4-2	3.26E-09 m2/s
SO3 - Aq	3.69E-10 m2/s
H2SO4 - A	3.41E-09 m2/s

(HF)2 - Aq	51387
(HF)2 - Vap	19124
HCl - Aq	1.69E+06
HCl - Vap	0.92798
HF2-1	4.1247
HF - Aq	6.17E-04
HF - Vap	19019
HNO3 - Aq	20.065
HNO3 - Va	1.40E+05
KHCO3	1.8452
KHSO4 - A	51.933
KHSO4	3.3663
K2CO3	54473
K2CO3.1.5	859.86
KCl - Aq	120.41
KCl	7.5444
KF	7251.8
KF.2H2O	395.96
KF.4H2O	63.719
KOH	4.83E+10
KOH.2H2C	1572.6
KOH.1H2C	17545
KNO3	0.78972
K2SO4	0.011589
KSO4-1	0.13228
K2SO4.1H	0.010377
NaHCO3 -	2.389
NaHCO3	0.40374
NaHSO4	356.65
Na2CO3	7.3005
Na2CO3 1	0.11036
Na2CO3 7	0.22354
NaCO3-1	0.28348
Na2CO3.1	1.0111
NaCl	36.197
NaF - Aq	1.2906
NaF	0.2625
NaF.Na2S	3.16E-03
NaHF2	7.28E-03
NaOH	8.05E+06
NaOH.1H2	64322
NaNO3 - A	17.412
NaNO3	26.746
Na2SO4	0.44942
Na2SO4	1.90E-07
Na2SO4.N	162.44
Na2SO4 1	0.046844
NaSO4-1	0.12009
SO3 - Aq	7726
SO3 - Vap	1.64E+09
H2SO4 - A	2.57E+10
H2SO4 - V	3.86E+05

Species Mobilities

HCO3-1	2.46E-04
HSO4-1	2.83E-04
CO3-2	4.09E-04
Cl-1	4.22E-04
Na2F+1	3.32E-04
F-1	3.04E-04
HF2-1	4.15E-04
H+1	1.93E-03
OH-1	1.09E-03
NO3-1	3.95E-04
K+1	4.05E-04
KSO4-1	2.11E-04
NaCO3-1	1.83E-04
Na+1	2.77E-04
NaSO4-1	1.93E-04
SO4-2	4.44E-04

Species Self Diffusivitie

H2O	2.25E-09
HCO3-1	1.10E-09
HSO4-1	1.25E-09
CO2 - Aq	1.87E-09
CO3-2	9.17E-10
Cl-1	1.85E-09
Na2F+1	1.46E-09
F-1	1.35E-09
(HF)2 - Aq	1.13E-09
HCl - Aq	1.98E-09
HF2-1	1.81E-09
HF - Aq	1.24E-10
H+1	7.92E-09
OH-1	4.56E-09
NO3-1	1.72E-09
HNO3 - Aq	1.84E-09
KHSO4 - A	1.45E-09
KCl - Aq	1.55E-09
K+1	1.77E-09
KSO4-1	9.40E-10
NaHCO3 -	9.63E-10
NaCO3-1	8.20E-10
NaF - Aq	1.08E-09
Na+1	1.24E-09
NaNO3 - A	1.17E-09
NaSO4-1	8.64E-10
SO4-2	9.90E-10
SO3 - Aq	1.05E-10
H2SO4 - A	1.04E-09

K. T. Chuang

12/19/04

SCWo6

Calculation Summary

SinglePoint_NaOH Calculation for Work1

Automatic Chemistry Model
Databanks:
Public

Unit Set: Default

Isothermal Calculation
Temperatu 25 °C
Pressure 1 atm

Stream Inflows

Water	1000 g
Sodium chl	0 g
Potassium	6.46 g
Sodium nitr	8.758 g
Sodium sul	20.697 g
Sodium bic	96.349 g
Sodium flu	3.096 g
Sodium hyc	9 g

Speciation Summary

Total number of species: 113

User Inflows	Related Inflows	Aqueous Species	Vapor Species	Solid Species	Second Liquid Spe
H2O	CO2	H2O	H2O - Vap	K2SO4.KNaSO4	
NaCl	H2CO3	HCO3-1	CO2 - Vap	2Na2SO4.Na2CO3	
KCl	K2SO4.KN	HSO4-1	(HF)2 - Vap	KHCO3	
NaNO3	2Na2SO4.I	CO2 - Aq	HCl - Vap	KHSO4	
Na2SO4	(HF)2	CO3-2	HF - Vap	K2CO3	
NaHCO3	HCl	Cl-1	HNO3 - Va	K2CO3.1.5H2O	
NaF	HF	Na2F+1	SO3 - Vap	KCl	
NaOH	(HF)6	F-1	H2SO4 - V	KF	
	HNO3	(HF)2 - Aq		KF.2H2O	
	KHCO3	HCl - Aq		KF.4H2O	
	KHSO4	HF2-1		KOH	
	K2CO3	HF - Aq		KOH.2H2O	
	K2CO3.1.5	H+1		KOH.1H2O	
	KF	OH-1		KNO3	
	KF.2H2O	NO3-1		K2SO4	
	KF.4H2O	HNO3 - Aq		K2SO4.1H2O	
	KOH	KHSO4 - Aq		NaHCO3	
	KOH.2H2O	KCl - Aq		NaHSO4	
	KOH.1H2O	K+1		Na2CO3	
	KNO3	KSO4-1		Na2CO3.10H2O	
	K2SO4	NaHCO3 - Aq		Na2CO3.7H2O	
	K2SO4.1H	NaCO3-1		Na2CO3.1H2O	
	NaHSO4	NaF - Aq		NaCl	
	Na2CO3	Na+1		NaF	
	Na2CO3.1	NaNO3 - Aq		NaF.Na2SO4	
	Na2CO3.7	NaSO4-1		NaHF2	
	Na2CO3.1	SO4-2		NaOH	
	NaF.Na2Si	SO3 - Aq		NaOH.1H2O	
	NaHF2	H2SO4 - Aq		NaNO3	
	NaOH.1H2O			Na2SO4	
	Na2SO4			Na2SO4	
	Na2SO4.NaHSO4			Na2SO4.NaHSO4	
	Na2SO4.10H2O			Na2SO4.10H2O	
	SO3				
	H2SO4				

Stream Parameters

Stream Am	1144.4	g
Temperatu	25	°C
Pressure	1	atm
pH	8.7906	pH
Ionic Stren	1.8711	mol/kg H2O
Osmotic Pr	66.896	atm
WaterActiv	0.95272	Activity
Electrical C	0.083683	1/ohm
Electrical C	49.313	cm2/ohm-mol
Viscosity, e	1.4534	cP
Viscosity, r	1.6318	cP/cP H2O

Aqueous g/ml	Vapor g/ml	Solid g/ml	2nd Liquid g/ml		Total --	Aqueous g/ml	Vapor g/ml	Solid g/ml	2nd Liquid g/ml	
1.0619	0	2.1997	0	Density	--	1.0929	0	0	0	Density

Aqueous cal	Vapor cal	Solid cal	2nd Liquid cal		Total cal	Aqueous cal	Vapor cal	Solid cal	2nd Liquid cal	
-4.12E+06	0	-5471.5	0	Enthalpy	-4.15E+06	-4.15E+06	0	0	0	Enthalpy

Total and Phase Flows (Amounts)

Aqueous mol	Vapor mol	Solid mol	2nd Liquid mol		Total mol	Aqueous mol	Vapor mol	Solid mol	2nd Liquid mol	
58.493	0	0.024121	0	Mole	58.937	58.937	0	0	0	Mole

Aqueous g	Vapor g	Solid g	2nd Liquid g		Total g	Aqueous g	Vapor g	Solid g	2nd Liquid g	
1133.3	0	2.0263	0	Mass	1144.4	1144.4	0	0	0	Mass

Aqueous L	Vapor L	Solid L	2nd Liquid L		Total L	Aqueous L	Vapor L	Solid L	2nd Liquid L	
1.0475	0	9.21E-04	0	Volume	1.0471	1.0471	0	0	0	Volume

Scaling Tendencies

solids with Temperature Range

Sodium bic	0.91796	0	200.00 °C	inside range	
Sodium flu	0.10757	0	100.00 °C	inside range	
Sodium sul	0.051844	0	32.400 °C	inside range	
Sodium car	0.05173	0	32.000 °C	inside range	
Sodium flu	3.52E-02	20	40.000 °C	inside range	
Potassium	9.96E-03	0	70.000 °C	inside range	
Sodium sul	8.77E-03	19	241.00 °C	inside range	
Potassium	3.15E-03	0	110.00 °C	inside range	
Sodium nitr	1.75E-03	0	300.00 °C	inside range	
Sodium chl	1.27E-03	0	350.00 °C	inside range	
Potassium	8.36E-04	97	292.00 °C	inside range	
Potassium	3.18E-04	0	200.00 °C	inside range	

Calculation Summary

SinglePoint_NaOH_95oC Calculation for Work1

Automatic Chemistry Model
Databanks:
Public

Unit Set: Default

Isothermal Calculation
Temperatu 95 °C
Pressure 1 atm

Stream Inflows

Water	1000 g
Sodium chl	0 g
Potassium	6.46 g
Sodium nitr	8.758 g
Sodium sul	20.697 g
Sodium bic	96.349 g
Sodium flu	3.096 g
Sodium hyc	9 g

Speciation Summary

Total number of species: 113

User Inflows	Related Inflows	Aqueous Species	Vapor Species	Solid Species	Second Liquid Spe
H2O	CO2	H2O	H2O - Vap	K2SO4.KNaSO4	
NaCl	H2CO3	HCO3-1	CO2 - Vap	2Na2SO4.Na2CO3	
KCl	K2SO4.KN	HSO4-1	(HF)2 - Vap	KHCO3	
NaNO3	2Na2SO4.I	CO2 - Aq	HCl - Vap	KHSO4	
Na2SO4	(HF)2	CO3-2	HF - Vap	K2CO3	
NaHCO3	HCl	Cl-1	HNO3 - Va	K2CO3.1.5H2O	
NaF	HF	Na2F+1	SO3 - Vap	KCl	
NaOH	(HF)6	F-1	H2SO4 - V	KF	
	HNO3	(HF)2 - Aq		KF.2H2O	
	KHCO3	HCl - Aq		KF.4H2O	
	KHSO4	HF2-1		KOH	
	K2CO3	HF - Aq		KOH.2H2O	
	K2CO3.1.5	H+1		KOH.1H2O	
	KF	OH-1		KNO3	
	KF.2H2O	NO3-1		K2SO4	
	KF.4H2O	HNO3 - Aq		K2SO4.1H2O	
	KOH	KHSO4 - Aq		NaHCO3	
	KOH.2H2O	KCl - Aq		NaHSO4	
	KOH.1H2O	K+1		Na2CO3	
	KNO3	KSO4-1		Na2CO3.10H2O	
	K2SO4	NaHCO3 - Aq		Na2CO3.7H2O	
	K2SO4.1H	NaCO3-1		Na2CO3.1H2O	
	NaHSO4	NaF - Aq		NaCl	
	Na2CO3	Na+1		NaF	
	Na2CO3.1	NaNO3 - Aq		NaF.Na2SO4	
	Na2CO3.7	NaSO4-1		NaHF2	
	Na2CO3.1	SO4-2		NaOH	
	NaF.Na2Si	SO3 - Aq		NaOH.1H2O	
	NaHF2	H2SO4 - Aq		NaNO3	
	NaOH.1H2O			Na2SO4	
	Na2SO4			Na2SO4	
	Na2SO4.NaHSO4			Na2SO4.NaHSO4	
	Na2SO4.10H2O			Na2SO4.10H2O	
	SO3				
	H2SO4				

Stream Parameters

Stream Am	1144.4	g
Temperatu	95	°C
Pressure	1	atm
pH	8.712	pH
Ionic Stren	1.7614	mol/kg H2O
Osmotic Pr	74.889	atm
WaterActiv	0.95518	Activity
Electrical C	0.20414	1/ohm
Electrical C	124.7	cm2/ohm-mol
Viscosity, e	0.51744	cP
Viscosity, r	1.7416	cP/cP H2O

Aqueous g/ml	Vapor g/ml	Solid g/ml	2nd Liquid g/ml		Total --	Aqueous g/ml	Vapor g/ml	Solid g/ml	2nd Liquid g/ml	
				Density	--	1.0618	0	0	0	Density

Aqueous cal	Vapor cal	Solid cal	2nd Liquid cal		Total cal	Aqueous cal	Vapor cal	Solid cal	2nd Liquid cal	
				Enthalpy	-4.08E+06	-4.08E+06	0	0	0	Enthalpy

Total and Phase Flows (Amounts)

Aqueous mol	Vapor mol	Solid mol	2nd Liquid mol		Total mol	Aqueous mol	Vapor mol	Solid mol	2nd Liquid mol	
				Mole	58.784	58.784	0	0	0	Mole

Aqueous g	Vapor g	Solid g	2nd Liquid g		Total g	Aqueous g	Vapor g	Solid g	2nd Liquid g	
				Mass	1144.4	1144.4	0	0	0	Mass

Aqueous L	Vapor L	Solid L	2nd Liquid L		Total L	Aqueous L	Vapor L	Solid L	2nd Liquid L	
				Volume	1.066	1.066	0	0	0	Volume

Scaling Tendencies

solids with Temperature Range

Sodium bic	0.33639	0	200.00 °C	inside range	
Sodium flu	0.07296	0	100.00 °C	inside range	
Sodium sul	0.018467	19	241.00 °C	inside range	
Sodium car	7.19E-03	35.37	109.00 °C	inside range	
Hexasodiur	2.86E-03	30	150.00 °C	inside range	
Sodium chl	1.63E-03	0	350.00 °C	inside range	
Sodium nitr	6.72E-04	0	300.00 °C	inside range	
Potassium	6.66E-04	0	110.00 °C	inside range	
Potassium	3.15E-04	97	292.00 °C	inside range	
Potassium	1.98E-04	0	200.00 °C	inside range	
Glaserite	2.31E-05	35	150.00 °C	inside range	
Sodium hyc	7.87E-08	data valid t		inside range	

Calculation Summary

SinglePoint1 Calculation for Work1

Automatic Chemistry Model
Databanks:
Public

Unit Set: Default

Isothermal Calculation
Temperatu 25 °C
Pressure 1 atm

Stream Inflows

Water	1000 g
Sodium chl	222.27 g
Potassium	0 g
Sodium nitr	32.88 g
Sodium sul	0 g
Sodium bic	0 g
Sodium flu	0 g
Sodium hyc	0 g

Speciation Summary

Total number of species: 113

User Inflows	Related Inflows	Aqueous Species	Vapor Species	Solid Species	Second Liquid Spe
H2O	CO2	H2O	H2O - Vap	K2SO4.KNaSO4	
NaCl	H2CO3	HCO3-1	CO2 - Vap	2Na2SO4.Na2CO3	
KCl	K2SO4.KN	HSO4-1	(HF)2 - Vap	KHCO3	
NaNO3	2Na2SO4.I	CO2 - Aq	HCl - Vap	KHSO4	
Na2SO4	(HF)2	CO3-2	HF - Vap	K2CO3	
NaHCO3	HCl	Cl-1	HNO3 - Va	K2CO3.1.5H2O	
NaF	HF	Na2F+1	SO3 - Vap	KCl	
NaOH	(HF)6	F-1	H2SO4 - V	KF	
	HNO3	(HF)2 - Aq		KF.2H2O	
	KHCO3	HCl - Aq		KF.4H2O	
	KHSO4	HF2-1		KOH	
	K2CO3	HF - Aq		KOH.2H2O	
	K2CO3.1.5	H+1		KOH.1H2O	
	KF	OH-1		KNO3	
	KF.2H2O	NO3-1		K2SO4	
	KF.4H2O	HNO3 - Aq		K2SO4.1H2O	
	KOH	KHSO4 - Aq		NaHCO3	
	KOH.2H2O	KCl - Aq		NaHSO4	
	KOH.1H2O	K+1		Na2CO3	
	KNO3	KSO4-1		Na2CO3.10H2O	
	K2SO4	NaHCO3 - Aq		Na2CO3.7H2O	
	K2SO4.1H	NaCO3-1		Na2CO3.1H2O	
	NaHSO4	NaF - Aq		NaCl	
	Na2CO3	Na+1		NaF	
	Na2CO3.1	NaNO3 - Aq		NaF.Na2SO4	
	Na2CO3.7	NaSO4-1		NaHF2	
	Na2CO3.1	SO4-2		NaOH	
	NaF.Na2Si	SO3 - Aq		NaOH.1H2O	
	NaHF2	H2SO4 - Aq		NaNO3	
	NaOH.1H2O			Na2SO4	
	Na2SO4			Na2SO4	
	Na2SO4.NaHSO4			Na2SO4.NaHSO4	
	Na2SO4.10H2O			Na2SO4.10H2O	
	SO3				
	H2SO4				

Stream Parameters

Stream Am	1255	g
Temperatu	25	°C
Pressure	1	atm
pH	6.9781	pH
Ionic Stren	4.1098	mol/kg H2O
Osmotic Pr	236.74	atm
WaterActiv	0.84702	Activity
Electrical C	0.21771	1/ohm
Electrical C	58.917	cm2/ohm-mol
Viscosity, e	1.3684	cP
Viscosity, r	1.5362	cP/cP H2O

Aqueous g/ml	Vapor g/ml	Solid g/ml	2nd Liquid g/ml		Total --	Aqueous g/ml	Vapor g/ml	Solid g/ml	2nd Liquid g/ml	
				Density	--	1.1463	0	0	0	Density

Aqueous cal	Vapor cal	Solid cal	2nd Liquid cal		Total cal	Aqueous cal	Vapor cal	Solid cal	2nd Liquid cal	
				Enthalpy	-4.20E+06	-4.20E+06	0	0	0	Enthalpy

Total and Phase Flows (Amounts)

Aqueous mol	Vapor mol	Solid mol	2nd Liquid mol		Total mol	Aqueous mol	Vapor mol	Solid mol	2nd Liquid mol	
				Mole	63.806	63.806	0	0	0	Mole

Aqueous g	Vapor g	Solid g	2nd Liquid g		Total g	Aqueous g	Vapor g	Solid g	2nd Liquid g	
				Mass	1255	1255	0	0	0	Mass

Aqueous L	Vapor L	Solid L	2nd Liquid L		Total L	Aqueous L	Vapor L	Solid L	2nd Liquid L	
				Volume	1.0948	1.0948	0	0	0	Volume

Scaling Tendencies

solids with Temperature Range

Sodium chl	0.26333	0	350.00 °C	inside range	
Sodium nitr	0.023261	0	300.00 °C	inside range	
Sodium hyc	3.47E-12	12	60.000 °C	inside range	

Species Output (True Species)

	Total g	Aqueous mol/kg H2O	Vapor mol	Solid mol	2nd Liquid n/a	
H2O	1000	55.508	0	0	0	H2O
NaNO3	6.6398	0.07812	0	0	0	NaNO3
HCl	3.31E-12	9.08E-14	0	0	0	HCl

Calculation Summary

SinglePoint1 Calculation for Work1

Automatic Chemistry Model
Databanks:
Public

Unit Set: Default

Isothermal Calculation
Temperatu 25
Pressure 1

Stream Inflows

Water	1000 g
Sodium chl	222.27 g
Potassium	0 g
Sodium nitr	32.88 g
Sodium sul	0 g
Sodium bic	0 g
Sodium flu	0 g
Sodium hyc	0 g

Speciation Summary

Total number of species: 113

User Inflows	Related Inflows	Aqueous Species
H2O	CO2	H2O
NaCl	H2CO3	HCO3-1
KCl	K2SO4.KN	HSO4-1
NaNO3	2Na2SO4.I	CO2 - Aq
Na2SO4	(HF)2	CO3-2
NaHCO3	HCl	Cl-1
NaF	HF	Na2F+1
NaOH	(HF)6	F-1
	HNO3	(HF)2 - A
	KHCO3	HCl - Aq
	KHSO4	HF2-1
	K2CO3	HF - Aq
	K2CO3.1.5	H+1
	KF	OH-1
	KF.2H2O	NO3-1
	KF.4H2O	HNO3 - Aq
	KOH	KHSO4 - A
	KOH.2H2O	KCl - Aq
	KOH.1H2O	K+1
	KNO3	KSO4-1
	K2SO4	NaHCO3 -
	K2SO4.1H	NaCO3-1
	NaHSO4	NaF - Aq
	Na2CO3	Na+1
	Na2CO3.1	NaNO3 - A
	Na2CO3.7	NaSO4-1
	Na2CO3.1	SO4-2
	NaF.Na2Si	SO3 - Aq
	NaHF2	H2SO4 - A
	NaOH.1H2O	
	Na2SO4	
	Na2SO4.NaHSO4	
	Na2SO4.10H2O	
	SO3	
	H2SO4	

Stream Parameters

Stream Am	1255	g
Temperatu	25	°C
Pressure	1	atm
pH	6.9781	pH
Ionic Stren	4.1098	mol/kg H2C
Osmotic Pr	236.74	atm
WaterActiv	0.84702	Activity
Electrical C	0.21771	1/ohm
Electrical C	58.917	cm2/ohm-m
Viscosity, e	1.3684	cP
Viscosity, r	1.5362	cP/cP H2O

Aqueous g/ml	Total --	Aqueous g/ml		
	Density	--	1.1463	Density

Aqueous cal	Total cal	Aqueous cal		
	Enthalpy	-4.20E+06	-4.20E+06	Enthalpy

Total and Phase Flows (Amounts)

Aqueous mol	Total mol	Aqueous mol		
	Mole	63.806	63.806	Mole

Aqueous g	Total g	Aqueous g		
	Mass	1255	1255	Mass

Aqueous L	Total L	Aqueous L		
	Volume	1.0948	1.0948	Volume

Species Output (True Species)

	Total g	Aqueous mol/kg H2C	
H2O	1000	55.508	H2O
NaNO3	6.6398	0.07812	NaNO3
HCl	3.31E-12	9.08E-14	HCl

K. J. Chiang 12/19/04

17.7	40.200 °C	inside range	
data valid tl	inside range		
0	80.000 °C	inside range	
data valid tl	inside range		
data valid tl	inside range		
0	33.000 °C	inside range	
12	60.000 °C	inside range	
0	82.500 °C	inside range	
data valid tl	inside range		

Species)

Aqueous mol/kg H2(	Vapor mol	Solid mol	2nd Liquid n/a
55.508	0	0	0
1.57E-05	0	0	0
3.55E-03	0	0	0
0.13624	0	0.024121	0
0.016306	0	0	0
0.019451	0	0	0
1.68E-17	0	0	0
5.38E-16	0	0	0
8.54E-07	0	0	0
4.32E-11	0	0	0
7 42E-12	0	0	0
9.79E-31	0	0	0
7.21E-27	0	0	0
0.94726	0	0	0
1 75E-08	0	0	0
0.014306	0	0	0
0.086606	0	0	0
3.22E-04	0	0	0
0.057129	0	0	0
1 36E-08	0	0	0
2.62E-08	0	0	0
6.18E-07	0	0	0
0.099451	0	0	0
0.082999	0	0	0
3.61E-03	0	0	0
5.15E-03	0	0	0
1.3502	0	0	0
0.078431	0	0	0
0 063621	0	0	0

arent Species)

Aqueous mol/kg H2(	Vapor mol	Solid mol	2nd Liquid n/a
55.08	0	0	0
0	0	0.024121	0
1.5905	0	0	0
1.1224	0	0	0
0.086621	0	0	0
0.073756	0	0	0
0.10301	0	0	0
0.086621	0	0	0
0 14586	0	0	0

Aqueous mol	Vapor mol	Solid mol	2nd Liquid n/a
1.1224	0	0.024121	0
0.086622	0	0	0
0.073757	0	0	0
112.1	0	0.024121	0
0.086622	0	0	0
0.10301	0	0	0
1 5905	0	0.024121	0
59.748	0	0.072362	0
0.14586	0	0	0

cients

Activity
Act-Coef
Act-Coef
Act-Coef
Act-Coef
Act-Coef
Act-Coef
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Fug-Coef

mol^0
mol^0
mol^0
mol^0
mol^0
mol^0
mol^0
mol^0
mol^0
mol^0

Potassium	3.21E-06	17.7	40.200 °C	inside range
Sodium hy	8.09E-08	data valid tl	inside range	
Potassium	2.46E-08	0	80.000 °C	inside range
Potassium	1 47E-10	0	33.000 °C	inside range
Sodium hy	7.62E-11	12	60.000 °C	inside range
Potassium	1 04E-11	data valid tl	inside range	
Sodium bis	1.97E-12	data valid tl	inside range	
Sodium sul	1 71E-14	0	82.500 °C	inside range
Potassium	5.28E-18	data valid tl	inside range	

Species Output (True Species)

	Total g	Aqueous mol/kg H2(	Vapor mol	Solid mol	2nd Liquid n/a
H2O	1004.1	5.55E+01	0	0	0
KCl	1.14E-03	1 53E-05	0	0	0
NaNO3	3.42E-01	4.01E-03	0	0	0
NaHCO3	1.00E+01	1.19E-01	0	0	0
NaF	7.07E-01	1.68E-02	0	0	0
CO2	5.45E-02	1 23E-03	0	0	0
(HF)2	4.43E-18	1.10E-19	0	0	0
HCl	1.51E-15	4 13E-17	0	0	0
HF	1.28E-06	6.38E-08	0	0	0
HNO3	2.04E-10	3.23E-12	0	0	0
KHSO4	7.06E-11	5.16E-13	0	0	0
SO3	4.31E-31	5.36E-33	0	0	0
H2SO4	3.86E-27	3.94E-29	0	0	0
HCO3-1	48.813	0 79674	0	0	0
HSO4-1	1.21E-07	1.24E-09	0	0	0
CO3-2	10.06	0.16696	0	0	0
Cl-1	3.0715	0.086285	0	0	0
Na2F+1	0.026266	4 03E-04	0	0	0
F-1	1.074	0.056304	0	0	0
HF2-1	4.06E-08	1 04E-09	0	0	0
H+1	2.21E-09	2.18E-09	0	0	0
OH-1	1.28E-04	7.47E-06	0	0	0
NO3-1	6.1396	0.098616	0	0	0
K+1	3.2563	0.082948	0	0	0
KSO4-1	0.45296	3.34E-03	0	0	0
NaCO3-1	4.8647	0.058373	0	0	0
Na+1	35.928	1.5564	0	0	0
NaSO4-1	9.249	0.077372	0	0	0
SO4-2	6.2125	0.064409	0	0	0

Molecular Output (Apparent Species)

	Total g	Aqueous mol/kg H2(	Vapor mol	Solid mol	2nd Liquid n/a
H2O	992.63	54.875	0	0	0
NaOH	73.602	1 8327	0	0	0
CO2	50.476	1.1423	0	0	0
HCl	3.1594	0.0863	0	0	0
HF	1.4761	0.073483	0	0	0
HNO3	6.4929	0.10262	0	0	0
KOH	4.8617	0.0863	0	0	0
SO3	11.686	0 14512	0	0	0

Element Balance

	Total mol	Aqueous mol	Vapor mol	Solid mol	2nd Liquid n/a
C(+4)	0	1.1423	0	0	0
CL(-1)	0	0.086301	0	0	0
F(-1)	0	0.073483	0	0	0
H(+1)	0	111.93	0	0	0
K(+1)	0	0.086301	0	0	0
N(+5)	0	0 10262	0	0	0
NA(+1)	0	1.8327	0	0	0
O(-2)	0	59.822	0	0	0
S(+6)	0	0.14512	0	0	0

Species Activity Coefficients

H2O	0.95272	Activity
HCO3-1	0.53954	Act-Coef
HSO4-1	0.65813	Act-Coef
CO2 - Aq	1.3041	Act-Coef
CO3-2	0.074663	Act-Coef
Cl-1	0.65076	Act-Coef
Na2F+1	0.50657	Act-Coef
F-1	0.58168	Act-Coef
(HF)2 - Aq	1.3041	Act-Coef
HCl - Aq	1.3041	Act-Coef
HF2-1	0.65813	Act-Coef
HF - Aq	1.3471	Act-Coef
H+1	0 74136	Act-Coef
OH-1	0.79832	Act-Coef
NO3-1	0.59031	Act-Coef
HNO3 - Aq	1.4564	Act-Coef
KHSO4 - A	1.3041	Act-Coef
KCl - Aq	1.3041	Act-Coef
K+1	0.51528	Act-Coef
KSO4-1	0.51333	Act-Coef
NaHCO3 -	1.3041	Act-Coef
NaCO3-1	0.64948	Act-Coef
NaF - Aq	1.3041	Act-Coef
Na+1	0.55394	Act-Coef
NaNO3 - A	0.71912	Act-Coef
NaSO4-1	0.49206	Act-Coef
SO4-2	0.062333	Act-Coef
SO3 - Aq	1.3041	Act-Coef
H2SO4 - A	1.3041	Act-Coef
H2O - Vap	1	Fug-Coef
CO2 - Vap	1.00E+00	Fug-Coef
(HF)2 - Va	1	Fug-Coef
HCl - Vap	1 00E+00	Fug-Coef
HF - Vap	1	Fug-Coef
HNO3 - Va	1.00E+00	Fug-Coef
SO3 - Vap	1	Fug-Coef
H2SO4 - V	1	Fug-Coef

Species K(eq)-Values

H2O	1.01E-14	mol^0
H2O - Vap	31.857	mol^0
HCO3-1	4.70E-11	mol^0
HSO4-1	1.05E-02	mol^0
CO2 - Aq	4.54E-07	mol^0
CO2 - Vap	0.03392	mol^0
Na2F+1	9.25E+01	mol^0
K2SO4.KN	9.29E-05	mol^0
2Na2SO4.I	3.44E-03	mol^0
(HF)2 - Aq	51387	mol^0

Potassium	3.86E-10	33	143.00 °C	inside range
Potassium	2.41E-11	data valid tl	inside range	
Sodium bis	1.60E-11	data valid tl	inside range	
Potassium	2.42E-14	data valid tl	inside range	

Species Output (True Species)

	Total g	Aqueous mol/kg H2(	Vapor mol	Solid mol	2nd Liquid n/a
H2O	1004.1	55.508	0	0	0
KCl	7.01E-03	9.36E-05	0	0	0
NaNO3	0.99731	1.17E-02	0	0	0
NaHCO3	2 76E+01	3.27E-01	0	0	0
NaF	6.28E-01	1.49E-02	0	0	0
CO2	4.91E-02	1.11E-03	0	0	0
(HF)2	9.59E-16	2.39E-17	0	0	0
HCl	1 29E-13	3.53E-15	0	0	0
HF	5.66E-06	2.82E-07	0	0	0
HNO3	1 10E-09	1.73E-11	0	0	0
KHSO4	2.31E-09	1.69E-11	0	0	0
SO3	1 70E-29	2.11E-31	0	0	0
H2SO4	3.82E-26	3.88E-28	0	0	0
HCO3-1	3.61E+01	5.89E-01	0	0	0
HSO4-1	1.37E-06	1.40E-08	0	0	0
CO3-2	12.266	0.20358	0	0	0
Cl-1	3.0686	0.086206	0	0	0
Na2F+1	0.057482	8.81E-04	0	0	0
F-1	1 1008	0 057705	0	0	0
HF2-1	3.66E-07	9.35E-09	0	0	0
H+1	3.03E-09	3.00E-09	0	0	0
OH-1	6.69E-03	3.92E-04	0	0	0
NO3-1	5.6616	0 090939	0	0	0
K+1	3.1301	0.079732	0	0	0
KSO4-1	0.87684	6 48E-03	0	0	0
NaCO3-1	1.7705	0.021246	0	0	0
Na+1	32.487	1.4074	0	0	0
NaSO4-1	5.8281	0 048756	0	0	0
SO4-2	8.6701	0.089888	0	0	0

Molecular Output (Apparent Species)

	Total g	Aqueous mol/kg H2(	Vapor mol	Solid mol	2nd Liquid n/a
H2O	992.63	54.876	0	0	0
NaOH	73.602	1 8327	0	0	0
CO2	50 476	1 1423	0	0	0
HCl	3 1594	0.086301	0	0	0
HF	1.4761	0.073483	0	0	0
HNO3	6.4929	0 10262	0	0	0
KOH	4.8617	0.086301	0	0	0
SO3	11.686	0.14512	0	0	0

Element Balance

	Total mol	Aqueous mol	Vapor mol	Solid mol	2nd Liquid n/a
C(+4)	0	1.1423	0	0	0
CL(-1)	0	0.086301	0	0	0
F(-1)	0	0.073484	0	0	0
H(+1)	0	111 93	0	0	0
K(+1)	0	0.086301	0	0	0
N(+5)	0	0.10262	0	0	0
NA(+1)	0	1.8327	0	0	0
O(-2)	0	59.823	0	0	0
S(+6)	0	0.14512	0	0	0

Species Activity Coefficients

H2O	0.95516	Activity
HCO3-1	0.511	Act-Coef
HSO4-1	0.58499	Act-Coef
CO2 - Aq	1.2797	Act-Coef
CO3-2	0.062679	Act-Coef
Cl-1	0.91263	Act-Coef
Na2F+1	0.46062	Act-Coef
F-1	0.54194	Act-Coef
(HF)2 - Aq	1 2871	Act-Coef
HCl - Aq	1.2871	Act-Coef
HF2-1	0.58499	Act-Coef
HF - Aq	1.3468	Act-Coef
H+1	0.64751	Act-Coef
OH-1	0.57595	Act-Coef
NO3-1	0.57256	Act-Coef
HNO3 - Aq	1.4577	Act-Coef
KHSO4 - A	1.2871	Act-Coef
KCl - Aq	1.2871	Act-Coef
K+1	0.51822	Act-Coef
KSO4-1	0.46656	Act-Coef
NaHCO3 -	1 2871	Act-Coef
NaCO3-1	0.67754	Act-Coef
NaF - Aq	1 2871	Act-Coef
Na+1	0.52148	Act-Coef
NaNO3 - A	0 71603	Act-Coef
NaSO4-1	0.82831	Act-Coef
SO4-2	0.055099	Act-Coef
SO3 - Aq	1.2871	Act-Coef
H2SO4 - A	1.2871	Act-Coef
H2O - Vap	1	Fug-Coef
CO2 - Vap	1	Fug-Coef
(HF)2 - Va	1	Fug-Coef
HCl - Vap	1 00E+00	Fug-Coef
HF - Vap	1	Fug-Coef
HNO3 - Va	1 00E+00	Fug-Coef
SO3 - Vap	1.00E+00	Fug-Coef
H2SO4 - V	1.00E+00	Fug-Coef

Species K(eq)-Values

H2O	4.59E-13	mol^0
H2O - Vap	1.2097	mol^0
HCO3-1	8.22E-11	mol^0
HSO4-1	1.17E-03	mol^0
CO2 - Aq	4 31E-07	mol^0
CO2 - Vap	1 11E-02	mol^0
Na2F+1	34.675	mol^0
K2SO4 KN	5.51E-05	mol^0
2Na2SO4.I	1.71E-05	mol^0
(HF)2 - Aq	4686.1	mol^0
(HF)2 - Va	499.84	mol^0
HCl - Aq	33570	mol^0
HCl - Vap	0 12142	mol^0
HF2-1	2 1685	mol^0
HF - Aq	1.60E-04	mol^0

HNO3	2.37E-08	3.77E-10	0	0	0
Cl-1	134.84	3.8032	0	0	0
H+1	6.30E-06	6.25E-06	0	0	0
OH-1	1 07E-06	6 29E-08	0	0	0
NO3-1	18.997	0.30636	0	0	0
Na+1	94 48	4 1096	0	0	0

Molecular Output (Apparent Species)

	Total g	Aqueous mol/kg H2(	Vapor mol	Solid mol	2nd Liquid n/a
H2O	950 17	52 742	0	0	0
NaCl	60 631	1 0374	0	0	0
NaNO3	32.68	0.38449	0	0	0
NaOH	110.62	2.7658	0	0	0
HCl	100.84	2.7658	0	0	0

Element Balance

	Total mol	Aqueous mol	Vapor mol	Solid mol	2nd Liquid n/a
C(+4)	0	0	0	0	0
CL(-1)	0	3.8032	0	0	0
F(-1)	0	0	0	0	0
H(+1)	0	111 02	0	0	0
K(+1)	0	0	0	0	0
N(+5)	0	0.3845	0	0	0
NA(+1)	0	4.1877	0	0	0
O(-2)	0	56.662	0	0	0
S(+6)	0	0	0	0	0

Species Activity Coefficients

H2O	0.84702	Activity
HCO3-1	0.42265	Act-Coef
HSO4-1	0.82027	Act-Coef
CO2 - Aq	2 1396	Act-Coef
CO3-2	0.042638	Act-Coef
Cl-1	0.82027	Act-Coef
Na2F+1	0.45458	Act-Coef
F-1	0.60073	Act-Coef
(HF)2 - Aq	2 1409	Act-Coef
HCl - Aq	2.1409	Act-Coef
HF2-1	0.82027	Act-Coef
HF - Aq	2.3681	Act-Coef
H+1	1.6826	Act-Coef
OH-1	1 2992	Act-Coef
NO3-1	0.67688	Act-Coef
HNO3 - Aq	2.8844	Act-Coef
KHSO4 - A	2 1409	Act-Coef
KCl - Aq	2 1409	Act-Coef
K+1	0.51496	Act-Coef
KSO4-1	0 45458	Act-Coef
NaHCO3 -	2 1409	Act-Coef
NaCO3-1	0.82027	Act-Coef
NaF - Aq	2.1409	Act-Coef
Na+1	0 78457	Act-Coef
NaNO3 - A	0.49157	Act-Coef
NaSO4-1	3.4775	Act-Coef
SO4-2	0.040713	Act-Coef
SO3 - Aq	2 1409	Act-Coef
H2SO4 - A	2 1409	Act-Coef
H2O - Vap	1	Fug-Coef
CO2 - Vap	1	Fug-Coef
(HF)2 - Va	1	Fug-Coef
HCl - Vap	1	Fug-Coef
HF - Vap	1	Fug-Coef
HNO3 - Va	1	Fug-Coef
SO3 - Vap	1	Fug-Coef
H2SO4 - V	1	Fug-Coef

Species K(eq)-Values

H2O	1.01E-14	mol^0
H2O - Vap	31.857	mol^0
HCO3-1	4 70E-11	mol^0
HSO4-1	0.010515	mol^0
CO2 - Aq	4.54E-07	mol^0
CO2 - Vap	0.03392	mol^0
Na2F+1	92.494	mol^0
K2SO4.KN	9.29E-05	mol^0
2Na2SO4.I	3.44E-03	mol^0
(HF)2 - Aq	51387	mol^0
(HF)2 - Va	19124	mol^0
HCl - Aq	1.69E+06	mol^0
HCl - Vap	0.92796	mol^0
HF2-1	4.1247	mol^0
HF - Aq	6 17E-04	mol^0
HF - Vap	19019	mol^0
HNO3 - Aq	20.065	mol^0
HNO3 - Va	1 40E+05	mol^0
KHCO3	1 8452	mol^0
KHSO4 - A	51.933	mol^0
KHSO4	3.3683	mol^0
K2CO3	54473	mol^0
K2CO3.1.E	859.86	mol^0
KCl - Aq	120.41	mol^0
KCl	7.5444	mol^0
KF	7251.8	mol^0
KF 2H2O	395.96	mol^0
KF.4H2O	63.719	mol^0
KOH	4.83E+10	mol^0
KOH.2H2(	1572.6	mol^0
KOH 1H2(	17545	mol^0
KNO3	0.78972	mol^0
K2SO4	0.011589	mol^0
KSO4-1	0.13228	mol^0
K2SO4.1H	0.010377	mol^0
NaHCO3 -	2.389	mol^0
NaHCO3	0.40374	mol^0
NaHSO4	356.65	mol^0
Na2CO3	7.3005	mol^0
Na2CO3 1	0.11036	mol^0
Na2CO3.7	0.22354	mol^0
NaCO3-1	0.28348	mol^0
Na2CO3 1	1.0111	mol^0
NaCl	38.197	mol^0
NaF - Aq	1.2906	mol^0
NaF	0.2625	mol^0
NaF Na2S(	3 16E-03	mol^0
NaHF2	7.28E-03	mol^0
NaOH	8.05E+06	mol^0
NaOH 1H2	64322	mol^0
NaNO3 - A	17 412	mol^0

HNO3	2.37E-08	3 77E-10
Cl-1	134.84	3.8032
H+1	6.30E-06	6.25E-06
OH-1	1.07E-06	6.29E-08
NO3-1	18.997	0.30636
Na+1	94.48	4.1096

Molecular Output (Apparent Speci

	Total g	Aqueous mol/kg H2(
H2O	960.17	52.742
NaCl	60.631	1.0374
NaNO3	32.68	0.38449
NaOH	110.62	2.7658
HCl	100.84	2.7658

Element Balance

	Total mol	Aqueous mol
C(+4)	0	0
CL(-1)	0	3.8032
F(-1)	0	0
H(+1)	0	111 02
K(+1)	0	0
N(+5)	0	0.3845
NA(+1)	0	4 1877
O(-2)	0	56.662
S(+6)	0	0

Species Activity Coefficients

H2O	0.84702	Activity
HCO3-1	0.42265	Act-Coef
HSO4-1	0.82027	Act-Coef
CO2 - Aq	2 1396	Act-Coef
CO3-2	0.042638	Act-Coef
Cl-1	0.82027	Act-Coef
Na2F+1	0.45458	Act-Coef
F-1	0.60073	Act-Coef
(HF)2 - Aq	2 1409	Act-Coef
HCl - Aq	2.1409	Act-Coef
HF2-1	0.82027	Act-Coef
HF - Aq	2.3681	Act-Coef
H+1	1 6826	Act-Coef
OH-1	1.2992	Act-Coef
NO3-1	0.67688	Act-Coef
HNO3 - Aq	2.8844	Act-Coef
KHSO4 - A	2.1409	Act-Coef
KCl - Aq	2.1409	Act-Coef
K+1	0.51496	Act-Coef
KSO4-1	0 45458	Act-Coef
NaHCO3 -	2.1409	Act-Coef
NaCO3-1	0.82027	Act-Coef
NaF - Aq	2.1409	Act-Coef
Na+1	0.78457	Act-Coef
NaNO3 - A	0.49157	Act-Coef
NaSO4-1	3.4775	Act-Coef
SO4-2	0.040713	Act-Coef
SO3 - Aq	2.1409	Act-Coef
H2SO4 - A	2.1409	Act-Coef
H2O - Vap	1	Fug-Coef
CO2 - Vap	1	Fug-Coef
(HF)2 - Va	1	Fug-Coef
HCl - Vap	1	Fug-Coef
HF - Vap	1	Fug-Coef
HNO3 - Va	1	Fug-Coef
SO3 - Vap	1	Fug-Coef
H2SO4 - V	1	Fug-Coef

Species K(eq)-Values

H2O	1 01E-14	mol^0
H2O - Vap	31 857	mol^0
HCO3-1	4.70E-11	mol^0
HSO4-1	0.010515	mol^0
CO2 - Aq	4.54E-07	mol^0
CO2 - Vap	0.03392	mol^0
Na2F+1	92.494	mol^0
K2SO4.KN	9.29E-05	mol^0
2Na2SO4.I	3 44E-03	mol^0
(HF)2 - Aq	51387	mol^0
(HF)2 - Va	19124	mol^0
HCl - Aq	1.69E+06	mol^0
HCl - Vap	0.92796	mol^0
HF2-1	4.1247	mol^0
HF - Aq	6 17E-04	mol^0
HF - Vap	19019	mol^0
HNO3 - Aq	20.065	mol^0
HNO3 - Va	1.40E+05	mol^0
KHCO3	1.8452	mol^0
KHSO4 - A	51.933	mol^0
KHSO4	3.3683	mol^0
K2CO3	54473	mol^0
K2CO3.1 E	859.86	mol^0
KCl - Aq	120.41	mol^0
KCl	7 5444	mol^0
KF	7251.8	mol^0
KF.2H2O	395.96	mol^0
KF.4H2O	63 719	mol^0
KOH	4.83E+10	mol^0
KOH.2H2(	1572.6	mol^0
KOH.1H2(	17545	mol^0
KNO3	0 78972	mol^0
K2SO4	0.011589	mol^0
KSO4-1	0.13228	mol^0
K2SO4 1H	0.010377	mol^0
NaHCO3 -	2.389	mol^0
NaHCO3	0.40374	mol^0
NaHSO4	356.65	mol^0
Na2CO3	7.3005	mol^0
Na2CO3.1	0.11036	mol^0
Na2CO3.7	0.22354	mol^0
NaCO3-1	0.28348	mol^0
Na2CO3.1	1.0111	mol^0
NaCl	38 197	mol^0
NaF - Aq	1 2906	mol^0
NaF	0.2625	mol^0
NaF.Na2S(	3 16E-03	mol^0
NaHF2	7.28E-03	mol^0
NaOH	8.05E+06	mol^0
NaOH.1H2	64322	mol^0
NaNO3 - A	17.412	mol^0

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mol^0 (×52)

m2/ohm-mol (×16)

es

m2/s (×29)

(HF)2 - Va	19124	mol^0
HCl - Aq	1 69E+06	mol^0
HCl - Vap	0.92796	mol^0
HF2-1	4.1247	mol^0
HF - Aq	6.17E-04	mol^0
HF - Vap	19019	mol^0
HNO3 - Aq	20.065	mol^0
HNO3 - Va	1.40E+05	mol^0
KHCO3	1.8452	mol^0
KHSO4 - A	51.933	mol^0
KHSO4	3.3683	mol^0
K2CO3	54473	mol^0
K2CO3.1.5	859.86	mol^0
KCl - Aq	120.41	mol^0
KCl	7 5444	mol^0
KF	7251.8	mol^0
KF 2H2O	395.96	mol^0
KF.4H2O	63.719	mol^0
KOH	4.63E+10	mol^0
KOH.2H2C	1572.6	mol^0
KOH.1H2C	17545	mol^0
KNO3	0.78972	mol^0
K2SO4	0.011589	mol^0
KSO4-1	0.13228	mol^0
K2SO4.1H	0.010377	mol^0
NaHCO3 -	2.39E+00	mol^0
NaHCO3	4.04E-01	mol^0
NaHSO4	3.57E+02	mol^0
Na2CO3	7.3006	mol^0
Na2CO3 1	0.11036	mol^0
Na2CO3.7	0.22354	mol^0
NaCO3-1	0.26348	mol^0
Na2CO3.1	1.01E+00	mol^0
NaCl	36.197	mol^0
NaF - Aq	1.2906	mol^0
NaF	0.2625	mol^0
NaF.Na2S	3.16E-03	mol^0
NaHF2	7.26E-03	mol^0
NaOH	8.06E+06	mol^0
NaOH.1H2	6 43E+04	mol^0
NaNO3 - A	17 412	mol^0
NaNO3	28 746	mol^0
Na2SO4	0.44942	mol^0
Na2SO4	1.90E-07	mol^0
Na2SO4.N	1.62E+02	mol^0
Na2SO4 1	4 68E-02	mol^0
NaSO4-1	1.20E-01	mol^0
SO3 - Aq	7.73E+03	mol^0
SO3 - Vap	1.64E+09	mol^0
H2SO4 - A	2.57E+10	mol^0
H2SO4 - V	3.86E+05	mol^0

Species Mobilities

HCO3-1	2.29E-04	m2/ohm-mol
HSO4-1	2.64E-04	m2/ohm-mol
CO3-2	3.81E-04	m2/ohm-mol
Cl-1	3.93E-04	m2/ohm-mol
Na2F+1	3.09E-04	m2/ohm-mol
F-1	2.83E-04	m2/ohm-mol
HF2-1	3.86E-04	m2/ohm-mol
H+1	1.80E-03	m2/ohm-mol
OH-1	1.01E-03	m2/ohm-mol
NO3-1	3.68E-04	m2/ohm-mol
K+1	3.77E-04	m2/ohm-mol
KSO4-1	1.97E-04	m2/ohm-mol
NaCO3-1	1.70E-04	m2/ohm-mol
Na+1	2.58E-04	m2/ohm-mol
NaSO4-1	1.80E-04	m2/ohm-mol
SO4-2	4 14E-04	m2/ohm-mol

Species Self Diffusivities

H2O	2.16E-09	m2/s
HCO3-1	1 05E-09	m2/s
HSO4-1	1 19E-09	m2/s
CO2 - Aq	1.80E-09	m2/s
CO3-2	8.77E-10	m2/s
Cl-1	1.77E-09	m2/s
Na2F+1	1.40E-09	m2/s
F-1	1.30E-09	m2/s
(HF)2 - Aq	1 06E-09	m2/s
HCl - Aq	1.89E-09	m2/s
HF2-1	1.74E-09	m2/s
HF - Aq	1.19E-10	m2/s
H+1	7.66E-09	m2/s
OH-1	4.39E-09	m2/s
NO3-1	1.65E-09	m2/s
HNO3 - Aq	1.77E-09	m2/s
KHSO4 - A	1 39E-09	m2/s
KCl - Aq	1 51E-09	m2/s
K+1	1.70E-09	m2/s
KSO4-1	8.98E-10	m2/s
NaHCO3 -	9.23E-10	m2/s
NaCO3-1	7.84E-10	m2/s
NaF - Aq	1.03E-09	m2/s
Na+1	1.19E-09	m2/s
NaNO3 - A	1.12E-09	m2/s
NaSO4-1	8.26E-10	m2/s
SO4-2	9.45E-10	m2/s
SO3 - Aq	1.00E-10	m2/s
H2SO4 - A	9.90E-10	m2/s

HF - Vap	379.93	mol^0
HNO3 - Aq	4.002	mol^0
HNO3 - Va	920.44	mol^0
KHCO3	7.74E+00	mol^0
KHSO4 - A	1.56E+01	mol^0
KHSO4	14.067	mol^0
K2CO3	2670	mol^0
K2CO3.1.5	2055.7	mol^0
KCl - Aq	26.986	mol^0
KCl	16.596	mol^0
KF	54867	mol^0
KF.2H2O	1732.1	mol^0
KF.4H2O	6.69E+09	mol^0
KOH	3.85E+08	mol^0
KOH.2H2C	7614.8	mol^0
KOH.1H2C	23065	mol^0
KNO3	3.2319	mol^0
K2SO4	0.02685	mol^0
KSO4-1	0.067733	mol^0
K2SO4 1H	0.067869	mol^0
NaHCO3 -	0.52509	mol^0
NaHCO3	0.65701	mol^0
NaHSO4	3 76E+02	mol^0
Na2CO3	1.316	mol^0
Na2CO3 1	2.36E-01	mol^0
Na2CO3 7	1.3745	mol^0
NaCO3-1	0 7632	mol^0
Na2CO3 1	0.91296	mol^0
NaCl	35.518	mol^0
NaF - Aq	1 20E+00	mol^0
NaF	0.31449	mol^0
NaF.Na2S	3.16E-03	mol^0
NaHF2	0.051036	mol^0
NaOH	1 94E+05	mol^0
NaOH.1H2	16297	mol^0
NaNO3 - A	4.57E+00	mol^0
NaNO3	56.88	mol^0
Na2SO4	0.14445	mol^0
Na2SO4	2 13E-03	mol^0
Na2SO4.N	155.99	mol^0
Na2SO4.1	26.306	mol^0
NaSO4-1	9.00E-02	mol^0
SO3 - Aq	1.92E+03	mol^0
SO3 - Vap	7 67E+04	mol^0
H2SO4 - A	3.19E+10	mol^0
H2SO4 - V	2.48E+02	mol^0

Species Mobilities

HCO3-1	6.09E-04	m2/ohm-mol
HSO4-1	6.51E-04	m2/ohm-mol
CO3-2	1.08E-03	m2/ohm-mol
Cl-1	9.72E-04	m2/ohm-mol
Na2F+1	8.75E-04	m2/ohm-mol
F-1	7.66E-04	m2/ohm-mol
HF2-1	1 09E-03	m2/ohm-mol
H+1	3.02E-03	m2/ohm-mol
OH-1	2 10E-03	m2/ohm-mol
NO3-1	8.73E-04	m2/ohm-mol
K+1	9.08E-04	m2/ohm-mol
KSO4-1	5.16E-04	m2/ohm-mol
NaCO3-1	4.75E-04	m2/ohm-mol
Na+1	6.96E-04	m2/ohm-mol
NaSO4-1	4 82E-04	m2/ohm-mol
SO4-2	1 10E-03	m2/ohm-mol

Species Self Diffusivities

H2O	7 39E-09	m2/s
HCO3-1	3.69E-09	m2/s
HSO4-1	3.91E-09	m2/s
CO2 - Aq	6.42E-09	m2/s
CO3-2	3.28E-09	m2/s
Cl-1	5.80E-09	m2/s
Na2F+1	5.22E-09	m2/s
F-1	4.65E-09	m2/s
(HF)2 - Aq	3.86E-09	m2/s
HCl - Aq	6.15E-09	m2/s
HF2-1	6.49E-09	m2/s
HF - Aq	4.46E-10	m2/s
H+1	1 74E-08	m2/s
OH-1	1 22E-08	m2/s
NO3-1	5.21E-09	m2/s
HNO3 - Aq	5.52E-09	m2/s
KHSO4 - A	5.20E-09	m2/s
KCl - Aq	4.83E-09	m2/s
K+1	5.44E-09	m2/s
KSO4-1	3 12E-09	m2/s
NaHCO3 -	3.26E-09	m2/s
NaCO3-1	2.89E-09	m2/s
NaF - Aq	3.66E-09	m2/s
Na+1	4.24E-09	m2/s
NaNO3 - A	3.85E-09	m2/s
NaSO4-1	2.92E-09	m2/s
SO4-2	3.33E-09	m2/s
SO3 - Aq	3.76E-10	m2/s
H2SO4 - A	3.48E-09	m2/s

NaNO3	28 746	mol^0
Na2SO4	0.44942	mol^0
Na2SO4	1.90E-07	mol^0
Na2SO4.N	162.44	mol^0
Na2SO4.1	0.046844	mol^0
NaSO4-1	0.12009	mol^0
SO3 - Aq	7726	mol^0
SO3 - Vap	1.64E+09	mol^0
H2SO4 - A	2.57E+10	mol^0
H2SO4 - V	3.86E+05	mol^0

Species Mobilities

Cl-1	3.64E-04	m2/ohm-mol
H+1	1.67E-03	m2/ohm-mol
OH-1	9.39E-04	m2/ohm-mol
NO3-1	3.40E-04	m2/ohm-mol
Na+1	2.39E-04	m2/ohm-mol

Species Self Diffusivities

H2O	1.67E-09	m2/s
HCO3-1	8.06E-10	m2/s
HSO4-1	9.06E-10	m2/s
CO2 - Aq	1.40E-09	m2/s
CO3-2	6.71E-10	m2/s
Cl-1	1.34E-09	m2/s
Na2F+1	1.06E-09	m2/s
F-1	1.00E-09	m2/s
(HF)2 - Aq	8.28E-10	m2/s
HCl - Aq	1 45E-09	m2/s
HF2-1	1.32E-09	m2/s
HF - Aq	9.12E-11	m2/s
H+1	5.68E-09	m2/s
OH-1	3.30E-09	m2/s
NO3-1	1 26E-09	m2/s
HNO3 - Aq	1.35E-09	m2/s
KHSO4 - A	1.06E-09	m2/s
KCl - Aq	1.23E-09	m2/s
K+1	1.31E-09	m2/s
KSO4-1	6.82E-10	m2/s
NaHCO3 -	7.07E-10	m2/s
NaCO3-1	5.99E-10	m2/s
NaF - Aq	7.81E-10	m2/s
Na+1	9.30E-10	m2/s
NaNO3 - A	8.56E-10	m2/s
NaSO4-1	6.26E-10	m2/s
SO4-2	7.12E-10	m2/s
SO3 - Aq	7.66E-11	m2/s
H2SO4 - A	7.51E-10	m2/s

NaNO3	28.746	mol^0
Na2SO4	0.44942	mol^0
Na2SO4	1.90E-07	mol^0
Na2SO4.N	162.44	mol^0
Na2SO4 1	0.046844	mol^0
NaSO4-1	0.12009	mol^0
SO3 - Aq	7726	mol^0
SO3 - Vap	1.64E+09	mol^0
H2SO4 - A	2.57E+10	mol^0
H2SO4 - V	3.86E+05	mol^0

Species Mobilities

Cl-1	3.64E-04	m2/ohm-m
H+1	1.67E-03	m2/ohm-m
OH-1	9.39E-04	m2/ohm-m
NO3-1	3.40E-04	m2/ohm-m
Na+1	2.39E-04	m2/ohm-m

Species Self Diffusivities

H2O	1.67E-09	m2/s
HCO3-1	8.06E-10	m2/s
HSO4-1	9.06E-10	m2/s
CO2 - Aq	1.40E-09	m2/s
CO3-2	6.71E-10	m2/s
Cl-1	1.34E-09	m2/s
Na2F+1	1.06E-09	m2/s
F-1	1.00E-09	m2/s
(HF)2 - Aq	8.28E-10	m2/s
HCl - Aq	1.45E-09	m2/s
HF2-1	1.32E-09	m2/s
HF - Aq	9.12E-11	m2/s
H+1	5.68E-09	m2/s
OH-1	3.30E-09	m2/s
NO3-1	1.26E-09	m2/s
HNO3 - Aq	1.35E-09	m2/s
KHSO4 - A	1.06E-09	m2/s
KCl - Aq	1.23E-09	m2/s
K+1	1.31E-09	m2/s
KSO4-1	6.82E-10	m2/s
NaHCO3 -	7.07E-10	m2/s
NaCO3-1	5.99E-10	m2/s
NaF - Aq	7.81E-10	m2/s
Na+1	9.30E-10	m2/s
NaNO3 - A	8.56E-10	m2/s
NaSO4-1	6.26E-10	m2/s
SO4-2	7.12E-10	m2/s
SO3 - Aq	7.66E-11	m2/s
H2SO4 - A	7.51E-10	m2/s

K. J. Chiang
12/19/04

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Vapor       Solid       Second
Species     Species     Liquid Spe
H2O - Vap   K2SO4 KNaSO4
CO2 - Vap   2Na2SO4.Na2CO3
(HF)2 - Va  KHCO3
HCl - Vap   KHSO4
HF - Vap    K2CO3
HNO3 - Va   K2CO3.1 5H2O
SO3 - Vap   KCl
H2SO4 - V   KF
            KF.2H2O
            KF.4H2O
            KOH
            KOH.2H2O
            KOH.1H2O
            KNO3
            K2SO4
1           K2SO4.1H2O
\q          NaHCO3
            NaHSO4
            Na2CO3
            Na2CO3 10H2O
 Aq         Na2CO3.7H2O
            Na2CO3.1H2O
            NaCl
            NaF
\q          NaF.Na2SO4
            NaHF2
            NaOH
            NaOH.1H2O
\q          NaNO3
            Na2SO4
            Na2SO4
            Na2SO4.NaHSO4
            Na2SO4.10H2O

)



nol

)

Vapor       Solid       2nd Liquid
g/ml        g/ml        g/ml
        0           0           0

Vapor       Solid       2nd Liquid
cal         cal         cal
        0           0           0

Vapor       Solid       2nd Liquid
mol         mol         mol
        0           0           0

Vapor       Solid       2nd Liquid
g           g           g
        0           0           0

Vapor       Solid       2nd Liquid
L           L           L
        0           0           0

350.00 °C  inside range
300.00 °C  inside range
60.000 °C  inside range

Vapor       Solid       2nd Liquid
mol         mol         n/a
        0           0           0
        0           0           0
        0           0           0
```

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Calculation Summary

SinglePoint_NaOH_95oC Calculation for Work1

Automatic Chemistry Model
            Databanks:
                        Public

Unit Set: Default

Isothermal Calculation
            Temperatu         25 °C
            Pressure           1 atm

Stream Inflows

Water          1000 g
Sodium chl   222.27 g
Potassium         0 g
Sodium nit    32.68 g
Sodium sul        0 g
Sodium bic        0 g
Sodium flu        0 g
Sodium hy  1.60E-03 g

Speciation Summary

Total number of species:   113

User       Related    Aqueous      Vapor      Solid       Second
Inflows    Inflows    Species      Species    Species     Liquid Spe
H2O        CO2        H2O          H2O - Vap  K2SO4.KNaSO4
NaCl       H2CO3      HCO3-1       CO2 - Vap  2Na2SO4.Na2CO3
KCl        K2SO4 KN   HSO4-1       (HF)2 - Va KHCO3
NaNO3      2Na2SO4 I  CO2 - Aq     HCl - Vap  KHSO4
Na2SO4     (HF)2      CO3-2        HF - Vap   K2CO3
NaHCO3     HCl        Cl-1         HNO3 - Va  K2CO3.1.5H2O
NaF        HF         Na2F+1       SO3 - Vap  KCl
NaOH       (HF)6      F-1          H2SO4 - V  KF
           HNO3       (HF)2 - Aq              KF.2H2O
           KHCO3      HCl - Aq                KF.4H2O
           KHSO4      HF2-1                   KOH
           K2CO3      HF - Aq                 KOH.2H2O
           K2CO3.1.5  H+1                     KOH.1H2O
           KF         OH-1                    KNO3
           KF.2H2O    NO3-1                   K2SO4
           KF.4H2O    HNO3 - Aq               K2SO4 1H2O
           KOH        KHSO4 - Aq              NaHCO3
           KOH.2H2C   KCl - Aq                NaHSO4
           KOH.1H2C   K+1                     Na2CO3
           KNO3       KSO4-1                  Na2CO3.10H2O
           K2SO4      NaHCO3 - Aq             Na2CO3.7H2O
           K2SO4.1H   NaCO3-1                 Na2CO3 1H2O
           NaHSO4     NaF - Aq                NaCl
           Na2CO3     Na+1                    NaF
           Na2CO3.1   NaNO3 - Aq              NaF.Na2SO4
           Na2CO3.7   NaSO4-1                 NaHF2
           Na2CO3 1   SO4-2                   NaOH
           NaF.Na2S   SO3 - Aq                NaOH.1H2O
           NaHF2      H2SO4 - Aq              NaNO3
           NaOH.1H2O                          Na2SO4
           Na2SO4                             Na2SO4
           Na2SO4.NaHSO4                      Na2SO4.NaHSO4
           Na2SO4 10H2O                       Na2SO4.10H2O
           SO3
           H2SO4

Stream Parameters

Stream Am       1255 g
Temperatu         25 °C
Pressure           1 atm
pH            9 7817 pH
Ionic Stren   4 1096 mol/kg H2O
Osmotic Pi    236 74 atm
WaterActiv   0 84702 Activity
Electrical C 0.21771 1/ohm
Electrical C  56.916 cm2/ohm-mol
Viscosity, a  1.3684 cP
Viscosity, r  1 5363 cP/cP H2O

              Total      Aqueous    Vapor      Solid      2nd Liquid
              --         g/ml       g/ml       g/ml       g/ml
Density       --           1.1463           0          0           0

              Total      Aqueous    Vapor      Solid      2nd Liquid
              cal        cal        cal        cal        cal
Enthalpy      -4.20E+06  -4.20E+06          0          0           0

Total and Phase Flows (Amounts)

              Total      Aqueous    Vapor      Solid      2nd Liquid
              mol        mol        mol        mol        mol
Mole             63.806     63.806          0          0           0

              Total      Aqueous    Vapor      Solid      2nd Liquid
              g          g          g          g          g
Mass               1255       1255          0          0           0

              Total      Aqueous    Vapor      Solid      2nd Liquid
              L          L          L          L          L
Volume           1.0946     1 0946          0          0           0

Scaling Tendencies

solids withi Temperature Range
Sodium chl     0.26334            0 350.00 °C  inside range
Sodium nit    0.023261            0 300.00 °C  inside range
Sodium hy     2.21E-09           12 60 000 °C  inside range

Species Output (True Species)

              Total      Aqueous    Vapor      Solid      2nd Liquid
              g          mol/kg H2( mol        mol        n/a
H2O                1000     55.506          0          0           0
NaNO3            6.6399   0 078121          0          0           0
HCl            5.20E-15   1.43E-16          0          0           0
```

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SCW11
Calculation Summary

SinglePoint1 Calculation for Work1

Automatic Chemistry Model
            Databanks:
                        Public

Unit Set: Default

Isothermal Calculation
            Temperatu         25 °C
            Pressure           1 atm

Stream Inflows

Water           500 g
Sodium chl   222.39 g
Potassium         0 g
Sodium nit    32 68 g
Sodium sul        0 g
Sodium bic        0 g
Sodium flu        0 g
Sodium hy         0 g

Speciation Summary

Total number of species:   113

User       Related    Aqueous      Vapor      Solid       Second
Inflows    Inflows    Species      Species    Species     Liquid Spe
H2O        CO2        H2O          H2O - Vap  K2SO4 KNaSO4
NaCl       H2CO3      HCO3-1       CO2 - Vap  2Na2SO4 Na2CO3
KCl        K2SO4.KN   HSO4-1       (HF)2 - Va KHCO3
NaNO3      2Na2SO4.I  CO2 - Aq     HCl - Vap  KHSO4
Na2SO4     (HF)2      CO3-2        HF - Vap   K2CO3
NaHCO3     HCl        Cl-1         HNO3 - Va  K2CO3.1.5H2O
NaF        HF         Na2F+1       SO3 - Vap  KCl
NaOH       (HF)6      F-1          H2SO4 - V  KF
           HNO3       (HF)2 - Aq              KF.2H2O
           KHCO3      HCl - Aq                KF.4H2O
           KHSO4      HF2-1                   KOH
           K2CO3      HF - Aq                 KOH.2H2O
           K2CO3.1 E  H+1                     KOH.1H2O
           KF         OH-1                    KNO3
           KF.2H2O    NO3-1                   K2SO4
           KF 4H2O    HNO3 - Aq               K2SO4.1H2O
           KOH        KHSO4 - Aq              NaHCO3
           KOH.2H2C   KCl - Aq                NaHSO4
           KOH.1H2C   K+1                     Na2CO3
           KNO3       KSO4-1                  Na2CO3.10H2O
           K2SO4      NaHCO3 - Aq             Na2CO3.7H2O
           K2SO4.1H   NaCO3-1                 Na2CO3 1H2O
           NaHSO4     NaF - Aq                NaCl
           Na2CO3     Na+1                    NaF
           Na2CO3.1   NaNO3 - Aq              NaF.Na2SO4
           Na2CO3.7   NaSO4-1                 NaHF2
           Na2CO3.1   SO4-2                   NaOH
           NaF.Na2S   SO3 - Aq                NaOH 1H2O
           NaHF2      H2SO4 - Aq              NaNO3
           NaOH.1H2O                          Na2SO4
           Na2SO4                             Na2SO4
           Na2SO4.NaHSO4                      Na2SO4 NaHSO4
           Na2SO4.10H2O                       Na2SO4 10H2O
           SO3
           H2SO4

Stream Parameters

Stream Am     755.07 g
Temperatu         25 °C
Pressure           1 atm
pH            6.9403 pH
Ionic Stren   6.5592 mol/kg H2O
Osmotic Pi    424.67 atm
WaterActiv   0.74553 Activity
Electrical C 0 25558 1/ohm
Electrical C  35.568 cm2/ohm-mol
Viscosity, a  1.8631 cP
Viscosity, r  2.0916 cP/cP H2O

              Total      Aqueous    Vapor      Solid      2nd Liquid
              --         g/ml       g/ml       g/ml       g/ml
Density       --           1.2188           0     2.1638           0

              Total      Aqueous    Vapor      Solid      2nd Liquid
              cal        cal        cal        cal        cal
Enthalpy      -2.31E+06  -2 23E+06          0     -74671           0

Total and Phase Flows (Amounts)

              Total      Aqueous    Vapor      Solid      2nd Liquid
              mol        mol        mol        mol        mol
Mole             35 223     34.464          0    0.75967           0

              Total      Aqueous    Vapor      Solid      2nd Liquid
              g          g          g          g          g
Mass             755 07     710.67          0     44.398           0

              Total      Aqueous    Vapor      Solid      2nd Liquid
              L          L          L          L          L
Volume          0.60359    0.58308          0   0.020519           0

Scaling Tendencies

solids withi Temperature Range
Sodium chl           1            0 350.00 °C  inside range
Sodium nit    0 076482            0 300.00 °C  inside range
Sodium hy     4.57E-12           12 60.000 °C  inside range

Species Output (True Species)

              Total      Aqueous    Vapor      Solid      2nd Liquid
              g          mol/kg H2( mol        mol        n/a
H2O                 500     55.506          0          0           0
NaCl             44 398          0          0    0.75967           0
NaNO3            12 793    0 30103          0          0           0
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Calculation Summary

SinglePoint1 Calculation for Work1

Automatic Chemistry Model
            Databanks.
                        Public

Unit Set. Default

Isothermal Calculation
            Temperatu         25 °C
            Pressure           1 atm

Stream Inflows

Water           500 g
Sodium chl     2.72 g
Potassium         0 g
Sodium nit    4.342 g
Sodium sul        0 g
Sodium bic        0 g
Sodium flu        0 g
Sodium hy  0 00E+00 g

Speciation Summary

Total number of species.   113

User       Related    Aqueous      Vapor      Solid       Second
Inflows    Inflows    Species      Species    Species     Liquid Spe
H2O        CO2        H2O          H2O - Vap  K2SO4.KNaSO4
NaCl       H2CO3      HCO3-1       CO2 - Vap  2Na2SO4.Na2CO3
KCl        K2SO4.KN   HSO4-1       (HF)2 - Va KHCO3
NaNO3      2Na2SO4.I  CO2 - Aq     HCl - Vap  KHSO4
Na2SO4     (HF)2      CO3-2        HF - Vap   K2CO3
NaHCO3     HCl        Cl-1         HNO3 - Va  K2CO3.1.5H2O
NaF        HF         Na2F+1       SO3 - Vap  KCl
NaOH       (HF)6      F-1          H2SO4 - V  KF
           HNO3       (HF)2 - Aq              KF.2H2O
           KHCO3      HCl - Aq                KF.4H2O
           KHSO4      HF2-1                   KOH
           K2CO3      HF - Aq                 KOH.2H2O
           K2CO3 1.5  H+1                     KOH.1H2O
           KF         OH-1                    KNO3
           KF 2H2O    NO3-1                   K2SO4
           KF.4H2O    HNO3 - Aq               K2SO4.1H2O
           KOH        KHSO4 - Aq              NaHCO3
           KOH.2H2C   KCl - Aq                NaHSO4
           KOH 1H2C   K+1                     Na2CO3
           KNO3       KSO4-1                  Na2CO3.10H2O
           K2SO4      NaHCO3 - Aq             Na2CO3.7H2O
           K2SO4.1H   NaCO3-1                 Na2CO3.1H2O
           NaHSO4     NaF - Aq                NaCl
           Na2CO3     Na+1                    NaF
           Na2CO3.1   NaNO3 - Aq              NaF.Na2SO4
           Na2CO3.7   NaSO4-1                 NaHF2
           Na2CO3.1   SO4-2                   NaOH
           NaF.Na2S   SO3 - Aq                NaOH.1H2O
           NaHF2      H2SO4 - Aq              NaNO3
           NaOH 1H2O                          Na2SO4
           Na2SO4                             Na2SO4
           Na2SO4.NaHSO4                      Na2SO4 NaHSO4
           Na2SO4.10H2O                       Na2SO4.10H2O
           SO3
           H2SO4

Stream Parameters

Stream Am     507 06 g
Temperatu         25 °C
Pressure           1 atm
pH            6.9767 pH
Ionic Stren  0.19462 mol/kg H2O
Osmotic Pi    8.7965 atm
WaterActiv   0.99354 Activity
Electrical C 0 019003 1/ohm
Electrical C  96.071 cm2/ohm-mol
Viscosity, a 0.90313 cP
Viscosity, r  1.0139 cP/cP H2O

              Total      Aqueous    Vapor      Solid      2nd Liquid
              --         g/ml       g/ml       g/ml       g/ml
Density       --           1 0064           0          0           0

              Total      Aqueous    Vapor      Solid      2nd Liquid
              cal        cal        cal        cal        cal
Enthalpy      -1.91E+06  -1 91E+06          0          0           0

Total and Phase Flows (Amounts)

              Total      Aqueous    Vapor      Solid      2nd Liquid
              mol        mol        mol        mol        mol
Mole             27.949     27.949          0          0           0

              Total      Aqueous    Vapor      Solid      2nd Liquid
              g          g          g          g          g
Mass             507 06     507.06          0          0           0

              Total      Aqueous    Vapor      Solid      2nd Liquid
              L          L          L          L          L
Volume          0.50383    0.50383          0          0           0

Scaling Tendencies

solids withi Temperature Range
Sodium nit    3.66E-04            0 300.00 °C  inside range
Sodium chl    2.56E-04            0 350.00 °C  inside range
Sodium hy     2.10E-13           12 60 000 °C  inside range

Species Output (True Species)

              Total      Aqueous    Vapor      Solid      2nd Liquid
              g          mol/kg H2( mol        mol        n/a
H2O                 500     55.506          0          0           0
NaNO3          0.026943   6.34E-04          0          0           0
HCl            7.62E-14   4.18E-15          0          0           0
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SCW12
Calculation Summary

SinglePoint_NaOH Calculation for Work1

Automatic Chemistry Model
            Databanks:
                        Public

Unit Set: Default

Isothermal Calculation
            Temperatu         25 °C
            Pressure           1 atm

Stream Inflows

Water           500 g
Sodium chl     2.72 g
Potassium         0 g
Sodium nit    4 342 g
Sodium sul        0 g
Sodium bic        0 g
Sodium flu        0 g
Sodium hy  7 00E-04 g

Speciation Summary

Total number of species:   113

User       Related    Aqueous      Vapor
Inflows    Inflows    Species      Species
H2O        CO2        H2O          H2O - Vap
NaCl       H2CO3      HCO3-1       CO2 - Vap
KCl        K2SO4.KN   HSO4-1       (HF)2 - Va
NaNO3      2Na2SO4.I  CO2 - Aq     HCl - Vap
Na2SO4     (HF)2      CO3-2        HF - Vap
NaHCO3     HCl        Cl-1         HNO3 - Va
NaF        HF         Na2F+1       SO3 - Vap
NaOH       (HF)6      F-1          H2SO4 - V
           HNO3       (HF)2 - Aq
           KHCO3      HCl - Aq
           KHSO4      HF2-1
           K2CO3      HF - Aq
           K2CO3.1.5  H+1
           KF         OH-1
           KF.2H2O    NO3-1
           KF.4H2O    HNO3 - Aq
           KOH        KHSO4 - Aq
           KOH.2H2C   KCl - Aq
           KOH.1H2C   K+1
           KNO3       KSO4-1
           K2SO4      NaHCO3 - Aq
           K2SO4.1H   NaCO3-1
           NaHSO4     NaF - Aq
           Na2CO3     Na+1
           Na2CO3.1   NaNO3 - Aq
           Na2CO3 7   NaSO4-1
           Na2CO3.1   SO4-2
           NaF.Na2S   SO3 - Aq
           NaHF2      H2SO4 - Aq
           NaOH 1H2O
           Na2SO4
           Na2SO4.NaHSO4
           Na2SO4 10H2O
           SO3
           H2SO4

Stream Parameters

Stream Am     507.06 g
Temperatu         25 °C
Pressure           1 atm
pH            9.4221 pH
Ionic Stren  0.19466 mol/kg H2O
Osmotic Pi    8.7961 atm
WaterActiv   0.99354 Activity
Electrical C 0.019003 1/ohm
Electrical C  96.053 cm2/ohm-mol
Viscosity, a 0.90314 cP
Viscosity, r  1.0139 cP/cP H2O

              Total      Aqueous    Vapor
              --         g/ml       g/ml
Density       --           1.0064           0

              Total      Aqueous    Vapor
              cal        cal        cal
Enthalpy      -1 91E+06  -1 91E+06          0

Total and Phase Flows (Amounts)

              Total      Aqueous    Vapor
              mol        mol        mol
Mole             27.949     27.949          0

              Total      Aqueous    Vapor
              g          g          g
Mass             507.06     507.06          0

              Total      Aqueous    Vapor
              L          L          L
Volume          0 50383    0.50383          0

Scaling Tendencies

solids withi Temperature Range
Sodium nit    3.66E-04            0 300.00 °C
Sodium chl    2.56E-04            0 350.00 °C
Sodium hy     5.86E-11           12 60.000 °C

Species Output (True Species)

              Total      Aqueous    Vapor
              g          mol/kg H2( mol
H2O                 500     55.506          0
NaNO3          0.026947   6.34E-04          0
HCl            2.73E-16   1.50E-17          0
```

K. T. Chieng
12/19/04

0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0

es)

Vapor mol	Solid mol	2nd Liquid n/a
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0

Vapor mol	Solid mol	2nd Liquid n/a
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0

HNO3	3 73E-11	5.92E-13	0	0	0
Cl-1	134 84	3.8032	0	0	0
H+1	9 90E-11	9 82E-11	0	0	0
OH-1	6.80E-04	4.00E-05	0	0	0
NO3-1	18.997	0.30638	0	0	0
Na+1	94.48	4 1096	0	0	0

Molecular Output (Apparent Species)

	Total g	Aqueous mol/kg H2(	Vapor mol	Solid mol	2nd Liquid n/a
H2O	950.17	52.742	0	0	0
NaCl	60.63	1.0374	0	0	0
NaNO3	32.68	0.38449	0	0	0
NaOH	110.63	2 7658	0	0	0
HCl	100.84	2 7658	0	0	0

Element Balance

	Total mol	Aqueous mol	Vapor mol	Solid mol	2nd Liquid n/a
C(+4)	0	0	0	0	0
CL(-1)	0	3.8032	0	0	0
F(-1)	0	0	0	0	0
H(+1)	0	111.02	0	0	0
K(+1)	0	0	0	0	0
N(+5)	0	0.3845	0	0	0
NA(+1)	0	4 1878	0	0	0
O(-2)	0	56.662	0	0	0
S(+6)	0	0	0	0	0

Species Activity Coefficients

H2O	0.84702	Activity
HCO3-1	0.42285	Act-Coef
HSO4-1	0.82027	Act-Coef
CO2 - Aq	2 1396	Act-Coef
CO3-2	0.042638	Act-Coef
Cl-1	0.82027	Act-Coef
Na2F+1	0 45458	Act-Coef
F-1	0.60073	Act-Coef
(HF)2 - Aq	2 1409	Act-Coef
HCl - Aq	2.1409	Act-Coef
HF2-1	0.82027	Act-Coef
HF - Aq	2.3681	Act-Coef
H+1	1.6826	Act-Coef
OH-1	1.2992	Act-Coef
NO3-1	0.67688	Act-Coef
HNO3 - Aq	2.8844	Act-Coef
KHSO4 - A	2 1409	Act-Coef
KCl - Aq	2 1409	Act-Coef
K+1	0 51497	Act-Coef
KSO4-1	0.45458	Act-Coef
NaHCO3 -	2.1409	Act-Coef
NaCO3-1	0.82027	Act-Coef
NaF - Aq	2.1409	Act-Coef
Na+1	0.78457	Act-Coef
NaNO3 - A	0 49157	Act-Coef
NaSO4-1	3.4775	Act-Coef
SO4-2	0 040713	Act-Coef
SO3 - Aq	2.1409	Act-Coef
H2SO4 - A	2.1409	Act-Coef
H2O - Vap	1	Fug-Coef
CO2 - Vap	1	Fug-Coef
(HF)2 - Va	1	Fug-Coef
HCl - Vap	1	Fug-Coef
HF - Vap	1	Fug-Coef
HNO3 - Va	1	Fug-Coef
SO3 - Vap	1	Fug-Coef
H2SO4 - V	1	Fug-Coef

Species K(eq)-Values

H2O	1.01E-14	mol^0
H2O - Vap	31.857	mol^0
HCO3-1	4.70E-11	mol^0
HSO4-1	0.010515	mol^0
CO2 - Aq	4.54E-07	mol^0
CO2 - Vap	0.03392	mol^0
Na2F+1	92.494	mol^0
K2SO4.KN	9.29E-05	mol^0
2Na2SO4 I	3.44E-03	mol^0
(HF)2 - Aq	51387	mol^0
(HF)2 - Va	19124	mol^0
HCl - Aq	1.69E+06	mol^0
HCl - Vap	0.92796	mol^0
HF2-1	4 1247	mol^0
HF - Aq	6 17E-04	mol^0
HF - Vap	19019	mol^0
HNO3 - Aq	20.065	mol^0
HNO3 - Va	1 40E+05	mol^0
KHCO3	1.8452	mol^0
KHSO4 - A	51.933	mol^0
KHSO4	3.3683	mol^0
K2CO3	54473	mol^0
K2CO3 1.5	859.86	mol^0
KCl - Aq	120 41	mol^0
KCl	7.5444	mol^0
KF	7251.8	mol^0
KF.2H2O	395.96	mol^0
KF.4H2O	63.719	mol^0
KOH	4.83E+10	mol^0
KOH.2H2C	1572.6	mol^0
KOH.1H2C	17545	mol^0
KNO3	0 78972	mol^0
K2SO4	0.011589	mol^0
KSO4-1	0 13228	mol^0
K2SO4.1H	0.010377	mol^0
NaHCO3 -	2.389	mol^0
NaHCO3	0.40374	mol^0
NaHSO4	356.65	mol^0
Na2CO3	7.3005	mol^0
Na2CO3.1	0.11036	mol^0
Na2CO3 7	0.22354	mol^0
NaCO3-1	0.28348	mol^0
Na2CO3.1	1.0111	mol^0
NaCl	38.197	mol^0
NaF - Aq	1.2906	mol^0
NaF	0.2625	mol^0
NaF.Na2S	3.16E-03	mol^0
NaHF2	7.28E-03	mol^0
NaOH	8.05E+06	mol^0
NaOH.1H2	64322	mol^0
NaNO3 - A	17.412	mol^0

HCl	2.34E-12	1.28E-13	0	0	0
HNO3	1.22E-08	3.87E-10	0	0	0
Cl-1	107.96	6.0912 ✓	0	0	0
H+1	1 57E-08	3.12E-08	0	0	0
OH-1	2 69E-07	3.16E-08	0	0	0
NO3-1	14.508	0.46797 ✓	0	0	0
Na+1	75.397	6.5592 ✓	0	0	0

Molecular Output (Apparent Species)

	Total g	Aqueous mol/kg H2(	Vapor mol	Solid mol	2nd Liquid n/a
H2O	459.71	51.035	0	0	0
NaCl	91 68	1.6161	0	0.75967	0
NaNO3	32.68	0.76899	0	0	0
NaOH	89 456	4 4731	0	0	0
HCl	61 546	4.4731	0	0	0

Element Balance

	Total mol	Aqueous mol	Vapor mol	Solid mol	2nd Liquid n/a
C(+4)	0	0	0	0	0
CL(-1)	0	6.0912	0	0 75967	0
F(-1)	0	0	0	0	0
H(+1)	0	111.02	0	0	0
K(+1)	0	0	0	0	0
N(+5)	0	0.76899	0	0	0
NA(+1)	0	6.8602	0	0 75967	0
O(-2)	0	57 815	0	0	0
S(+6)	0	0	0	0	0

Species Activity Coefficients

H2O	0 74553	Activity
HCO3-1	0.37113	Act-Coef
HSO4-1	1.047	Act-Coef
CO2 - Aq	3.3756	Act-Coef
CO3-2	0.030963	Act-Coef
Cl-1	1.047	Act-Coef
Na2F+1	0.42884	Act-Coef
F-1	0.64887	Act-Coef
(HF)2 - Aq	3.3788	Act-Coef
HCl - Aq	3.3788	Act-Coef
HF2-1	1.047	Act-Coef
HF - Aq	3.9414	Act-Coef
H+1	3.6762	Act-Coef
OH-1	2 0856	Act-Coef
NO3-1	0 78443	Act-Coef
HNO3 - Ac	5.4212	Act-Coef
KHSO4 - A	3.3788	Act-Coef
KCl - Aq	3.3788	Act-Coef
K+1	0.60061	Act-Coef
KSO4-1	0.42884	Act-Coef
NaHCO3 -	3.3788	Act-Coef
NaCO3-1	1.047	Act-Coef
NaF - Aq	3 3788	Act-Coef
Na+1	0.9131	Act-Coef
NaNO3 - A	0.41945	Act-Coef
NaSO4-1	18.466	Act-Coef
SO4-2	0.020369	Act-Coef
SO3 - Aq	3.3788	Act-Coef
H2SO4 - A	3.3788	Act-Coef
H2O - Vap	1	Fug-Coef
CO2 - Vap	1	Fug-Coef
(HF)2 - Va	1	Fug-Coef
HCl - Vap	1	Fug-Coef
HF - Vap	1	Fug-Coef
HNO3 - Va	1	Fug-Coef
SO3 - Vap	1	Fug-Coef
H2SO4 - V	1	Fug-Coef

Species K(eq)-Values

H2O	1.01E-14	mol^0
H2O - Vap	31.857	mol^0
HCO3-1	4.70E-11	mol^0
HSO4-1	0.010515	mol^0
CO2 - Aq	4.54E-07	mol^0
CO2 - Vap	0.03392	mol^0
Na2F+1	92.494	mol^0
K2SO4.KN	9.29E-05	mol^0
2Na2SO4.I	3.44E-03	mol^0
(HF)2 - Aq	51387	mol^0
(HF)2 - Va	19124	mol^0
HCl - Aq	1 69E+06	mol^0
HCl - Vap	0.92796	mol^0
HF2-1	4.1247	mol^0
HF - Aq	6 17E-04	mol^0
HF - Vap	19019	mol^0
HNO3 - Aq	20.065	mol^0
HNO3 - Va	1.40E+05	mol^0
KHCO3	1 8452	mol^0
KHSO4 - A	51.933	mol^0
KHSO4	3.3683	mol^0
K2CO3	54473	mol^0
K2CO3 1 5	859.86	mol^0
KCl - Aq	120.41	mol^0
KCl	7.5444	mol^0
KF	7251.8	mol^0
KF.2H2O	395.96	mol^0
KF 4H2O	63.719	mol^0
KOH	4.83E+10	mol^0
KOH.2H2C	1572.6	mol^0
KOH.1H2C	17545	mol^0
KNO3	0.78972	mol^0
K2SO4	0.011589	mol^0
KSO4-1	0.13228	mol^0
K2SO4.1H	0.010377	mol^0
NaHCO3 -	2.389	mol^0
NaHCO3	0.40374	mol^0
NaHSO4	356.65	mol^0
Na2CO3	7.3005	mol^0
Na2CO3.1	0.11036	mol^0
Na2CO3.7	0.22354	mol^0
NaCO3-1	0.28348	mol^0
Na2CO3.1	1.0111	mol^0
NaCl	38.197	mol^0
NaF - Aq	1.2906	mol^0
NaF	0.2625	mol^0
NaF.Na2S	3.16E-03	mol^0
NaHF2	7.28E-03	mol^0
NaOH	8.05E+06	mol^0
NaOH.1H2	64322	mol^0

HNO3	1.16E-08	3.69E-10	0	0	0
Cl-1	1.65	0.093063	0	0	0
H+1	6.31E-08	1 26E-07	0	0	0
OH-1	1.07E-06	1.26E-07	0	0	0
NO3-1	3.1479	0 10154	0	0	0
Na+1	2.2372	0.19462	0	0	0

Molecular Output (Apparent Species)

	Total g	Aqueous mol/kg H2(	Vapor mol	Solid mol	2nd Liquid n/a
H2O	498.83	55.378	0	0	0
NaNO3	2.7749	0.065295	0	0	0
NaOH	2.599	0.12996	0	0	0
HCl	1.6969	0.093082	0	0	0
HNO3	1.1618	0.036875	0	0	0

Element Balance

	Total mol	Aqueous mol	Vapor mol	Solid mol	2nd Liquid n/a
C(+4)	0	0	0	0	0
CL(-1)	0	0 093063	0	0	0
F(-1)	0	0	0	0	0
H(+1)	0	111 02	0	0	0
K(+1)	0	0	0	0	0
N(+5)	0	0.10217	0	0	0
NA(+1)	0	0 19525	0	0	0
O(-2)	0	55.815	0	0	0
S(+6)	0	0	0	0	0

Species Activity Coefficients

H2O	0.99354	Activity
HCO3-1	0 71559	Act-Coef
HSO4-1	0.737	Act-Coef
CO2 - Aq	1 0258	Act-Coef
CO3-2	0.25524	Act-Coef
Cl-1	0.737	Act-Coef
Na2F+1	0.69741	Act-Coef
F-1	0 7216	Act-Coef
(HF)2 - Aq	1 0258	Act-Coef
HCl - Aq	1.0258	Act-Coef
HF2-1	0.737	Act-Coef
HF - Aq	1.0607	Act-Coef
H+1	0.84329	Act-Coef
OH-1	0.76095	Act-Coef
NO3-1	0.72715	Act-Coef
HNO3 - Aq	1.0532	Act-Coef
KHSO4 - A	1.0258	Act-Coef
KCl - Aq	1.0258	Act-Coef
K+1	0.69315	Act-Coef
KSO4-1	0.69741	Act-Coef
NaHCO3 -	1.0258	Act-Coef
NaCO3-1	0.737	Act-Coef
NaF - Aq	1.0258	Act-Coef
Na+1	0.73167	Act-Coef
NaNO3 - A	0.95242	Act-Coef
NaSO4-1	0.72642	Act-Coef
SO4-2	0.27539	Act-Coef
SO3 - Aq	1 0258	Act-Coef
H2SO4 - A	1.0258	Act-Coef
H2O - Vap	1	Fug-Coef
CO2 - Vap	1	Fug-Coef
(HF)2 - Va	1	Fug-Coef
HCl - Vap	1	Fug-Coef
HF - Vap	1	Fug-Coef
HNO3 - Va	1	Fug-Coef
SO3 - Vap	1	Fug-Coef
H2SO4 - V	1	Fug-Coef

Species K(eq)-Values

H2O	1.01E-14	mol^0
H2O - Vap	31.857	mol^0
HCO3-1	4.70E-11	mol^0
HSO4-1	0.010515	mol^0
CO2 - Aq	4.54E-07	mol^0
CO2 - Vap	0 03392	mol^0
Na2F+1	92.494	mol^0
K2SO4.KN	9.29E-05	mol^0
2Na2SO4 I	3.44E-03	mol^0
(HF)2 - Aq	51387	mol^0
(HF)2 - Va	19124	mol^0
HCl - Aq	1 69E+06	mol^0
HCl - Vap	0.92796	mol^0
HF2-1	4 1247	mol^0
HF - Aq	6.17E-04	mol^0
HF - Vap	19019	mol^0
HNO3 - Aq	20 065	mol^0
HNO3 - Va	1 40E+05	mol^0
KHCO3	1 8452	mol^0
KHSO4 - A	51 933	mol^0
KHSO4	3.3683	mol^0
K2CO3	54473	mol^0
K2CO3.1 5	859.86	mol^0
KCl - Aq	120.41	mol^0
KCl	7.5444	mol^0
KF	7251.8	mol^0
KF.2H2O	395.96	mol^0
KF.4H2O	63.719	mol^0
KOH	4.83E+10	mol^0
KOH.2H2C	1572.6	mol^0
KOH.1H2C	17545	mol^0
KNO3	0.78972	mol^0
K2SO4	0.011589	mol^0
KSO4-1	0 13228	mol^0
K2SO4.1H	0.010377	mol^0
NaHCO3 -	2.389	mol^0
NaHCO3	0.40374	mol^0
NaHSO4	356.65	mol^0
Na2CO3	7.3005	mol^0
Na2CO3 1	0.11036	mol^0
Na2CO3.7	0.22354	mol^0
NaCO3-1	0.28348	mol^0
Na2CO3.1	1.0111	mol^0
NaCl	38 197	mol^0
NaF - Aq	1 2906	mol^0
NaF	0.2625	mol^0
NaF Na2S	3.16E-03	mol^0
NaHF2	7.28E-03	mol^0
NaOH	8.05E+06	mol^0
NaOH.1H2	64322	mol^0
NaNO3 - A	17.412	mol^0

HNO3	4.16E-11	1.32E-12	0
Cl-1	1.65	0.093063	0
H+1	2.26E-10	4.49E-10	0
OH-1	2.98E-04	3.50E-05	0
NO3-1	3.1479	0.10154	0
Na+1	2.2376	0 19466	0

Molecular Output (Apparent Species)

	Total g	Aqueous mol/kg H2(	Vapor mol
H2O	498.83	55.378	0
NaNO3	2 7739	0.065272	0
NaOH	2.6001	0.13002	0
HCl	1.6969	0.093082	0
HNO3	1.1625	0 036898	0

Element Balance

	Total mol	Aqueous mol	Vapor mol
C(+4)	0	0	0
CL(-1)	0	0 093063	0
F(-1)	0	0	0
H(+1)	0	111 02	0
K(+1)	0	0	0
N(+5)	0	0.10217	0
NA(+1)	0	0.19529	0
O(-2)	0	55.815	0
S(+6)	0	0	0

Species Activity Coefficients

H2O	0.99354	Activity
HCO3-1	0 71558	Act-Coef
HSO4-1	0 73699	Act-Coef
CO2 - Aq	1.0258	Act-Coef
CO3-2	0.25522	Act-Coef
Cl-1	0.73699	Act-Coef
Na2F+1	0.6974	Act-Coef
F-1	0.72176	Act-Coef
(HF)2 - Aq	1 0258	Act-Coef
HCl - Aq	1.0258	Act-Coef
HF2-1	0 73699	Act-Coef
HF - Aq	1.0607	Act-Coef
H+1	0.84327	Act-Coef
OH-1	0.76094	Act-Coef
NO3-1	0 72714	Act-Coef
HNO3 - Aq	1.0532	Act-Coef
KHSO4 - A	1.0258	Act-Coef
KCl - Aq	1.0258	Act-Coef
K+1	0.69314	Act-Coef
KSO4-1	0.6974	Act-Coef
NaHCO3 -	1.0258	Act-Coef
NaCO3-1	0.73699	Act-Coef
NaF - Aq	1.0258	Act-Coef
Na+1	0 73166	Act-Coef
NaNO3 - A	0.95242	Act-Coef
NaSO4-1	0.7264	Act-Coef
SO4-2	0.27537	Act-Coef
SO3 - Aq	1 0258	Act-Coef
H2SO4 - A	1.0258	Act-Coef
H2O - Vap	1	Fug-Coef
CO2 - Vap	1	Fug-Coef
(HF)2 - Va	1	Fug-Coef
HCl - Vap	1	Fug-Coef
HF - Vap	1	Fug-Coef
HNO3 - Va	1	Fug-Coef
SO3 - Vap	1	Fug-Coef
H2SO4 - V	1	Fug-Coef

Species K(eq)-Values

H2O	1.01E-14	mol^0
H2O - Vap	31.857	mol^0
HCO3-1	4.70E-11	mol^0
HSO4-1	0.010515	mol^0
CO2 - Aq	4.54E-07	mol^0
CO2 - Vap	0.03392	mol^0
Na2F+1	92.494	mol^0
K2SO4.KN	9.29E-05	mol^0
2Na2SO4.I	3.44E-03	mol^0
(HF)2 - Aq	51387	mol^0
(HF)2 - Va	19124	mol^0
HCl - Aq	1.69E+06	mol^0
HCl - Vap	0.92796	mol^0
HF2-1	4.1247	mol^0
HF - Aq	6 17E-04	mol^0
HF - Vap	19019	mol^0
HNO3 - Aq	20.065	mol^0
HNO3 - Va	1.40E+05	mol^0
KHCO3	1.8452	mol^0
KHSO4 - A	51.933	mol^0
KHSO4	3.3683	mol^0
K2CO3	54473	mol^0
K2CO3.1.5	859 86	mol^0
KCl - Aq	120.41	mol^0
KCl	7.5444	mol^0
KF	7251.8	mol^0
KF.2H2O	395.96	mol^0
KF.4H2O	63.719	mol^0
KOH	4.83E+10	mol^0
KOH.2H2C	1572.6	mol^0
KOH.1H2C	17545	mol^0
KNO3	0.78972	mol^0
K2SO4	0.011589	mol^0
KSO4-1	0.13228	mol^0
K2SO4.1H	0.010377	mol^0
NaHCO3 -	2.389	mol^0
NaHCO3	0 40374	mol^0
NaHSO4	356.65	mol^0
Na2CO3	7.3005	mol^0
Na2CO3 1	0 11036	mol^0
Na2CO3 7	0.22354	mol^0
NaCO3-1	0.28348	mol^0
Na2CO3.1	1 0111	mol^0
NaCl	38.197	mol^0
NaF - Aq	1.2906	mol^0
NaF	0.2625	mol^0
NaF Na2S	3.16E-03	mol^0
NaHF2	7.28E-03	mol^0
NaOH	8.05E+06	mol^0
NaOH 1H2	64322	mol^0
NaNO3 - A	17 412	mol^0

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NaNO3	28.746 mol^0
Na2SO4	0.44942 mol^0
Na2SO4	1.90E-07 mol^0
Na2SO4.N	162.44 mol^0
Na2SO4.1(	0.046844 mol^0
NaSO4-1	0.12009 mol^0
SO3 - Aq	7726 mol^0
SO3 - Vap	1.64E+09 mol^0
H2SO4 - A	2.57E+10 mol^0
H2SO4 - V	3.86E+05 mol^0

Species Mobilities

Cl-1	3.64E-04 m2/ohm-mol
H+1	1.67E-03 m2/ohm-mol
OH-1	9.38E-04 m2/ohm-mol
NO3-1	3.40E-04 m2/ohm-mol
Na+1	2.39E-04 m2/ohm-mol

Species Self Diffusivities

H2O	1.67E-09 m2/s
HCO3-1	6.06E-10 m2/s
HSO4-1	9.05E-10 m2/s
CO2 - Aq	1.40E-09 m2/s
CO3-2	6.71E-10 m2/s
Cl-1	1.34E-09 m2/s
Na2F+1	1.06E-09 m2/s
F-1	1.00E-09 m2/s
(HF)2 - Aq	8.28E-10 m2/s
HCl - Aq	1.45E-09 m2/s
HF2-1	1.32E-09 m2/s
HF - Aq	9.12E-11 m2/s
H+1	5.68E-09 m2/s
OH-1	3.30E-09 m2/s
NO3-1	1.26E-09 m2/s
HNO3 - Aq	1.35E-09 m2/s
KHSO4 - A	1.06E-09 m2/s
KCl - Aq	1.23E-09 m2/s
K+1	1.31E-09 m2/s
KSO4-1	6.82E-10 m2/s
NaHCO3 -	7.07E-10 m2/s
NaCO3-1	5.99E-10 m2/s
NaF - Aq	7.81E-10 m2/s
Na+1	9.30E-10 m2/s
NaNO3 - A	8.56E-10 m2/s
NaSO4-1	6.28E-10 m2/s
SO4-2	7.12E-10 m2/s
SO3 - Aq	7.66E-11 m2/s
H2SO4 - A	7.51E-10 m2/s

NaNO3 - A	17.412 mol^0
NaNO3	28.746 mol^0
Na2SO4	0.44942 mol^0
Na2SO4	1.90E-07 mol^0
Na2SO4.N	162.44 mol^0
Na2SO4.1(	0.046844 mol^0
NaSO4-1	0.12009 mol^0
SO3 - Aq	7726 mol^0
SO3 - Vap	1.64E+09 mol^0
H2SO4 - A	2.57E+10 mol^0
H2SO4 - V	3.86E+05 mol^0

Species Mobilities

Cl-1	2.85E-04 m2/ohm-mol
H+1	1.31E-03 m2/ohm-mol
OH-1	7.35E-04 m2/ohm-mol
NO3-1	2.67E-04 m2/ohm-mol
Na+1	1.87E-04 m2/ohm-mol

Species Self Diffusivities

H2O	1.17E-09 m2/s
HCO3-1	5.68E-10 m2/s
HSO4-1	6.25E-10 m2/s
CO2 - Aq	9.97E-10 m2/s
CO3-2	4.68E-10 m2/s
Cl-1	9.38E-10 m2/s
Na2F+1	7.39E-10 m2/s
F-1	7.17E-10 m2/s
(HF)2 - Aq	5.74E-10 m2/s
HCl - Aq	1.01E-09 m2/s
HF2-1	9.22E-10 m2/s
HF - Aq	6.35E-11 m2/s
H+1	4.17E-09 m2/s
OH-1	2.37E-09 m2/s
NO3-1	8.78E-10 m2/s
HNO3 - Aq	9.36E-10 m2/s
KHSO4 - A	7.26E-10 m2/s
KCl - Aq	9.07E-10 m2/s
K+1	9.36E-10 m2/s
KSO4-1	4.67E-10 m2/s
NaHCO3 -	4.91E-10 m2/s
NaCO3-1	4.16E-10 m2/s
NaF - Aq	5.36E-10 m2/s
Na+1	6.61E-10 m2/s
NaNO3 - A	5.90E-10 m2/s
NaSO4-1	4.31E-10 m2/s
SO4-2	4.86E-10 m2/s
SO3 - Aq	5.28E-11 m2/s
H2SO4 - A	5.13E-10 m2/s

NaNO3	28.746 mol^0
Na2SO4	0.44942 mol^0
Na2SO4	1.90E-07 mol^0
Na2SO4.N	162.44 mol^0
Na2SO4.1(	0.046844 mol^0
NaSO4-1	0.12009 mol^0
SO3 - Aq	7726 mol^0
SO3 - Vap	1.64E+09 mol^0
H2SO4 - A	2.57E+10 mol^0
H2SO4 - V	3.86E+05 mol^0

Species Mobilities

Cl-1	6.29E-04 m2/ohm-mol
H+1	2.88E-03 m2/ohm-mol
OH-1	1.62E-03 m2/ohm-mol
NO3-1	5.88E-04 m2/ohm-mol
Na+1	4.12E-04 m2/ohm-mol

Species Self Diffusivities

H2O	2.28E-09 m2/s
HCO3-1	1.13E-09 m2/s
HSO4-1	1.30E-09 m2/s
CO2 - Aq	1.90E-09 m2/s
CO3-2	9.44E-10 m2/s
Cl-1	1.91E-09 m2/s
Na2F+1	1.51E-09 m2/s
F-1	1.39E-09 m2/s
(HF)2 - Aq	1.15E-09 m2/s
HCl - Aq	2.01E-09 m2/s
HF2-1	1.88E-09 m2/s
HF - Aq	1.26E-10 m2/s
H+1	8.32E-09 m2/s
OH-1	4.78E-09 m2/s
NO3-1	1.79E-09 m2/s
HNO3 - Aq	1.88E-09 m2/s
KHSO4 - A	1.48E-09 m2/s
KCl - Aq	1.57E-09 m2/s
K+1	1.83E-09 m2/s
KSO4-1	9.73E-10 m2/s
NaHCO3 -	9.82E-10 m2/s
NaCO3-1	8.46E-10 m2/s
NaF - Aq	1.09E-09 m2/s
Na+1	1.27E-09 m2/s
NaNO3 - A	1.20E-09 m2/s
NaSO4-1	8.94E-10 m2/s
SO4-2	1.02E-09 m2/s
SO3 - Aq	1.07E-10 m2/s
H2SO4 - A	1.06E-09 m2/s

NaNO3	28.746 mol^0
Na2SO4	0.44942 mol^0
Na2SO4	1.90E-07 mol^0
Na2SO4.N	162.44 mol^0
Na2SO4.1(	0.046844 mol^0
NaSO4-1	0.12009 mol^0
SO3 - Aq	7726 mol^0
SO3 - Vap	1.64E+09 mol^0
H2SO4 - A	2.57E+10 mol^0
H2SO4 - V	3.86E+05 mol^0

Species Mobilities

Cl-1	6.29E-04 m2/ohm-mol
H+1	2.88E-03 m2/ohm-mol
OH-1	1.62E-03 m2/ohm-mol
NO3-1	5.88E-04 m2/ohm-mol
Na+1	4.12E-04 m2/ohm-mol

Species Self Diffusivities

H2O	2.28E-09 m2/s
HCO3-1	1.13E-09 m2/s
HSO4-1	1.30E-09 m2/s
CO2 - Aq	1.90E-09 m2/s
CO3-2	9.44E-10 m2/s
Cl-1	1.91E-09 m2/s
Na2F+1	1.51E-09 m2/s
F-1	1.39E-09 m2/s
(HF)2 - Aq	1.15E-09 m2/s
HCl - Aq	2.01E-09 m2/s
HF2-1	1.88E-09 m2/s
HF - Aq	1.26E-10 m2/s
H+1	8.32E-09 m2/s
OH-1	4.78E-09 m2/s
NO3-1	1.79E-09 m2/s
HNO3 - Aq	1.88E-09 m2/s
KHSO4 - A	1.48E-09 m2/s
KCl - Aq	1.57E-09 m2/s
K+1	1.83E-09 m2/s
KSO4-1	9.73E-10 m2/s
NaHCO3 -	9.82E-10 m2/s
NaCO3-1	8.46E-10 m2/s
NaF - Aq	1.09E-09 m2/s
Na+1	1.27E-09 m2/s
NaNO3 - A	1.20E-09 m2/s
NaSO4-1	8.94E-10 m2/s
SO4-2	1.02E-09 m2/s
SO3 - Aq	1.07E-10 m2/s
H2SO4 - A	1.06E-09 m2/s

K. J. Chang
12/19/04

SCW13

Calculation Summary

SinglePoint_NaOH_95oC Calculation for Work1

Automatic Chemistry Model
Databanks:
Public

Unit Set: Default

Isothermal Calculation
Temperatu 95 °C
Pressure 1 atm

Stream Inflows

Water	500 g
Sodium chl	2.72 g
Potassium	0 g
Sodium nitr	4.342 g
Sodium sul	0 g
Sodium bic	0 g
Sodium flu	0 g
Sodium hyd	7.00E-04 g

Speciation Summary

Total number of species: 113

Solid Species	Second Liquid Spe	User Inflows	Related Inflows	Aqueous Species	Vapor Species	Solid Species	Second Liquid Spe
K2SO4.KNaSO4		H2O	CO2	H2O	H2O - Vap	K2SO4.KNaSO4	
2Na2SO4.Na2CO3		NaCl	H2CO3	HCO3-1	CO2 - Vap	2Na2SO4.Na2CO3	
KHCO3		KCl	K2SO4.KN	HSO4-1	(HF)2 - Va	KHCO3	
KHSO4		NaNO3	2Na2SO4.I	CO2 - Aq	HCl - Vap	KHSO4	
K2CO3		Na2SO4	(HF)2	CO3-2	HF - Vap	K2CO3	
K2CO3.1.5H2O		NaHCO3	HCl	Cl-1	HNO3 - Va	K2CO3.1.5H2O	
KCl		NaF	HF	Na2F+1	SO3 - Vap	KCl	
KF		NaOH	(HF)6	F-1	H2SO4 - V	KF	
KF.2H2O			HNO3	(HF)2 - Aq		KF.2H2O	
KF.4H2O			KHCO3	HCl - Aq		KF.4H2O	
KOH			KHSO4	HF2-1		KOH	
KOH.2H2O			K2CO3	HF - Aq		KOH.2H2O	
KOH.1H2O			K2CO3.1.5	H+1		KOH.1H2O	
KNO3			KF	OH-1		KNO3	
K2SO4			KF.2H2O	NO3-1		K2SO4	
K2SO4.1H2O			KF.4H2O	HNO3 - Aq		K2SO4.1H2O	
NaHCO3			KOH	KHSO4 - Aq		NaHCO3	
NaHSO4			KOH.2H2O	KCl - Aq		NaHSO4	
Na2CO3			KOH.1H2O	K+1		Na2CO3	
Na2CO3.10H2O			KNO3	KSO4-1		Na2CO3.10H2O	
Na2CO3.7H2O			K2SO4	NaHCO3 - Aq		Na2CO3.7H2O	
Na2CO3.1H2O			K2SO4.1H	NaCO3-1		Na2CO3.1H2O	
NaCl			NaHSO4	NaF - Aq		NaCl	
NaF			Na2CO3	Na+1		NaF	
NaF.Na2SO4			Na2CO3.1	NaNO3 - Aq		NaF.Na2SO4	
NaHF2			Na2CO3.7	NaSO4-1		NaHF2	
NaOH			Na2CO3.1	SO4-2		NaOH	
NaOH.1H2O			NaF.Na2SO	SO3 - Aq		NaOH.1H2O	
NaNO3			NaHF2	H2SO4 - Aq		NaNO3	
Na2SO4			NaOH.1H2O			Na2SO4	
Na2SO4			Na2SO4			Na2SO4	
Na2SO4.NaHSO4			Na2SO4.NaHSO4			Na2SO4.NaHSO4	
Na2SO4.10H2O			Na2SO4.10H2O			Na2SO4.10H2O	
			SO3				
			H2SO4				

Stream Parameters

Stream Am	507.06 g
Temperatu	95 °C
Pressure	1 atm
pH	7.7281 pH
Ionic Stren	0.19311 mol/kg H2O
Osmotic Pr	10.309 atm
WaterActiv	0.99364 Activity
Electrical C	0.048036 1/ohm
Electrical C	256.96 cm2/ohm-mol
Viscosity, c	0.30437 cP
Viscosity, r	1.0245 cP/cP H2O

Solid g/ml	2nd Liquid g/ml		Total --	Aqueous g/ml	Vapor g/ml	Solid g/ml	2nd Liquid g/ml	
0	0	Density	--	0.9706	0	0	0	0
Solid cal	2nd Liquid cal		Total cal	Aqueous cal	Vapor cal	Solid cal	2nd Liquid cal	
0	0	Enthalpy	-1.87E+06	-1.87E+06	0	0	0	0

Total and Phase Flows (Amounts)

Solid mol	2nd Liquid mol		Total mol	Aqueous mol	Vapor mol	Solid mol	2nd Liquid mol	
0	0	Mole	27.948	27.948	0	0	0	0
Solid g	2nd Liquid g		Total g	Aqueous g	Vapor g	Solid g	2nd Liquid g	
0	0	Mass	507.06	507.06	0	0	0	0
Solid L	2nd Liquid L		Total L	Aqueous L	Vapor L	Solid L	2nd Liquid L	
0	0	Volume	0.52231	0.52231	0	0	0	0

Scaling Tendencies

solids within Temperature Range

Sodium chl	2.47E-04	0	350.00 °C	inside range	
Sodium nitr	1.66E-04	0	300.00 °C	inside range	
inside range					
inside range					

Species Output (True Species)

Solid mol	2nd Liquid n/a		Total g	Aqueous mol/kg H2O	Vapor mol	Solid mol	2nd Liquid n/a
		H2O	500	55.506	0	0	0
0	0	NaNO3	0.092548	2.18E-03	0	0	0
0	0	HCl	6.44E-13	3.53E-14	0	0	0
0	0	HNO3	9.77E-09	3.10E-10	0	0	0

Calculation Summary

SinglePoint1 Calculation for Work1

Automatic Chemistry Model
Databanks:
Public

Unit Set: Default

Isothermal Calculation
Temperatu 25 °C
Pressure 1 atm

Stream Inflows

Water	1000 g
Sodium chl	5.427 g
Potassium	6.472 g
Sodium nitr	8.759 g
Sodium sul	20.691 g
Sodium bic	0 g
Sodium flu	3.113 g
Sodium hyd	0 g

Speciation Summary

Total number of species: 113

Solid Species	Second Liquid Spe	User Inflows	Related Inflows	Aqueous Species	Vapor Species	Solid Species	Second Liquid Spe
K2SO4.KNaSO4		H2O	CO2	H2O	H2O - Vap	K2SO4.KNaSO4	
2Na2SO4.Na2CO3		NaCl	H2CO3	HCO3-1	CO2 - Vap	2Na2SO4.Na2CO3	
KHCO3		KCl	K2SO4.KN	HSO4-1	(HF)2 - Va	KHCO3	
KHSO4		NaNO3	2Na2SO4.I	CO2 - Aq	HCl - Vap	KHSO4	
K2CO3		Na2SO4	(HF)2	CO3-2	HF - Vap	K2CO3	
K2CO3.1.5H2O		NaHCO3	HCl	Cl-1	HNO3 - Va	K2CO3.1.5H2O	
KCl		NaF	HF	Na2F+1	SO3 - Vap	KCl	
KF		NaOH	(HF)6	F-1	H2SO4 - V	KF	
KF.2H2O			HNO3	(HF)2 - Aq		KF.2H2O	
KF.4H2O			KHCO3	HCl - Aq		KF.4H2O	
KOH			KHSO4	HF2-1		KOH	
KOH.2H2O			K2CO3	HF - Aq		KOH.2H2O	
KOH.1H2O			K2CO3.1.5	H+1		KOH.1H2O	
KNO3			KF	OH-1		KNO3	
K2SO4			KF.2H2O	NO3-1		K2SO4	
K2SO4.1H2O			KF.4H2O	HNO3 - Aq		K2SO4.1H2O	
NaHCO3			KOH	KHSO4 - Aq		NaHCO3	
NaHSO4			KOH.2H2O	KCl - Aq		NaHSO4	
Na2CO3			KOH.1H2O	K+1		Na2CO3	
Na2CO3.10H2O			KNO3	KSO4-1		Na2CO3.10H2O	
Na2CO3.7H2O			K2SO4	NaHCO3 - Aq		Na2CO3.7H2O	
Na2CO3.1H2O			K2SO4.1H	NaCO3-1		Na2CO3.1H2O	
NaCl			NaHSO4	NaF - Aq		NaCl	
NaF			Na2CO3	Na+1		NaF	
NaF.Na2SO4			Na2CO3.1	NaNO3 - Aq		NaF.Na2SO4	
NaHF2			Na2CO3.7	NaSO4-1		NaHF2	
NaOH			Na2CO3.1	SO4-2		NaOH	
NaOH.1H2O			NaF.Na2SO	SO3 - Aq		NaOH.1H2O	
NaNO3			NaHF2	H2SO4 - Aq		NaNO3	
Na2SO4			NaOH.1H2O			Na2SO4	
Na2SO4			Na2SO4			Na2SO4	
Na2SO4.NaHSO4			Na2SO4.NaHSO4			Na2SO4.NaHSO4	
Na2SO4.10H2O			Na2SO4.10H2O			Na2SO4.10H2O	
			SO3				
			H2SO4				

Stream Parameters

Stream Am	1044.5 g
Temperatu	25 °C
Pressure	1 atm
pH	7.8273 pH
Ionic Stren	0.8581 mol/kg H2O
Osmotic Pr	24.034 atm
WaterActiv	0.98256 Activity
Electrical C	0.046321 1/ohm
Electrical C	93.43 cm2/ohm-mol
Viscosity, c	0.97281 cP
Viscosity, r	1.0922 cP/cP H2O

Solid g/ml	2nd Liquid g/ml		Total --	Aqueous g/ml	Vapor g/ml	Solid g/ml	2nd Liquid g/ml	
0	0	Density	--	1.0304	0	0	0	0
Solid cal	2nd Liquid cal		Total cal	Aqueous cal	Vapor cal	Solid cal	2nd Liquid cal	
0	0	Enthalpy	-3.88E+06	-3.88E+06	0	0	0	0

Total and Phase Flows (Amounts)

Solid mol	2nd Liquid mol		Total mol	Aqueous mol	Vapor mol	Solid mol	2nd Liquid mol	
0	0	Mole	56.586	56.586	0	0	0	0
Solid g	2nd Liquid g		Total g	Aqueous g	Vapor g	Solid g	2nd Liquid g	
0	0	Mass	1044.5	1044.5	0	0	0	0
Solid L	2nd Liquid L		Total L	Aqueous L	Vapor L	Solid L	2nd Liquid L	
0	0	Volume	1.0136	1.0136	0	0	0	0

Scaling Tendencies

solids within Temperature Range

Sodium flu	0.049976	0	100.00 °C	inside range	
Sodium sul	0.023022	0	32.400 °C	inside range	
Sodium flu	5.34E-03	20	40.000 °C	inside range	
Potassium	3.83E-03	0	110.00 °C	inside range	
Sodium sul	2.86E-03	19	241.00 °C	inside range	
Potassium	2.48E-03	9	7 292.00 °C	inside range	
Sodium chl	1.03E-03	0	350.00 °C	inside range	
Potassium	7.81E-04	0	200.00 °C	inside range	
Sodium nitr	7.04E-04	0	300.00 °C	inside range	
Potassium	4.78E-06	17	7 40.200 °C	inside range	
Sodium hyd	4.34E-07	data valid t		inside range	
Potassium	2.54E-10	data valid t		inside range	

Calculation Summary

SinglePoint_NaOH Calculation for Work1

Automatic Chemistry Model
Databanks:
Public

Unit Set: Default

Isothermal Calculation
Temperatu 25 °C
Pressure 1 atm

Stream Inflows

Water	1000 g
Sodium chl	5.427 g
Potassium	6.472 g
Sodium nitr	8.759 g
Sodium sul	20.691 g
Sodium bic	0 g
Sodium flu	3.113 g
Sodium hyd	3.00E-03 g

Speciation Summary

Total number of species: 113

Solid Species	Second Liquid Spe	User Inflows	Related Inflows	Aqueous Species	Vapor Species	Solid Species	Second Liquid Spe
K2SO4.KNaSO4		H2O	CO2	H2O	H2O - Vap	K2SO4.KNaSO4	
2Na2SO4.Na2CO3		NaCl	H2CO3	HCO3-1	CO2 - Vap	2Na2SO4.Na2CO3	
KHCO3		KCl	K2SO4.KN	HSO4-1	(HF)2 - Va	KHCO3	
KHSO4		NaNO3	2Na2SO4.I	CO2 - Aq	HCl - Vap	KHSO4	
K2CO3		Na2SO4	(HF)2	CO3-2	HF - Vap	K2CO3	
K2CO3.1.5H2O		NaHCO3	HCl	Cl-1	HNO3 - Va	K2CO3.1.5H2O	
KCl		NaF	HF	Na2F+1	SO3 - Vap	KCl	
KF		NaOH	(HF)6	F-1	H2SO4 - V	KF	
KF.2H2O			HNO3	(HF)2 - Aq		KF.2H2O	
KF.4H2O			KHCO3	HCl - Aq		KF.4H2O	
KOH			KHSO4	HF2-1		KOH	
KOH.2H2O			K2CO3	HF - Aq		KOH.2H2O	
KOH.1H2O			K2CO3.1.5	H+1		KOH.1H2O	
KNO3			KF	OH-1		KNO3	
K2SO4			KF.2H2O	NO3-1		K2SO4	
K2SO4.1H2O			KF.4H2O	HNO3 - Aq		K2SO4.1H2O	
NaHCO3			KOH	KHSO4 - Aq		NaHCO3	
NaHSO4			KOH.2H2O	KCl - Aq		NaHSO4	
Na2CO3			KOH.1H2O	K+1		Na2CO3	
Na2CO3.10H2O			KNO3	KSO4-1		Na2CO3.10H2O	
Na2CO3.7H2O			K2SO4	NaHCO3 - Aq		Na2CO3.7H2O	
Na2CO3.1H2O			K2SO4.1H	NaCO3-1		Na2CO3.1H2O	
NaCl			NaHSO4	NaF - Aq		NaCl	
NaF			Na2CO3	Na+1		NaF	
NaF.Na2SO4			Na2CO3.1	NaNO3 - Aq		NaF.Na2SO4	
NaHF2			Na2CO3.7	NaSO4-1		NaHF2	
NaOH			Na2CO3.1	SO4-2		NaOH	
NaOH.1H2O			NaF.Na2SO	SO3 - Aq		NaOH.1H2O	
NaNO3			NaHF2	H2SO4 - Aq		NaNO3	
Na2SO4			NaOH.1H2O			Na2SO4	
Na2SO4			Na2SO4			Na2SO4	
Na2SO4.NaHSO4			Na2SO4.NaHSO4			Na2SO4.NaHSO4	
Na2SO4.10H2O			Na2SO4.10H2O			Na2SO4.10H2O	
			SO3				
			H2SO4				

Stream Parameters

Stream Am	1044.5 g
Temperatu	25 °C
Pressure	1 atm
pH	9.7303 pH
Ionic Stren	0.85919 mol/kg H2O
Osmotic Pr	24.038 atm
WaterActiv	0.98255 Activity
Electrical C	0.04632 1/ohm
Electrical C	93.414 cm2/ohm-mol
Viscosity, c	0.97282 cP
Viscosity, r	1.0922 cP/cP H2O

Solid g/ml	2nd Liquid g/ml		Total --	Aqueous g/ml	Vapor g/ml	Solid g/ml	2nd Liquid g/ml	
0	0	Density	--	1.0304	0	0	0	0
Solid cal	2nd Liquid cal		Total cal	Aqueous cal	Vapor cal	Solid cal	2nd Liquid cal	
0	0	Enthalpy	-3.88E+06	-3.88E+06	0	0	0	0

Total and Phase Flows (Amounts)

Solid mol	2nd Liquid mol		Total mol	Aqueous mol	Vapor mol	Solid mol	2nd Liquid mol	
0	0	Mole	56.586	56.586	0	0	0	0
Solid g	2nd Liquid g		Total g	Aqueous g	Vapor g	Solid g	2nd Lxquid g	
0	0	Mass	1044.5	1044.5	0	0	0	0
Solid L	2nd Liquid L		Total L	Aqueous L	Vapor L	Solid L	2nd Liquid L	
0	0	Volume	1.0136	1.0136	0	0	0	0

Scaling Tendencies

solids within Temperature Range

Sodium flu	0.049983	0	100.00 °C	inside range	
Sodium sul	0.023026	0	32.400 °C	inside range	
Sodium flu	5.34E-03	20	40.000 °C	inside range	
Potassium	3.83E-03	0	110.00 °C	inside range	
Sodium sul	2.86E-03	19	241.00 °C	inside range	
Potassium	2.48E-03	9	7 292.00 °C	inside range	
Sodium chl	1.03E-03	0	350.00 °C	inside range	
Potassium	7.81E-04	0	200.00 °C	inside range	
Sodium nitr	7.04E-04	0	300.00 °C	inside range	
Potassium	4.78E-06	17	7 40.200 °C	inside range	
Sodium hyd	5.43E-09	data valid t		inside range	
Potassium	1.57E-09	0	33.000 °C	inside range	

Calculation Summary

SinglePoint_NaOH_95 Calculation for Work1

Automatic Chemistry Model
Databanks:
Public

Unit Set: Default

Isothermal Calculation
Temperatu 95 °C
Pressure 1 atm

Stream Inflows

Water	1000 g
Sodium chl	5.427 g
Potassium	6.472 g
Sodium nitr	8.759 g
Sodium sul	20.691 g
Sodium bic	0 g
Sodium flu	3.113 g
Sodium hyd	3.00E-03 g

Speciation Summary

Total number of species: 113

Solid Species	Second Liquid Spe	User Inflows	Related Inflows	Aqueous Species	Vapor Species	Solid Species	Second Liquid Spe
K2SO4.KN		H2O	CO2	H2O	H2O - Vap	K2SO4.KN	
2Na2SO4.I		NaCl	H2CO3	HCO3-1	CO2 - Vap	2Na2SO4.I	
KHCO3		KCl	K2SO4.KN	HSO4-1	(HF)2 - Va	KHCO3	
KHSO4		NaNO3	2Na2SO4.I	CO2 - Aq	HCl - Vap	KHSO4	
K2CO3		Na2SO4	(HF)2	CO3-2	HF - Vap	K2CO3	
K2CO3.1.5		NaHCO3	HCl	Cl-1	HNO3 - Va	K2CO3.1.5	
KCl		NaF	HF	Na2F+1	SO3 - Vap	KCl	
KF		NaOH	(HF)6	F-1	H2SO4 - V	KF	
KF.2H2O			HNO3	(HF)2 - Aq		KF.2H2O	
KF.4H2O			KHCO3	HCl - Aq		KF.4H2O	
KOH			KHSO4	HF2-1		KOH	
KOH.2H2O			K2CO3	HF - Aq		KOH.2H2O	
KOH.1H2O			K2CO3.1.5	H+1		KOH.1H2O	
KNO3			KF	OH-1		KNO3	
K2SO4			KF.2H2O	NO3-1		K2SO4	
K2SO4.1H			KF.4H2O	HNO3 - Aq		K2SO4.1H2	
NaHCO3			KOH	KHSO4 - Aq		NaHCO3	
NaHSO4			KOH.2H2O	KCl - Aq		NaHSO4	
Na2CO3			KOH.1H2O	K+1		Na2CO3	
Na2CO3.1(			KNO3	KSO4-1		Na2CO3.1(	
Na2CO3.7H			K2SO4	NaHCO3 - Aq		Na2CO3.7H	
Na2CO3.1H			K2SO4.1H	NaCO3-1		Na2CO3.1H	
NaCl			NaHSO4	NaF - Aq		NaCl	
NaF			Na2CO3	Na+1		NaF	
NaF.Na2S(			Na2CO3.1	NaNO3 - Aq		NaF.Na2S(	
NaHF2			Na2CO3.7	NaSO4-1		NaHF2	
NaOH			Na2CO3.1	SO4-2		NaOH	
NaOH.1H2			NaF.Na2S(	SO3 - Aq		NaOH.1H2	
NaNO3			NaHF2	H2SO4 - Aq		NaNO3	
Na2SO4			NaOH.1H2O			Na2SO4	
Na2SO4			Na2SO4			Na2SO4	
Na2SO4.N			Na2SO4.NaHSO4			Na2SO4.N	
Na2SO4.1(			Na2SO4.10H2O			Na2SO4.1(	
			SO3				
			H2SO4				

Stream Parameters

Stream Am	1044.5 g
Temperatu	95 °C
Pressure	1 atm
pH	8.0143 pH
Ionic Stren	0.71561 mol/kg H2O
Osmotic Pr	28.723 atm
WaterActiv	0.98248 Activity
Electrical C	0.12244 1/ohm
Electrical C	256.37 cm2/ohm-mol
Viscosity, c	0.34042 cP
Viscosity, r	1.1456 cP/cP H2O

Solid g/ml	2nd Liquid g/ml		Total --	Aqueous g/ml	Vapor g/ml	Solid g/ml	
0	0	Density	--	0.99248	0	0	0
Solid cal	2nd Liquid cal		Total cal	Aqueous cal	Vapor cal	Solid cal	
0	0	Enthalpy	-3.81E+06	-3.81E+06	0	0	0

Total and Phase Flows (Amounts)

Solid mol	2nd Liquid mol		Total mol	Aqueous mol	Vapor mol	Solid mol	
0	0	Mole	56.613	56.613	0	0	0
Solid g	2nd Liquid g		Total g	Aqueous g	Vapor g	Solid g	
0	0	Mass	1044.5	1044.5	0	0	0
Solid L	2nd Liquid L		Total L	Aqueous L	Vapor L	Solid L	
0	0	Volume	1.0524	1.0524	0	0	0

Scaling Tendencies

solids within Temperature Range

Sodium flu	0.03806	0	100.00 °C	inside range	
Sodium sul	7.98E-03	19	241.00 °C	inside range	
Sodium chl	1.13E-03	0	350.00 °C	inside range	
Potassium	7.68E-04	9.7	292.00 °C	inside range	
Potassium	7.59E-04	0	110.00 °C	inside range	
Potassium	3.24E-04	0	200.00 °C	inside range	
Sodium nitr	3.22E-04	0	300.00 °C	inside range	
Glaserite	5.77E-05	35	150.00 °C	inside range	
Sodium hyd	2.50E-07	data valid t		inside range	
Potassium	2.89E-10	data valid t		inside range	
Potassium	8.33E-11	33	143.00 °C	inside range	
Sodium bic	8.06E-11	data valid t		inside range	

K. J. Chisholm
12/19/04

0	0	Cl-1	1.65	0.093083	0	0	0
0	0	H+1	1.18E-08	2.35E-08	0	0	0
0	0	OH-1	2.98E-04	3.50E-05	0	0	0
0	0	NO3-1	3.1001	0.099994	0	0	0
0	0	Na+1	2.2196	0.19311	0	0	0
0	0						

Molecular Output (Apparent Species)

Solid mol	2nd Liquid n/a		Total g	Aqueous mol/kg H2O	Vapor mol	Solid mol	2nd Liquid n/a	
		H2O	498.83	55.379	0	0	0	0
0	0	NaNO3	2.7956	0.065787	0	0	0	0
0	0	NaOH	2.5899	0.1295	0	0	0	0
0	0	HCl	1.6969	0.093082	0	0	0	0
0	0	HNO3	1.1463	0.036384	0	0	0	0
0	0							

Element Balance

Solid mol	2nd Liquid n/a		Total mol	Aqueous mol	Vapor mol	Solid mol	2nd Liquid n/a	
		C(+4)	0	0	0	0	0	0
0	0	CL(-1)	0	0.093083	0	0	0	0
0	0	F(-1)	0	0	0	0	0	0
0	0	H(+1)	0	111.02	0	0	0	0
0	0	K(+1)	0	0	0	0	0	0
0	0	N(+5)	0	0.10217	0	0	0	0
0	0	NA(+1)	0	0.19529	0	0	0	0
0	0	O(-2)	0	55.815	0	0	0	0
0	0	S(+6)	0	0	0	0	0	0
0	0							

Species Activity Coefficients

H2O	0.98364	Activity
HCO3-1	0.89895	Act-Coef
HSO4-1	0.89859	Act-Coef
CO2 - Aq	1.0198	Act-Coef
CO3-2	0.21554	Act-Coef
Cl-1	0.89859	Act-Coef
Na2F+1	0.86102	Act-Coef
F-1	0.88903	Act-Coef
(HF)2 - Aq	1.0257	Act-Coef
HCl - Aq	1.0257	Act-Coef
HF2-1	0.89859	Act-Coef
HF - Aq	1.0781	Act-Coef
H+1	0.7964	Act-Coef
OH-1	0.89582	Act-Coef
NO3-1	0.89877	Act-Coef
HNO3 - Aq	1.0534	Act-Coef
KHSO4 - A	1.0257	Act-Coef
KCl - Aq	1.0257	Act-Coef
K+1	0.89966	Act-Coef
KSO4-1	0.86102	Act-Coef
NaHCO3 -	1.0257	Act-Coef
NaCO3-1	0.89859	Act-Coef
NaF - Aq	1.0257	Act-Coef
Na+1	0.89803	Act-Coef
NaNO3 - A	0.94707	Act-Coef
NaSO4-1	1.5836	Act-Coef
SO4-2	0.21941	Act-Coef
SO3 - Aq	1.0257	Act-Coef
H2SO4 - A	1.0257	Act-Coef
H2O - Vap	1	Fug-Coef
CO2 - Vap	1	Fug-Coef
(HF)2 - Vaj	1	Fug-Coef
HCl - Vap	1	Fug-Coef
HF - Vap	1	Fug-Coef
HNO3 - Va	1	Fug-Coef
SO3 - Vap	1	Fug-Coef
H2SO4 - V	1	Fug-Coef

Species K(eq)-Values

H2O	4.59E-13	mol^0
H2O - Vap	1.2097	mol^0
HCO3-1	8.22E-11	mol^0
HSO4-1	1.17E-03	mol^0
CO2 - Aq	4.31E-07	mol^0
CO2 - Vap	0.011137	mol^0
Na2F+1	34.675	mol^0
K2SO4.KN	5.51E-05	mol^0
2Na2SO4.I	1.71E-05	mol^0
(HF)2 - Aq	4686.1	mol^0
(HF)2 - Vaj	499.84	mol^0
HCl - Aq	33570	mol^0
HCl - Vap	0.12142	mol^0
HF2-1	2.1685	mol^0
HF - Aq	1.60E-04	mol^0
HF - Vap	379.93	mol^0
HNO3 - Aq	4.002	mol^0
HNO3 - Va	920.44	mol^0
KHCO3	7.7419	mol^0
KHSO4 - A	15.597	mol^0
KHSO4	14.067	mol^0
K2CO3	2870	mol^0
K2CO3.1.5	2055.7	mol^0
KCl - Aq	26.966	mol^0
KCl	18.598	mol^0
KF	54667	mol^0
KF.2H2O	1732.1	mol^0
KF.4H2O	6.69E+09	mol^0
KOH	3.85E+08	mol^0
KOH.2H2O	7614.8	mol^0
KOH.1H2O	23065	mol^0
KNO3	3.2319	mol^0
K2SO4	0.02665	mol^0
KSO4-1	0.067735	mol^0
K2SO4.1H	0.087869	mol^0
NaHCO3 -	0.52509	mol^0
NaHCO3	0.65701	mol^0
NaHSO4	376.35	mol^0
Na2CO3	1.318	mol^0
Na2CO3.1	0.23607	mol^0
Na2CO3.7	1.3745	mol^0
NaCO3-1	0.7632	mol^0
Na2CO3.1	0.91296	mol^0
NaCl	35.618	mol^0
NaF - Aq	1.197	mol^0
NaF	0.31449	mol^0
NaF.Na2S	3.16E-03	mol^0
NaHF2	0.051038	mol^0
NaOH	1.94E+05	mol^0
NaOH.1H2	16297	mol^0
NaNO3 - A	4.5867	mol^0
NaNO3	56.88	mol^0

Potassium	1.95E-11	0	33.000	°C	inside range		
Sodium bis	1.60E-11	data valid t			inside range		
Sodium hyd	3.26E-12	12	60.000	°C	inside range		
Sodium sul	4.53E-14	0	82.500	°C	inside range		
Potassium	6.61E-19	data valid t			inside range		

Species Output (True Species)

	Total g	Aqueous mol/kg H2O	Vapor mol	Solid mol	2nd Liquid n/a	
H2O	1000	55.508	0	0	0	0
KCl	3.32E-03	4.45E-05	0	0	0	0
NaNO3	0.1086	1.28E-03	0	0	0	0
NaF	0.38834	9.25E-03	0	0	0	0
(HF)2	7.00E-16	1.75E-17	0	0	0	0
HCl	3.62E-14	9.93E-16	0	0	0	0
HF	1.75E-05	8.75E-07	0	0	0	0
HNO3	2.58E-09	4.10E-11	0	0	0	0
KHSO4	2.04E-09	1.50E-11	0	0	0	0
SO3	9.97E-29	1.25E-30	0	0	0	0
H2SO4	9.27E-25	9.45E-27	0	0	0	0
HSO4-1	2.63E-06	2.71E-08	0	0	0	0
Cl-1	6.3684	0.17963	0	0	0	0
Na2F+1	3.85E-03	5.93E-05	0	0	0	0
F-1	1.2317	0.064831	0	0	0	0
HF2-1	5.64E-07	1.50E-08	0	0	0	0
H+1	2.14E-08	2.13E-08	0	0	0	0
OH-1	1.60E-05	9.38E-07	0	0	0	0
NO3-1	6.3106	0.10178	0	0	0	0
K+1	3.0947	0.079153	0	0	0	0
KSO4-1	1.0294	7.62E-03	0	0	0	0
Na+1	11.41	0.4963	0	0	0	0
NaSO4-1	6.4814	0.054441	0	0	0	0
SO4-2	8.0319	0.08361	0	0	0	0

Molecular Output (Apparent Species)

	Total g	Aqueous mol/kg H2O	Vapor mol	Solid mol	2nd Liquid n/a	
H2O	993.53	55.149	0	0	0	0
KCl	0.9448	0.012673	0	0	0	0
NaNO3	4.7929	0.05639	0	0	0	0
NaOH	20.198	0.505	0	0	0	0
HCl	6.089	0.167	0	0	0	0
HNO3	2.9404	0.046683	0	0	0	0
KF	4.3073	0.07414	0	0	0	0
SO3	11.663	0.14567	0	0	0	0

Element Balance

	Total mol	Aqueous mol	Vapor mol	Solid mol	2nd Liquid n/a	
C(+4)	0	0	0	0	0	0
CL(-1)	0	0.17967	0	0	0	0
F(-1)	0	0.07414	0	0	0	0
H(+1)	0	111.02	0	0	0	0
K(+1)	0	0.096813	0	0	0	0
N(+5)	0	0.10305	0	0	0	0
NA(+1)	0	0.56139	0	0	0	0
O(-2)	0	56.4	0	0	0	0
S(+6)	0	0.14567	0	0	0	0

Species Activity Coefficients

H2O	0.98256	Activity
HCO3-1	0.80717	Act-Coef
HSO4-1	0.86359	Act-Coef
CO2 - Aq	1.099	Act-Coef
CO3-2	0.14195	Act-Coef
Cl-1	0.86908	Act-Coef
Na2F+1	0.59007	Act-Coef
F-1	0.63556	Act-Coef
(HF)2 - Aq	1.0991	Act-Coef
HCl - Aq	1.0991	Act-Coef
HF2-1	0.86359	Act-Coef
HF - Aq	1.1365	Act-Coef
H+1	0.7	Act-Coef
OH-1	0.7138	Act-Coef
NO3-1	0.8241	Act-Coef
HNO3 - Aq	1.1498	Act-Coef
KHSO4 - A	1.0991	Act-Coef
KCl - Aq	1.0991	Act-Coef
K+1	0.80172	Act-Coef
KSO4-1	0.59968	Act-Coef
NaHCO3 -	1.0991	Act-Coef
NaCO3-1	0.85296	Act-Coef
NaF - Aq	1.0991	Act-Coef
Na+1	0.64152	Act-Coef
NaNO3 - A	0.90905	Act-Coef
NaSO4-1	0.61777	Act-Coef
SO4-2	0.15172	Act-Coef
SO3 - Aq	1.0991	Act-Coef
H2SO4 - A	1.0991	Act-Coef
H2O - Vap	1	Fug-Coef
CO2 - Vap	1	Fug-Coef
(HF)2 - Vaj	1	Fug-Coef
HCl - Vap	1	Fug-Coef
HF - Vap	1	Fug-Coef
HNO3 - Va	1	Fug-Coef
SO3 - Vap	1	Fug-Coef
H2SO4 - V	1	Fug-Coef

Species K(eq)-Values

H2O	1.01E-14	mol^0
H2O - Vap	31.857	mol^0
HCO3-1	4.70E-11	mol^0
HSO4-1	0.010515	mol^0
CO2 - Aq	4.54E-07	mol^0
CO2 - Vap	0.03392	mol^0
Na2F+1	92.494	mol^0
K2SO4.KN	9.29E-05	mol^0
2Na2SO4.I	3.44E-03	mol^0
(HF)2 - Aq	51387	mol^0
(HF)2 - Vaj	19124	mol^0
HCl - Aq	1.69E+06	mol^0
HCl - Vap	0.92796	mol^0
HF2-1	4.1247	mol^0
HF - Aq	6.17E-04	mol^0
HF - Vap	19019	mol^0
HNO3 - Aq	20.065	mol^0
HNO3 - Va	1.40E+05	mol^0
KHCO3	1.8452	mol^0

Sodium hyd	2.60E-10	12	60.000	°C	inside range		
Potassium	3.17E-12	data valid t			inside range		
Sodium bis	2.00E-13	data valid t			inside range		
Sodium sul	5.68E-16	0	82.500	°C	inside range		
Potassium	5.28E-17	data valid t			inside range		

Species Output (True Species)

	Total g	Aqueous mol/kg H2O	Vapor mol	Solid mol	2nd Liquid n/a	
H2O	1000	55.508	0	0	0	0
KCl	3.32E-03	4.45E-05	0	0	0	0
NaNO3	0.10861	1.28E-03	0	0	0	0
NaF	0.38839	9.25E-03	0	0	0	0
(HF)2	1.09E-19	2.73E-21	0	0	0	0
HCl	4.53E-15	1.24E-17	0	0	0	0
HF	2.19E-07	1.09E-08	0	0	0	0
HNO3	3.23E-11	5.12E-13	0	0	0	0
KHSO4	2.55E-11	1.87E-13	0	0	0	0
SO3	1.56E-32	1.95E-34	0	0	0	0
H2SO4	1.45E-28	1.48E-30	0	0	0	0
HSO4-1	3.28E-08	3.38E-10	0	0	0	0
Cl-1	6.3684	0.17963	0	0	0	0
Na2F+1	3.85E-03	5.93E-05	0	0	0	0
F-1	1.2317	0.064831	0	0	0	0
HF2-1	7.30E-09	1.87E-10	0	0	0	0
H+1	2.68E-10	2.66E-10	0	0	0	0
OH-1	1.28E-03	7.50E-05	0	0	0	0
NO3-1	6.3106	0.10178	0	0	0	0
K+1	3.0947	0.079153	0	0	0	0
KSO4-1	1.0294	7.62E-03	0	0	0	0
Na+1	11.412	0.49637	0	0	0	0
NaSO4-1	6.4819	0.054446	0	0	0	0
SO4-2	8.0315	0.083606	0	0	0	0

Molecular Output (Apparent Species)

	Total g	Aqueous mol/kg H2O	Vapor mol	Solid mol	2nd Liquid n/a	
H2O	993.53	55.149	0	0	0	0
KCl	0.9448	0.012673	0	0	0	0
NaNO3	4.7889	0.056343	0	0	0	0
NaOH	20.203	0.50512	0	0	0	0
HCl	6.089	0.167	0	0	0	0
HNO3	2.9434	0.04671	0	0	0	0
KF	4.3073	0.07414	0	0	0	0
SO3	11.663	0.14567	0	0	0	0

Element Balance

	Total mol	Aqueous mol	Vapor mol	Solid mol	2nd Liquid n/a	
C(+4)	0	0	0	0	0	0
CL(-1)	0	0.17967	0	0	0	0
F(-1)	0	0.07414	0	0	0	0
H(+1)	0	111.02	0	0	0	0
K(+1)	0	0.096813	0	0	0	0
N(+5)	0	0.10305	0	0	0	0
NA(+1)	0	0.56147	0	0	0	0
O(-2)	0	56.4	0	0	0	0
S(+6)	0	0.14567	0	0	0	0

Species Activity Coefficients

H2O	0.98255	Activity
HCO3-1	0.80717	Act-Coef
HSO4-1	0.86359	Act-Coef
CO2 - Aq	1.0991	Act-Coef
CO3-2	0.14195	Act-Coef
Cl-1	0.86908	Act-Coef
Na2F+1	0.59006	Act-Coef
F-1	0.63555	Act-Coef
(HF)2 - Aq	1.0991	Act-Coef
HCl - Aq	1.0991	Act-Coef
HF2-1	0.86359	Act-Coef
HF - Aq	1.1365	Act-Coef
H+1	0.69999	Act-Coef
OH-1	0.71381	Act-Coef
NO3-1	0.82409	Act-Coef
HNO3 - Aq	1.1498	Act-Coef
KHSO4 - A	1.0991	Act-Coef
KCl - Aq	1.0991	Act-Coef
K+1	0.80172	Act-Coef
KSO4-1	0.59967	Act-Coef
NaHCO3 -	1.0991	Act-Coef
NaCO3-1	0.85296	Act-Coef
NaF - Aq	1.0991	Act-Coef
Na+1	0.64152	Act-Coef
NaNO3 - A	0.90904	Act-Coef
NaSO4-1	0.61775	Act-Coef
SO4-2	0.15172	Act-Coef
SO3 - Aq	1.0991	Act-Coef
H2SO4 - A	1.0991	Act-Coef
H2O - Vap	1	Fug-Coef
CO2 - Vap	1	Fug-Coef
(HF)2 - Vaj	1	Fug-Coef
HCl - Vap	1	Fug-Coef
HF - Vap	1	Fug-Coef
HNO3 - Va	1	Fug-Coef
SO3 - Vap	1	Fug-Coef
H2SO4 - V	1	Fug-Coef

Species K(eq)-Values

H2O	1.01E-14	mol^0
H2O - Vap	31.857	mol^0
HCO3-1	4.70E-11	mol^0
HSO4-1	0.010515	mol^0
CO2 - Aq	4.54E-07	mol^0
CO2 - Vap	0.03392	mol^0
Na2F+1	92.494	mol^0
K2SO4.KN	9.29E-05	mol^0
2Na2SO4.I	3.44E-03	mol^0
(HF)2 - Aq	51387	mol^0
(HF)2 - Vaj	19124	mol^0
HCl - Aq	1.69E+06	mol^0
HCl - Vap	0.92796	mol^0
HF2-1	4.1247	mol^0
HF - Aq	6.17E-04	mol^0
HF - Vap	19019	mol^0
HNO3 - Aq	20.065	mol^0
HNO3 - Va	1.40E+05	mol^0
KHCO3	1.8452	mol^0

Potassium	5.06E-15	data valid t			inside range		
Ionic Stren	0.71561	mol/kg H2O				SCW13, 9	
Species Output (True Species)						SCW13, 9	

	Total g	Aqueous mol/kg H2O	Vapor mol	Solid mol		
H2O	1000	55.508	0	0		
KCl	0.013443	1.80E-04	0	0		
NaNO3	0.38414	4.52E-03	0	0		
NaF	0.38003	9.05E-03	0	0		
(HF)2	4.13E-14	1.03E-15	0	0		
HCl	1.22E-12	3.34E-14	0	0		
HF	3.98E-05	1.99E-06	0	0		
HNO3	7.63E-09	1.21E-10	0	0		
KHSO4	3.21E-06	2.36E-10	0	0		
SO3	1.13E-27	1.41E-29	0	0		
H2SO4	2.60E-24	2.86E-26	0	0		
HSO4-1	1.55E-05	1.60E-07	0	0		
Cl-1	6.3636	0.17949	0	0		
Na2F+1	0.010927	1.68E-04	0	0		
F-1	1.2334	0.064919	0	0		
HF2-1	2.62E-06	6.72E-08	0	0		
H+1	1.48E-08	1.47E-08	0	0		
OH-1	1.31E-03	7.72E-05	0	0		
NO3-1	6.1098	0.098534	0	0		
K+1	2.8667	0.073321	0	0		
KSO4-1	1.7993	0.013312	0	0		
Na+1	12.154	0.52866	0	0		
NaSO4-1	2.2497	0.018896	0	0		
SO4-2	10.899	0.11346	0	0		

Molecular Output (Apparent Species)

	Total g	Aqueous mol/kg H2O	Vapor mol	Solid mol		
H2O	993.37	55.14	0	0		
KCl	0.9448	0.012673	0	0		
NaNO3	4.0391	0.047521	0	0		
NaOH	20.566	0.51394	0	0		
HCl	6.089	0.167	0	0		
HNO3	3.4992	0.055532	0	0		
KF	4.3073	0.07414	0	0		
SO3	11.663	0.14567	0	0		

Element Balance

	Total mol	Aqueous mol	Vapor mol	Solid mol		
C(+4)	0	0	0	0		
CL(-1)	0	0.17967	0	0		
F(-1)	0	0.07414	0	0		
H(+1)	0	111.02	0	0		
K(+1)	0	0.096813	0	0		
N(+5)	0	0.10305	0	0		
NA(+1)	0	0.56147	0	0		
O(-2)	0	56.4	0	0		
S(+6)	0	0.14567	0	0		

Species Activity Coefficients

H2O	0.98248	Activity
HCO3-1	0.5843	Act-Coef
HSO4-1	0.80808	Act-Coef
CO2 - Aq	1.0922	Act-Coef
CO3-2	0.10791	Act-Coef
Cl-1	0.71356	Act-Coef
Na2F+1	0.53719	Act-Coef
F-1	0.58858	Act-Coef
(HF)2 - Aq	1.1048	Act-Coef
HCl - Aq	1.1048	Act-Coef
HF2-1	0.80808	Act-Coef
HF - Aq	1.1604	Act-Coef
H+1	0.65825	Act-Coef
OH-1	0.80282	Act-Coef
NO3-1	0.59279	Act-Coef
HNO3 - Aq	1.1659	Act-Coef
KHSO4 - A	1.1048	Act-Coef
KCl - Aq	1.1048	Act-Coef
K+1	0.57248	Act-Coef
KSO4-1	0.54514	Act-Coef
NaHCO3 -	1.1048	Act-Coef
NaCO3-1	0.59722	Act-Coef
NaF - Aq	1.1048	Act-Coef
Na+1	0.59255	Act-Coef
NaNO3 - A	0.88852	Act-Coef
NaSO4-1	2.1569	Act-Coef
SO4-2	0.10321	Act-Coef
SO3 - Aq	1.1048	Act-Coef
H2SO4 - A	1.1048	Act-Coef
H2O - Vap	1	Fug-Coef
CO2 - Vap	1	Fug-Coef
(HF)2 - Vaj	1	Fug-Coef
HCl - Vap	1	Fug-Coef
HF - Vap	1	Fug-Coef
HNO3 - Va	1	Fug-Coef
SO3 - Vap	1	Fug-Coef
H2SO4 - V	1	Fug-Coef

Species K(eq)-Values

H2O	4.59E-13	mol^0
H2O - Vap	1.2097	mol^0
HCO3-1	8.22E-11	mol^0
HSO4-1	1.17E-03	mol^0
CO2 - Aq	4.31E-07	mol^0
CO2 - Vap	0.011137	mol^0
Na2F+1	34.675	mol^0
K2SO4.KN	5.51E-05	mol^0
2Na2SO4.I	1.71E-05	mol^0
(HF)2 - Aq	4686.1	mol^0
(HF)2 - Vaj	499.84	mol^0
HCl - Aq	33570	mol^0
HCl - Vap	0.12142	mol^0
HF2-1	2.1685	mol^0
HF - Aq	1.60E-04	mol^0
HF - Vap	379.93	mol^0
HNO3 - Aq	4.002	mol^0
HNO3 - Va	920.44	mol^0
KHCO3	7.7419	mol^0
KHSO4 - A	15.597	mol^0
KHSO4	14.067	mol^0
K2CO3	2870	mol^0
K2CO3.1.5	2055.7	mol^0

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Na2SO4	0.14445 mol^0
Na2SO4	2.13E-03 mol^0
Na2SO4.N	155.99 mol^0
Na2SO4.1(	26.308 mol^0
NaSO4-1	0.090006 mol^0
SO3 - Aq	1922.2 mol^0
SO3 - Vap	78679 mol^0
H2SO4 - A	3.19E+10 mol^0
H2SO4 - V	248.07 mol^0

Species Mobilities

Cl-1	1.62E-03 m2/ohm-mol
H+1	6.03E-03 m2/ohm-mol
OH-1	3.50E-03 m2/ohm-mol
NO3-1	1.45E-03 m2/ohm-mol
Na+1	1.18E-03 m2/ohm-mol

Species Self Diffusivities

H2O	7.73E-09 m2/s
HCO3-1	3.92E-09 m2/s
HSO4-1	4.18E-09 m2/s
CO2 - Aq	6.73E-09 m2/s
CO3-2	3.49E-09 m2/s
Cl-1	6.18E-09 m2/s
Na2F+1	5.57E-09 m2/s
F-1	4.90E-09 m2/s
(HF)2 - Aq	4.05E-09 m2/s
HCl - Aq	6.46E-09 m2/s
HF2-1	6.90E-09 m2/s
HF - Aq	4.67E-10 m2/s
H+1	1.83E-08 m2/s
OH-1	1.29E-08 m2/s
NO3-1	5.55E-09 m2/s
HNO3 - Aq	5.81E-09 m2/s
KHSO4 - A	5.51E-09 m2/s
KCl - Aq	5.01E-09 m2/s
K+1	5.77E-09 m2/s
KSO4-1	3.33E-09 m2/s
NaHCO3 -	3.45E-09 m2/s
NaCO3-1	3.08E-09 m2/s
NaF - Aq	3.88E-09 m2/s
Na+1	4.46E-09 m2/s
NaNO3 - A	4.07E-09 m2/s
NaSO4-1	3.12E-09 m2/s
SO4-2	3.56E-09 m2/s
SO3 - Aq	3.98E-10 m2/s
H2SO4 - A	3.89E-09 m2/s

KHSO4 - A	51.933 mol^0
KHSO4	3.3683 mol^0
K2CO3	54473 mol^0
K2CO3.1.5	859.86 mol^0
KCl - Aq	120.41 mol^0
KCl	7.5444 mol^0
KF	7251.8 mol^0
KF.2H2O	395.98 mol^0
KF.4H2O	63.719 mol^0
KOH	4.83E+10 mol^0
KOH.2H2O	1572.6 mol^0
KOH.1H2O	17545 mol^0
KNO3	0.78972 mol^0
K2SO4	0.011589 mol^0
KSO4-1	0.13228 mol^0
K2SO4.1H	0.010377 mol^0
NaHCO3 -	2.389 mol^0
NaHCO3	0.40374 mol^0
NaHSO4	356.65 mol^0
Na2CO3	7.3005 mol^0
Na2CO3.1(	0.11036 mol^0
Na2CO3.7	0.22354 mol^0
NaCO3-1	0.28348 mol^0
Na2CO3.1	1.0111 mol^0
NaCl	38.197 mol^0
NaF - Aq	1.2906 mol^0
NaF	0.2625 mol^0
NaF.Na2Si	3.18E-03 mol^0
NaHF2	7.28E-03 mol^0
NaOH	8.05E+06 mol^0
NaOH.1H2	84322 mol^0
NaNO3 - A	17.412 mol^0
NaNO3	28.746 mol^0
Na2SO4	0.44942 mol^0
Na2SO4	1.90E-07 mol^0
Na2SO4.N	162.44 mol^0
Na2SO4.1(	0.046844 mol^0
NaSO4-1	0.12009 mol^0
SO3 - Aq	7726 mol^0
SO3 - Vap	1.64E+09 mol^0
H2SO4 - A	2.57E+10 mol^0
H2SO4 - V	3.86E+06 mol^0

Species Mobilities

HSO4-1	3.52E-04 m2/ohm-mol
Cl-1	5.25E-04 m2/ohm-mol
Na2F+1	4.12E-04 m2/ohm-mol
F-1	3.78E-04 m2/ohm-mol
HF2-1	5.15E-04 m2/ohm-mol
H+1	2.40E-03 m2/ohm-mol
OH-1	1.35E-03 m2/ohm-mol
NO3-1	4.90E-04 m2/ohm-mol
K+1	5.03E-04 m2/ohm-mol
KSO4-1	2.62E-04 m2/ohm-mol
Na+1	3.44E-04 m2/ohm-mol
NaSO4-1	2.40E-04 m2/ohm-mol
SO4-2	5.52E-04 m2/ohm-mol

Species Self Diffusivities

H2O	2.18E-09 m2/s
HCO3-1	1.08E-09 m2/s
HSO4-1	1.23E-09 m2/s
CO2 - Aq	1.82E-09 m2/s
CO3-2	9.00E-10 m2/s
Cl-1	1.83E-09 m2/s
Na2F+1	1.44E-09 m2/s
F-1	1.33E-09 m2/s
(HF)2 - Aq	1.10E-09 m2/s
HCl - Aq	1.91E-09 m2/s
HF2-1	1.79E-09 m2/s
HF - Aq	1.20E-10 m2/s
H+1	8.03E-09 m2/s
OH-1	4.59E-09 m2/s
NO3-1	1.71E-09 m2/s
HNO3 - Aq	1.79E-09 m2/s
KHSO4 - A	1.41E-09 m2/s
KCl - Aq	1.52E-09 m2/s
K+1	1.76E-09 m2/s
KSO4-1	9.25E-10 m2/s
NaHCO3 -	9.36E-10 m2/s
NaCO3-1	8.05E-10 m2/s
NaF - Aq	1.04E-09 m2/s
Na+1	1.22E-09 m2/s
NaNO3 - A	1.14E-09 m2/s
NaSO4-1	8.50E-10 m2/s
SO4-2	9.73E-10 m2/s
SO3 - Aq	1.02E-10 m2/s
H2SO4 - A	1.01E-09 m2/s

KHSO4 - A	51.933 mol^0
KHSO4	3.3683 mol^0
K2CO3	54473 mol^0
K2CO3.1.5	859.86 mol^0
KCl - Aq	120.41 mol^0
KCl	7.5444 mol^0
KF	7251.8 mol^0
KF.2H2O	395.98 mol^0
KF.4H2O	63.719 mol^0
KOH	4.83E+10 mol^0
KOH.2H2O	1572.6 mol^0
KOH.1H2O	17545 mol^0
KNO3	0.78972 mol^0
K2SO4	0.011589 mol^0
KSO4-1	0.13228 mol^0
K2SO4.1H	0.010377 mol^0
NaHCO3 -	2.389 mol^0
NaHCO3	0.40374 mol^0
NaHSO4	356.65 mol^0
Na2CO3	7.3005 mol^0
Na2CO3.1(	0.11036 mol^0
Na2CO3.7	0.22354 mol^0
NaCO3-1	0.28348 mol^0
Na2CO3.1	1.0111 mol^0
NaCl	38.197 mol^0
NaF - Aq	1.2906 mol^0
NaF	0.2625 mol^0
NaF.Na2Si	3.18E-03 mol^0
NaHF2	7.28E-03 mol^0
NaOH	8.05E+06 mol^0
NaOH.1H2	84322 mol^0
NaNO3 - A	17.412 mol^0
NaNO3	28.746 mol^0
Na2SO4	0.44942 mol^0
Na2SO4	1.90E-07 mol^0
Na2SO4.N	162.44 mol^0
Na2SO4.1(	0.046844 mol^0
NaSO4-1	0.12009 mol^0
SO3 - Aq	7726 mol^0
SO3 - Vap	1.64E+09 mol^0
H2SO4 - A	2.57E+10 mol^0
H2SO4 - V	3.86E+06 mol^0

Species Mobilities

HSO4-1	3.52E-04 m2/ohm-mol
Cl-1	5.25E-04 m2/ohm-mol
Na2F+1	4.12E-04 m2/ohm-mol
F-1	3.78E-04 m2/ohm-mol
HF2-1	5.15E-04 m2/ohm-mol
H+1	2.40E-03 m2/ohm-mol
OH-1	1.35E-03 m2/ohm-mol
NO3-1	4.90E-04 m2/ohm-mol
K+1	5.03E-04 m2/ohm-mol
KSO4-1	2.62E-04 m2/ohm-mol
Na+1	3.44E-04 m2/ohm-mol
NaSO4-1	2.40E-04 m2/ohm-mol
SO4-2	5.52E-04 m2/ohm-mol

Species Self Diffusivities

H2O	2.18E-09 m2/s
HCO3-1	1.08E-09 m2/s
HSO4-1	1.23E-09 m2/s
CO2 - Aq	1.82E-09 m2/s
CO3-2	9.00E-10 m2/s
Cl-1	1.83E-09 m2/s
Na2F+1	1.44E-09 m2/s
F-1	1.33E-09 m2/s
(HF)2 - Aq	1.10E-09 m2/s
HCl - Aq	1.91E-09 m2/s
HF2-1	1.79E-09 m2/s
HF - Aq	1.20E-10 m2/s
H+1	8.03E-09 m2/s
OH-1	4.59E-09 m2/s
NO3-1	1.71E-09 m2/s
HNO3 - Aq	1.79E-09 m2/s
KHSO4 - A	1.41E-09 m2/s
KCl - Aq	1.52E-09 m2/s
K+1	1.76E-09 m2/s
KSO4-1	9.25E-10 m2/s
NaHCO3 -	9.36E-10 m2/s
NaCO3-1	8.05E-10 m2/s
NaF - Aq	1.04E-09 m2/s
Na+1	1.22E-09 m2/s
NaNO3 - A	1.14E-09 m2/s
NaSO4-1	8.50E-10 m2/s
SO4-2	9.73E-10 m2/s
SO3 - Aq	1.02E-10 m2/s
H2SO4 - A	1.01E-09 m2/s

KCl - Aq	26.986 mol^0
KCl	16.596 mol^0
KF	54667 mol^0
KF.2H2O	1732.1 mol^0
KF.4H2O	6.69E+09 mol^0
KOH	3.85E+08 mol^0
KOH.2H2O	7614.8 mol^0
KOH.1H2O	23065 mol^0
KNO3	3.2319 mol^0
K2SO4	0.02885 mol^0
KSO4-1	0.087733 mol^0
K2SO4.1H	0.067869 mol^0
NaHCO3 -	0.52509 mol^0
NaHCO3	0.65701 mol^0
NaHSO4	376.35 mol^0
Na2CO3	1.316 mol^0
Na2CO3.1(	0.23607 mol^0
Na2CO3.7	1.3745 mol^0
NaCO3-1	0.7632 mol^0
Na2CO3.1	0.91298 mol^0
NaCl	36.518 mol^0
NaF - Aq	1.197 mol^0
NaF	0.31449 mol^0
NaF.Na2Si	3.18E-03 mol^0
NaHF2	0.051038 mol^0
NaOH	1.94E+05 mol^0
NaOH.1H2	16297 mol^0
NaNO3 - A	4.5867 mol^0
NaNO3	56.88 mol^0
Na2SO4	0.14445 mol^0
Na2SO4	2.13E-03 mol^0
Na2SO4.N	155.99 mol^0
Na2SO4.1(	26.308 mol^0
NaSO4-1	0.090006 mol^0
SO3 - Aq	1922.2 mol^0
SO3 - Vap	78679 mol^0
H2SO4 - A	3.19E+10 mol^0
H2SO4 - V	248.07 mol^0

Species Mobilities

HSO4-1	8.60E-04 m2/ohm-mol
Cl-1	1.28E-03 m2/ohm-mol
Na2F+1	1.18E-03 m2/ohm-mol
F-1	1.01E-03 m2/ohm-mol
HF2-1	1.44E-03 m2/ohm-mol
H+1	3.98E-03 m2/ohm-mol
OH-1	2.77E-03 m2/ohm-mol
NO3-1	1.15E-03 m2/ohm-mol
K+1	1.20E-03 m2/ohm-mol
KSO4-1	6.81E-04 m2/ohm-mol
Na+1	9.19E-04 m2/ohm-mol
NaSO4-1	6.37E-04 m2/ohm-mol
SO4-2	1.46E-03 m2/ohm-mol

Species Self Diffusivities

H2O	7.43E-09 m2/s
HCO3-1	3.76E-09 m2/s
HSO4-1	3.99E-09 m2/s
CO2 - Aq	6.47E-09 m2/s
CO3-2	3.33E-09 m2/s
Cl-1	5.90E-09 m2/s
Na2F+1	5.32E-09 m2/s
F-1	4.70E-09 m2/s
(HF)2 - Aq	3.89E-09 m2/s
HCl - Aq	6.20E-09 m2/s
HF2-1	6.61E-09 m2/s
HF - Aq	4.49E-10 m2/s
H+1	1.77E-08 m2/s
OH-1	1.24E-08 m2/s
NO3-1	5.31E-09 m2/s
HNO3 - Aq	5.57E-09 m2/s
KHSO4 - A	5.27E-09 m2/s
KCl - Aq	4.88E-09 m2/s
K+1	5.53E-09 m2/s
KSO4-1	3.18E-09 m2/s
NaHCO3 -	3.30E-09 m2/s
NaCO3-1	2.94E-09 m2/s
NaF - Aq	3.71E-09 m2/s
Na+1	4.29E-09 m2/s
NaNO3 - A	3.90E-09 m2/s
NaSO4-1	2.98E-09 m2/s
SO4-2	3.40E-09 m2/s
SO3 - Aq	3.81E-10 m2/s
H2SO4 - A	3.53E-09 m2/s

K. T. Chiang

12/19/04

SCW14

Calculation Summary

SinglePoint1 Calculation for Work1

Automatic Chemistry Model
Databanks:
Public

Unit Set: Default

Isothermal Calculation
Temperatu 25 °C
Pressure 1 atm

Stream Inflows

Water	500 g
Sodium chl	0 g
Potassium	0 g
Sodium nitr	0 g
Sodium sul	0 g
Sodium bic	48.171 g
Sodium flu	0 g
Sodium hyc	0 g

Speciation Summary

Total number of species 113

Second Liquid Spe	User Inflows	Related Inflows	Aqueous Species	Vapor Species	Solid Species	Second Liquid Spe
laSO4	H2O	CO2	H2O	H2O - Vap	K2SO4.KNaSO4	
Na2CO3	NaCl	H2CO3	HCO3-1	CO2 - Vap	2Na2SO4.Na2CO3	
	KCl	K2SO4.KN	HSO4-1	(HF)2 - Vap	KHCO3	
	NaNO3	2Na2SO4.I	CO2 - Aq	HCl - Vap	KHSO4	
	Na2SO4	(HF)2	CO3-2	HF - Vap	K2CO3	
3H2O	NaHCO3	HCl	Cl-1	HNO3 - Va	K2CO3.1.5H2O	
	NaF	HF	Na2F+1	SO3 - Vap	KCl	
	NaOH	(HF)6	F-1	H2SO4 - V	KF	
		HNO3	(HF)2 - Aq		KF.2H2O	
		KHCO3	HCl - Aq		KF.4H2O	
		KHSO4	HF2-1		KOH	
)		K2CO3	HF - Aq		KOH.2H2O	
)		K2CO3.1.5	H+1		KOH.1H2O	
		KF	OH-1		KNO3	
		KF.2H2O	NO3-1		K2SO4	
l2O		KF.4H2O	HNO3 - Aq		K2SO4.1H2O	
		KOH	KHSO4 - Aq		NaHCO3	
		KOH.2H2O	KCl - Aq		NaHSO4	
		KOH.1H2O	K+1		Na2CO3	
0H2O		KNO3	KSO4-1		Na2CO3.10H2O	
H2O		K2SO4	NaHCO3 - Aq		Na2CO3.7H2O	
H2O		K2SO4.1H	NaCO3-1		Na2CO3.1H2O	
		NaHSO4	NaF - Aq		NaCl	
		Na2CO3	Na+1		NaF	
O4		Na2CO3.1	NaNO3 - Aq		NaF.Na2SO4	
		Na2CO3.7	NaSO4-1		NaHF2	
		Na2CO3.1	SO4-2		NaOH	
:O		NaF.Na2S	SO3 - Aq		NaOH.1H2O	
		NaHF2	H2SO4 - Aq		NaNO3	
		NaOH.1H2O			Na2SO4	
		Na2SO4			Na2SO4	
laHSO4		Na2SO4.NaHSO4			Na2SO4.NaHSO4	
0H2O		Na2SO4.10H2O			Na2SO4.10H2O	
		SO3				
		H2SO4				

Stream Parameters

Stream Am	548.17	g
Temperatu	25	°C
Pressure	1	atm
pH	7.7622	pH
Ionic Stren	1.0316	mol/kg H2O
Osmotic Pr	46.921	atm
WaterActiv	0.98808	Activity
Electrical C	0.053594	1/ohm
Electrical C	48.511	cm2/ohm-mol
Viscosity, e	1.3359	cP
Viscosity, r	1.4998	cP/cP H2O

2nd Liquid g/ml		Total --	Aqueous g/ml	Vapor g/ml	Solid g/ml	2nd Liquid g/ml
0	Density	--	1.0551	0	0	0

2nd Liquid cal		Total cal	Aqueous cal	Vapor cal	Solid cal	2nd Liquid cal
0	Enthalpy	-2.02E+06	-2.02E+06	0	0	0

Total and Phase Flows (Amounts)

2nd Liquid mol		Total mol	Aqueous mol	Vapor mol	Solid mol	2nd Liquid mol
0	Mole	28.846	28.846	0	0	0

2nd Liquid g		Total g	Aqueous g	Vapor g	Solid g	2nd Liquid g
0	Mass	548.17	548.17	0	0	0

2nd Liquid L		Total L	Aqueous L	Vapor L	Solid L	2nd Liquid L
0	Volume	0.51903	0.51903	0	0	0

Scaling Tendencies

solids withi Temperature Range

Sodium bic	0.85576	0	200.00	°C	inside range
Sodium car	3.60E-03	0	32.000	°C	inside range
Sodium hyc	5.09E-12	12	80.000	°C	inside range

Species Output (True Species)

	Total g	Aqueous mol/kg H2O	Vapor mol	Solid mol	2nd Liquid n/a
H2O	500.18	55.508	0	0	0
NaHCO3	5.2283	0.12443	0	0	0
CO2	0.43118	0.019587	0	0	0

Calculation Summary

SinglePoint_NaOH Calculation for Work1

Automatic Chemistry Model
Databanks:
Public

Unit Set: Default

Isothermal Calculation
Temperatu 25 °C
Pressure 1 atm

Stream Inflows

Water	500 g
Sodium chl	0 g
Potassium	0 g
Sodium nitr	0 g
Sodium sul	0 g
Sodium bic	48.171 g
Sodium flu	0 g
Sodium hyc	2.5 g

Speciation Summary

Total number of species 113

User Inflows	Related Inflows	Aqueous Species	Vapor Species	Solid Species	Second Liquid Spe
H2O	CO2	H2O	H2O - Vap	K2SO4.KNaSO4	
NaCl	H2CO3	HCO3-1	CO2 - Vap	2Na2SO4.Na2CO3	
KCl	K2SO4.KN	HSO4-1	(HF)2 - Vap	KHCO3	
NaNO3	2Na2SO4.I	CO2 - Aq	HCl - Vap	KHSO4	
Na2SO4	(HF)2	CO3-2	HF - Vap	K2CO3	
NaHCO3	HCl	Cl-1	HNO3 - Va	K2CO3.1.5H2O	
NaF	HF	Na2F+1	SO3 - Vap	KCl	
NaOH	(HF)6	F-1	H2SO4 - V	KF	
	HNO3	(HF)2 - Aq		KF.2H2O	
	KHCO3	HCl - Aq		KF.4H2O	
	KHSO4	HF2-1		KOH	
	K2CO3	HF - Aq		KOH.2H2O	
	K2CO3.1.5	H+1		KOH.1H2O	
	KF	OH-1		KNO3	
	KF.2H2O	NO3-1		K2SO4	
	KF.4H2O	HNO3 - Aq		K2SO4.1H2O	
	KOH	KHSO4 - Aq		NaHCO3	
	KOH.2H2O	KCl - Aq		NaHSO4	
	KOH.1H2O	K+1		Na2CO3	
	KNO3	KSO4-1		Na2CO3.10H2O	
	K2SO4	NaHCO3 - Aq		Na2CO3.7H2O	
	K2SO4.1H	NaCO3-1		Na2CO3.1H2O	
	NaHSO4	NaF - Aq		NaCl	
	Na2CO3	Na+1		NaF	
	Na2CO3.1	NaNO3 - Aq		NaF.Na2SO4	
	Na2CO3.7	NaSO4-1		NaHF2	
	Na2CO3.1	SO4-2		NaOH	
	NaF.Na2S	SO3 - Aq		NaOH.1H2O	
	NaHF2	H2SO4 - Aq		NaNO3	
	NaOH.1H2O			Na2SO4	
	Na2SO4			Na2SO4	
	Na2SO4.NaHSO4			Na2SO4.NaHSO4	
	Na2SO4.10H2O			Na2SO4.10H2O	
	SO3				
	H2SO4				

Stream Parameters

Stream Am	550.67	g
Temperatu	25	°C
Pressure	1	atm
pH	8.5791	pH
Ionic Stren	1.2156	mol/kg H2O
Osmotic Pr	47.068	atm
WaterActiv	0.98613	Activity
Electrical C	0.058704	1/ohm
Electrical C	47.877	cm2/ohm-mol
Viscosity, e	1.35	cP
Viscosity, r	1.5158	cP/cP H2O

2nd Liquid g/ml		Total --	Aqueous g/ml	Vapor g/ml	Solid g/ml	2nd Liquid g/ml
0	Density	--	1.0618	0	0	0

2nd Liquid cal		Total cal	Aqueous cal	Vapor cal	Solid cal	2nd Liquid cal
0	Enthalpy	-2.03E+06	-2.03E+06	0	0	0

Total and Phase Flows (Amounts)

2nd Liquid mol		Total mol	Aqueous mol	Vapor mol	Solid mol	2nd Liquid mol
0	Mole	28.953	28.953	0	0	0

2nd Liquid g		Total g	Aqueous g	Vapor g	Solid g	2nd Liquid g
0	Mass	550.67	550.67	0	0	0

2nd Liquid L		Total L	Aqueous L	Vapor L	Solid L	2nd Liquid L
0	Volume	0.51864	0.51864	0	0	0

Scaling Tendencies

solids withi Temperature Range

Sodium bic	0.82441	0	200.00	°C	inside range
Sodium car	0.024594	0	32.000	°C	inside range
Sodium hyc	3.61E-11	12	80.000	°C	inside range

Species Output (True Species)

	Total g	Aqueous mol/kg H2O	Vapor mol	Solid mol	2nd Liquid n/a
H2O	501.15	55.508	0	0	0
NaHCO3	4.9185	0.11683	0	0	0
CO2	0.057274	2.60E-03	0	0	0

Calculation Summary

SinglePoint_NaOH_95oC Calculation for Work1

Automatic Chemistry Model
Databanks:
Public

Unit Set: Default

Isothermal Calculation
Temperatu 95 °C
Pressure 1 atm

Stream Inflows

Water	500 g
Sodium chl	0 g
Potassium	0 g
Sodium nitr	0 g
Sodium sul	0 g
Sodium bic	48.171 g
Sodium flu	0 g
Sodium hyc	2.5 g

Speciation Summary

Total number of species 113

User Inflows	Related Inflows	Aqueous Species	Vapor Species	Solid Species	Second Liquid Spe
H2O	CO2	H2O	H2O - Vap	K2SO4.KNaSO4	
NaCl	H2CO3	HCO3-1	CO2 - Vap	2Na2SO4.Na2CO3	
KCl	K2SO4.KN	HSO4-1	(HF)2 - Vap	KHCO3	
NaNO3	2Na2SO4.I	CO2 - Aq	HCl - Vap	KHSO4	
Na2SO4	(HF)2	CO3-2	HF - Vap	K2CO3	
NaHCO3	HCl	Cl-1	HNO3 - Va	K2CO3.1.5H2O	
NaF	HF	Na2F+1	SO3 - Vap	KCl	
NaOH	(HF)6	F-1	H2SO4 - V	KF	
	HNO3	(HF)2 - Aq		KF.2H2O	
	KHCO3	HCl - Aq		KF.4H2O	
	KHSO4	HF2-1		KOH	
	K2CO3	HF - Aq		KOH.2H2O	
	K2CO3.1.5	H+1		KOH.1H2O	
	KF	OH-1		KNO3	
	KF.2H2O	NO3-1		K2SO4	
	KF.4H2O	HNO3 - Aq		K2SO4.1H2O	
	KOH	KHSO4 - Aq		NaHCO3	
	KOH.2H2O	KCl - Aq		NaHSO4	
	KOH.1H2O	K+1		Na2CO3	
	KNO3	KSO4-1		Na2CO3.10H2O	
	K2SO4	NaHCO3 - Aq		Na2CO3.7H2O	
	K2SO4.1H	NaCO3-1		Na2CO3.1H2O	
	NaHSO4	NaF - Aq		NaCl	
	Na2CO3	Na+1		NaF	
	Na2CO3.1	NaNO3 - Aq		NaF.Na2SO4	
	Na2CO3.7	NaSO4-1		NaHF2	
	Na2CO3.1	SO4-2		NaOH	
	NaF.Na2S	SO3 - Aq		NaOH.1H2O	
	NaHF2	H2SO4 - Aq		NaNO3	
	NaOH.1H2O			Na2SO4	
	Na2SO4			Na2SO4	
	Na2SO4.NaHSO4			Na2SO4.NaHSO4	
	Na2SO4.10H2O			Na2SO4.10H2O	
	SO3				
	H2SO4				

Stream Parameters

Stream Am	550.67	g
Temperatu	95	°C
Pressure	1	atm
pH	8.6008	pH
Ionic Stren	1.0961	mol/kg H2O
Osmotic Pr	50.238	atm
WaterActiv	0.96953	Activity
Electrical C	0.13773	1/ohm
Electrical C	116.12	cm2/ohm-mol
Viscosity, e	0.46123	cP
Viscosity, r	1.5524	cP/cP H2O

SCW14 95C

		Total --	Aqueous g/ml	Vapor g/ml	Solid g/ml	2nd Liquid g/ml
0	Density	--	1.0239	7.67E-04	0	0

		Total cal	Aqueous cal	Vapor cal	Solid cal	2nd Liquid cal
0	Enthalpy	-1.99E+06	-1.99E+06	-4713.9	0	0

Total and Phase Flows (Amounts)

		Total mol	Aqueous mol	Vapor mol	Solid mol	2nd Liquid mol
0	Mole	28.883	28.809	0.073451	0	0

		Total g	Aqueous g	Vapor g	Solid g	2nd Liquid g
0	Mass	550.67	548.98	1.6891	0	0

		Total L	Aqueous L	Vapor L	Solid L	2nd Liquid L
0	Volume	2.739	0.53615	2.2029	0	0

Scaling Tendencies

solids withi Temperature Range

Sodium bic	0.28364	0	200.00	°C	inside range
Sodium car	3.41E-03	36.37	109.00	°C	inside range
pH	8.6008	pH			
Ionic Stren	1.0961	mol/kg H2O			SCW14 95C

Species Output (True Species)

	Total g	Aqueous mol/kg H2O	Vapor mol	Solid mol	2nd Liquid n/a
H2O	501.39	55.508	0.059377	0	0
NaHCO3	12.715	0.30251	0	0	0
CO2	0.65941	1.82E-03	0.014074	0	0
HCO3-1	20.12	0.65907	0	0	0

Calculation Summary

SinglePoint1 Calculation for Work1

Automatic Chemistry Model
Databanks:
Public

Unit Set: Default

Isothermal Calculation
Temperatu 25 °C
Pressure 1 atm

Stream Inflows

Water	500 g
Sodium chl	2.72 g
Potassium	3.241 g
Sodium nitr	4.375 g
Sodium sul	10.348 g
Sodium bic	46.21 g
Sodium flu	1.56 g
Sodium hyc	0 g

Speciation Summary

Total number of species 113

User Inflows	Related Inflows	Aqueous Species	Vapor Species	Solid Species	Second Liquid Spe
H2O	CO2	H2O	H2O - Vap	K2SO4.KNaSO4	
NaCl	H2CO3	HCO3-1	CO2 - Vap	2Na2SO4.Na2CO3	
KCl	K2SO4.KN	HSO4-1	(HF)2 - Vap	KHCO3	
NaNO3	2Na2SO4.I	CO2 - Aq	HCl - Vap	KHSO4	
Na2SO4	(HF)2	CO3-2	HF - Vap	K2CO3	
NaHCO3	HCl	Cl-1	HNO3 - Va	K2CO3.1.5H2O	
NaF	HF	Na2F+1	SO3 - Vap	KCl	
NaOH	(HF)6	F-1	H2SO4 - V	KF	
	HNO3	(HF)2 - Aq		KF.2H2O	
	KHCO3	HCl - Aq		KF.4H2O	
	KHSO4	HF2-1		KOH	
	K2CO3	HF - Aq		KOH.2H2O	
	K2CO3.1.5	H+1		KOH.1H2O	
	KF	OH-1		KNO3	
	KF.2H2O	NO3-1		K2SO4	
	KF.4H2O	HNO3 - Aq		K2SO4.1H2O	
	KOH	KHSO4 - Aq		NaHCO3	
	KOH.2H2O	KCl - Aq		NaHSO4	
	KOH.1H2O	K+1		Na2CO3	
	KNO3	KSO4-1		Na2CO3.10H2O	
	K2SO4	NaHCO3 - Aq		Na2CO3.7H2O	
	K2SO4.1H	NaCO3-1		Na2CO3.1H2O	
	NaHSO4	NaF - Aq		NaCl	
	Na2CO3	Na+1		NaF	
	Na2CO3.1	NaNO3 - Aq		NaF.Na2SO4	
	Na2CO3.7	NaSO4-1		NaHF2	
	Na2CO3.1	SO4-2		NaOH	
	NaF.Na2S	SO3 - Aq		NaOH.1H2O	
	NaHF2	H2SO4 - Aq		NaNO3	
	NaOH.1H2O			Na2SO4	
	Na2SO4			Na2SO4	
	Na2SO4.NaHSO4			Na2SO4.NaHSO4	
	Na2SO4.10H2O			Na2SO4.10H2O	
	SO3				
	H2SO4				

Stream Parameters

Stream Am	570.45	g
Temperatu	25	°C
Pressure	1	atm
pH	7.6933	pH
Ionic Stren	1.5672	mol/kg H2O
Osmotic Pr	70.787	atm
WaterActiv	0.94956	Activity
Electrical C	0.080161	1/ohm
Electrical C	50.904	cm2/ohm-mol
Viscosity, e	1.3989	cP
Viscosity, r	1.5705	cP/cP H2O

2nd Liquid g/ml		Total --	Aqueous g/ml	Vapor g/ml	Solid g/ml	2nd Liquid g/ml
0	Density	--	1.0832	0	2.1997	0

2nd Liquid cal		Total cal	Aqueous cal	Vapor cal	Solid cal	2nd Liquid cal
0	Enthalpy	-2.07E+06	-2.08E+06	0	-7284.2	0

Total and Phase Flows (Amounts)

2nd Liquid mol		Total mol	Aqueous mol	Vapor mol	Solid mol	2nd Liquid mol
0	Mole	29.334	29.302	0	0.032111	0

2nd Liquid g		Total g	Aqueous g	Vapor g	Solid g	2nd Liquid g
0	Mass	570.45	567.76	0	2.6976	0

2nd Liquid L		Total L	Aqueous L	Vapor L	Solid L	2nd Liquid L
0	Volume	0.52535	0.52413	0	1.23E-03	0

Scaling Tendencies

solids withi Temperature Range

Sodium bic	1	0	200.00	°C	inside range
Sodium flu	0.10399	0	100.00	°C	inside range
Sodium sul	0.05002	0	32.400	°C	inside range
Sodium flu	0.03396	20	40.000	°C	inside range
Potassium	0.011277	0	70.000	°C	inside range
Sodium sul	8.75E-03	19	241.00	°C	inside range
Sodium car	4.07E-03	0	32.000	°C	inside range
Potassium	3.13E-03	0	110.00	°C	inside range
Sodium chl	2.49E-03	0	350.00	°C	inside range
Sodium nitr	1.67E-03	0	300.00	°C	inside range
Potassium	9.01E-04	9.7	292.00	°C	inside range
Potassium	6.49E-04	0	200.00	°C	inside range

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	HCO3-1	29.995	0.98283	0	0	0
	CO3-2	0.43826	0.014601	0	0	0
5C	H+1	1.15E-08	2.27E-08	0	0	0
5C	OH-1	6.35E-08	7.48E-07	0	0	0
	NaCO3-1	0.20895	4.99E-03	0	0	0
2nd Liquid	Na+1	11.895	1.017	0	0	0
n/a						
0						

Molecular Output (Apparent Species)

	Total g	Aqueous mol/kg H2(	Vapor mol	Solid mol	2nd Liquid n/a	
H2O	500	55.489	0	0		0
NaOH	22.935	1.1484	0	0		0
CO2	25.236	1.1484	0	0		0

Element Balance

	Total mol	Aqueous mol	Vapor mol	Solid mol	2nd Liquid n/a	
C(+4)	0	1.1484	0	0		0
CL(-1)	0	0	0	0		0
F(-1)	0	0	0	0		0
H(+1)	0	112.12	0	0		0
K(+1)	0	0	0	0		0
N(+5)	0	0	0	0		0
NA(+1)	0	1.1464	0	0		0
O(-2)	0	58.928	0	0		0
S(+6)	0	0	0	0		0

Species Activity Coefficients

	H2O	0.98608 Activity
2nd Liquid	HCO3-1	0.58767 Act-Coef
n/a	HSO4-1	0.6641 Act-Coef
0	CO2 - Aq	1.1626 Act-Coef
0	CO3-2	0.10745 Act-Coef
0	Cl-1	0.63505 Act-Coef
0	Na2F+1	0.55255 Act-Coef
0	F-1	0.60896 Act-Coef
0	(HF)2 - Aq	1.1623 Act-Coef
0	HCl - Aq	1.1623 Act-Coef
0	HF2-1	0.6641 Act-Coef
	HF - Aq	1.1623 Act-Coef
	H+1	0.78026 Act-Coef
	OH-1	0.75772 Act-Coef
	NO3-1	0.62634 Act-Coef
2nd Liquid	HNO3 - Aq	1.236 Act-Coef
n/a	KHSO4 - A	1.1623 Act-Coef
0	KCl - Aq	1.1623 Act-Coef
0	K+1	0.53115 Act-Coef
0	KSO4-1	0.56255 Act-Coef
0	NaHCO3 -	1.1623 Act-Coef
0	NaCO3-1	0.6641 Act-Coef
0	NaF - Aq	1.1623 Act-Coef
0	Na+1	0.58619 Act-Coef
0	NaNO3 - A	0.78473 Act-Coef
0	NaSO4-1	0.60306 Act-Coef
	SO4-2	0.1227 Act-Coef
	SO3 - Aq	1.1623 Act-Coef
	H2SO4 - A	1.1623 Act-Coef
	H2O - Vap	1 Fug-Coef
	CO2 - Vap	1 Fug-Coef
	(HF)2 - Va	1 Fug-Coef
	HCl - Vap	1 Fug-Coef
	HF - Vap	1 Fug-Coef
	HNO3 - Va	1 Fug-Coef
	SO3 - Vap	1 Fug-Coef
	H2SO4 - V	1 Fug-Coef

Species K(eq)-Values

H2O	1.01E-14 mol^0
H2O - Vap	31.857 mol^0
HCO3-1	4.70E-11 mol^0
HSO4-1	0.010515 mol^0
CO2 - Aq	4.54E-07 mol^0
CO2 - Vap	0.03392 mol^0
Na2F+1	92.494 mol^0
K2SO4.KN	9.29E-05 mol^0
2Na2SO4.I	3.44E-03 mol^0
(HF)2 - Aq	51387 mol^0
(HF)2 - Va	19124 mol^0
HCl - Aq	1.69E+06 mol^0
HCl - Vap	0.92796 mol^0
HF2-1	4.1247 mol^0
HF - Aq	6.17E-04 mol^0
HF - Vap	19019 mol^0
HNO3 - Aq	20.065 mol^0
HNO3 - Va	1.40E+06 mol^0
KHCO3	1.8452 mol^0
KHSO4 - A	51.933 mol^0
KHSO4	3.3683 mol^0
K2CO3	54473 mol^0
K2CO3.1.5	859.86 mol^0
KCl - Aq	120.41 mol^0
KCl	7.5444 mol^0
KF	7251.8 mol^0
KF.2H2O	395.96 mol^0
KF.4H2O	63.719 mol^0
KOH	4.63E+10 mol^0
KOH.2H2C	1572.6 mol^0
KOH.1H2C	17545 mol^0
KNO3	0.78972 mol^0
K2SO4	0.011589 mol^0
KSO4-1	0.13226 mol^0
K2SO4.1H	0.010377 mol^0
NaHCO3 -	2.389 mol^0
NaHCO3	0.40374 mol^0
NaHSO4	356.65 mol^0
Na2CO3	7.3005 mol^0
Na2CO3.1(	0.11036 mol^0
Na2CO3.7	0.22354 mol^0
NaCO3-1	0.26348 mol^0
Na2CO3.1	1.0111 mol^0
NaCl	38.197 mol^0
NaF - Aq	1.2906 mol^0
NaF	0.2625 mol^0
NaF.Na2Si	3.16E-03 mol^0
NaHF2	7.28E-03 mol^0
NaOH	8.05E+06 mol^0
NaOH.1H2	64322 mol^0
NaNO3 - A	17.412 mol^0
NaNO3	28.746 mol^0
Na2SO4	0.44942 mol^0

	HCO3-1	27.444	0.89747	0	0	0
	CO3-2	2.8687	0.095389	0	0	0
	H+1	1.78E-09	3.52E-09	0	0	0
	OH-1	4.19E-05	4.92E-06	0	0	0
	NaCO3-1	1.3279	0.031925	0	0	0
	Na+1	12.906	1.1202	0	0	0

Molecular Output (Apparent Species)

	Total g	Aqueous mol/kg H2(	Vapor mol	Solid mol	2nd Liquid n/a	
H2O	500	55.381	0	0		0
NaOH	25.435	1.2689	0	0		0
CO2	25.236	1.1442	0	0		0

Element Balance

	Total mol	Aqueous mol	Vapor mol	Solid mol	2nd Liquid n/a	
C(+4)	0	1.1442	0	0		0
CL(-1)	0	0	0	0		0
F(-1)	0	0	0	0		0
H(+1)	0	112.03	0	0		0
K(+1)	0	0	0	0		0
N(+5)	0	0	0	0		0
NA(+1)	0	1.2689	0	0		0
O(-2)	0	58.936	0	0		0
S(+6)	0	0	0	0		0

Species Activity Coefficients

H2O	0.98613 Activity
HCO3-1	0.57423 Act-Coef
HSO4-1	0.65539 Act-Coef
CO2 - Aq	1.1926 Act-Coef
CO3-2	0.096275 Act-Coef
Cl-1	0.62752 Act-Coef
Na2F+1	0.53936 Act-Coef
F-1	0.59576 Act-Coef
(HF)2 - Aq	1.1926 Act-Coef
HCl - Aq	1.1926 Act-Coef
HF2-1	0.65539 Act-Coef
HF - Aq	1.1926 Act-Coef
H+1	0.74942 Act-Coef
OH-1	0.75557 Act-Coef
NO3-1	0.61739 Act-Coef
HNO3 - Aq	1.2784 Act-Coef
KHSO4 - A	1.1926 Act-Coef
KCl - Aq	1.1926 Act-Coef
K+1	0.54042 Act-Coef
KSO4-1	0.53936 Act-Coef
NaHCO3 -	1.1926 Act-Coef
NaCO3-1	0.65539 Act-Coef
NaF - Aq	1.1926 Act-Coef
Na+1	0.57557 Act-Coef
NaNO3 - A	0.7737 Act-Coef
NaSO4-1	0.49203 Act-Coef
SO4-2	0.10994 Act-Coef
SO3 - Aq	1.1926 Act-Coef
H2SO4 - A	1.1926 Act-Coef
H2O - Vap	1 Fug-Coef
CO2 - Vap	1 Fug-Coef
(HF)2 - Va	1 Fug-Coef
HCl - Vap	1 Fug-Coef
HF - Vap	1 Fug-Coef
HNO3 - Va	1 Fug-Coef
SO3 - Vap	1 Fug-Coef
H2SO4 - V	1 Fug-Coef

Species K(eq)-Values

H2O	1.01E-14 mol^0
H2O - Vap	31.857 mol^0
HCO3-1	4.70E-11 mol^0
HSO4-1	0.010515 mol^0
CO2 - Aq	4.54E-07 mol^0
CO2 - Vap	0.03392 mol^0
Na2F+1	92.494 mol^0
K2SO4.KN	9.29E-05 mol^0
2Na2SO4.I	3.44E-03 mol^0
(HF)2 - Aq	51387 mol^0
(HF)2 - Va	19124 mol^0
HCl - Aq	1.69E+06 mol^0
HCl - Vap	0.92796 mol^0
HF2-1	4.1247 mol^0
HF - Aq	6.17E-04 mol^0
HF - Vap	19019 mol^0
HNO3 - Ac	20.065 mol^0
HNO3 - Va	1.40E+06 mol^0
KHCO3	1.8452 mol^0
KHSO4 - A	51.933 mol^0
KHSO4	3.3683 mol^0
K2CO3	54473 mol^0
K2CO3.1.5	859.86 mol^0
KCl - Aq	120.41 mol^0
KCl	7.5444 mol^0
KF	7251.8 mol^0
KF.2H2O	395.96 mol^0
KF.4H2O	63.719 mol^0
KOH	4.63E+10 mol^0
KOH.2H2C	1572.6 mol^0
KOH.1H2C	17545 mol^0
KNO3	0.78972 mol^0
K2SO4	0.011589 mol^0
KSO4-1	0.13226 mol^0
K2SO4.1H	0.010377 mol^0
NaHCO3 -	2.389 mol^0
NaHCO3	0.40374 mol^0
NaHSO4	356.65 mol^0
Na2CO3	7.3005 mol^0
Na2CO3.1(	0.11036 mol^0
Na2CO3.7	0.22354 mol^0
NaCO3-1	0.26348 mol^0
Na2CO3.1	1.0111 mol^0
NaCl	38.197 mol^0
NaF - Aq	1.2906 mol^0
NaF	0.2625 mol^0
NaF.Na2Si	3.16E-03 mol^0
NaHF2	7.28E-03 mol^0
NaOH	8.05E+06 mol^0
NaOH.1H2	64322 mol^0
NaNO3 - A	17.412 mol^0
NaNO3	28.746 mol^0
Na2SO4	0.44942 mol^0

	CO3-2	4.2352	0.14106	0	0	0
	H+1	1.90E-09	3.77E-09	0	0	0
	OH-1	2.58E-03	3.04E-04	0	0	0
	NaCO3-1	0.56106	0.013511	0	0	0
	Na+1	10.985	0.95501	0	0	0

Molecular Output (Apparent Species)

	Total g	Aqueous mol/kg H2(	Vapor mol	Solid mol	2nd Liquid n/a	
H2O	500	55.354	0.059377	0		0
NaOH	25.435	1.271	0	0		0
CO2	25.236	1.118	0.014074	0		0

Element Balance

	Total mol	Aqueous mol	Vapor mol	Solid mol	2nd Liquid n/a	
C(+4)	0	1.118	0.014074	0		0
CL(-1)	0	0	0	0		0
F(-1)	0	0	0	0		0
H(+1)	0	111.98	0.11875	0		0
K(+1)	0	0	0	0		0
N(+5)	0	0	0	0		0
NA(+1)	0	1.271	0	0		0
O(-2)	0	58.861	0.087525	0		0
S(+6)	0	0	0	0		0

Species Activity Coefficients

H2O	0.98963 Activity
HCO3-1	0.53655 Act-Coef
HSO4-1	0.59281 Act-Coef
CO2 - Aq	1.1728 Act-Coef
CO3-2	0.082536 Act-Coef
Cl-1	0.66284 Act-Coef
Na2F+1	0.4998 Act-Coef
F-1	0.56107 Act-Coef
(HF)2 - Aq	1.1732 Act-Coef
HCl - Aq	1.1732 Act-Coef
HF2-1	0.59281 Act-Coef
HF - Aq	1.1732 Act-Coef
H+1	0.66494 Act-Coef
OH-1	0.58393 Act-Coef
NO3-1	0.59318 Act-Coef
HNO3 - Aq	1.268 Act-Coef
KHSO4 - A	1.1732 Act-Coef
KCl - Aq	1.1732 Act-Coef
K+1	0.54524 Act-Coef
KSO4-1	0.4998 Act-Coef
NaHCO3 -	1.1732 Act-Coef
NaCO3-1	0.59281 Act-Coef
NaF - Aq	1.1732 Act-Coef
Na+1	0.54978 Act-Coef
NaNO3 - A	0.78053 Act-Coef
NaSO4-1	0.46807 Act-Coef
SO4-2	0.077869 Act-Coef
SO3 - Aq	1.1732 Act-Coef
H2SO4 - A	1.1732 Act-Coef
H2O - Vap	0.99143 Fug-Coef
CO2 - Vap	0.99661 Fug-Coef
(HF)2 - Va	0.98948 Fug-Coef
HCl - Vap	0.99604 Fug-Coef
HF - Vap	0.98939 Fug-Coef
HNO3 - Va	0.98502 Fug-Coef
SO3 - Vap	0.97433 Fug-Coef
H2SO4 - V	0.94026 Fug-Coef

Species K(eq)-Values

H2O	4.59E-13 mol^0
H2O - Vap	1.2097 mol^0
HCO3-1	8.22E-11 mol^0
HSO4-1	1.17E-03 mol^0
CO2 - Aq	4.31E-07 mol^0
CO2 - Vap	0.011137 mol^0
Na2F+1	34.675 mol^0
K2SO4.KN	5.51E-06 mol^0
2Na2SO4.I	1.71E-05 mol^0
(HF)2 - Aq	4686.1 mol^0
(HF)2 - Va	499.84 mol^0
HCl - Aq	33570 mol^0
HCl - Vap	0.12142 mol^0
HF2-1	2.1685 mol^0
HF - Aq	1.80E-04 mol^0
HF - Vap	379.93 mol^0
HNO3 - Ac	4.002 mol^0
HNO3 - Va	920.44 mol^0
KHCO3	7.7419 mol^0
KHSO4 - A	15.597 mol^0
KHSO4	14.087 mol^0
K2CO3	2670 mol^0
K2CO3.1.5	2055.7 mol^0
KCl - Aq	26.986 mol^0
KCl	16.596 mol^0
KF	54667 mol^0
KF.2H2O	1732.1 mol^0
KF.4H2O	6.69E+09 mol^0
KOH	3.85E+08 mol^0
KOH.2H2C	7614.8 mol^0
KOH.1H2C	23065 mol^0
KNO3	3.2319 mol^0
K2SO4	0.02685 mol^0
KSO4-1	0.057733 mol^0
K2SO4.1H	0.057869 mol^0
NaHCO3 -	0.52539 mol^0
NaHCO3	0.65701 mol^0
NaHSO4	376.35 mol^0
Na2CO3	1.316 mol^0
Na2CO3.1(	0.23607 mol^0
Na2CO3.7	1.3745 mol^0
NaCO3-1	0.7632 mol^0
Na2CO3.1	0.91296 mol^0
NaCl	35.518 mol^0
NaF - Aq	1.197 mol^0
NaF	0.31449 mol^0
NaF.Na2Si	3.16E-03 mol^0
NaHF2	0.051038 mol^0
NaOH	1.94E+05 mol^0
NaOH.1H2	16297 mol^0
NaNO3 - A	4.5667 mol^0
NaNO3	56.88 mol^0
Na2SO4	0.14445 mol^0
Na2SO4	2.13E-03 mol^0

Potassium	3.20E-06	17.7	40.200 °C	inside range	
Sodium hyc	1.01E-06	data valid t	inside range		
Potassium	2.16E-09	0	80.000 °C	inside range	
Potassium	1.44E-10	data valid t	inside range		
Sodium bic	2.64E-11	data valid t	inside range		
Potassium	1.13E-11	0	33.000 °C	inside range	
Sodium hyc	5.65E-12	12	60.000 °C	inside range	
Sodium sul	2.28E-13	0	82.500 °C	inside range	
Potassium	4.09E-19	data valid t	inside range		

Species Output (True Species)

	Total g	Aqueous mol/kg H2(	Vapor mol	Solid mol	2nd Liquid n/a	
H2O	500.17	55.508	0	0		0
KCl	1.21E-03	3.24E-05	0	0		0
NaNO3	0.15932	3.75E-03	0	0		0
NaHCO3	8.3508	0.13454	0	0.032111		0
NaF	0.35362	0.016838	0	0		0
CO2	0.41257	0.018745	0	0		0
(HF)2	3.84E-16	1.92E-17	0	0		0
HCl	2.06E-14	1.13E-15	0	0		0
HF	8.58E-06	8.57E-07	0	0		0
HNO3	1.36E-09	4.32E-11	0	0		0
KHSO4	5.06E-10	7.43E-12	0	0		0
SO3	3.99E-29	9.97E-31	0	0		0
H2SO4	3.59E-25	7.32E-27	0	0		0
HCO3-1	27.807	0.91115	0	0		0
HSO4-1	8.52E-07	1.76E-08	0	0		0
CO3-2	0.41137	0.013706	0	0		0
Cl-1	3.1907	0.17994	0	0		0
Na2F+1	0.011526	3.55E-04	0	0		0
F-1	0.54247	0.057088	0	0		0
HF2-1	2.68E-07	1.37E-08	0	0		0
H+1	1.33E-08	2.63E-08	0	0		0
OH-1	5.09E-06	5.99E-07	0	0		0
NO3-1	3.0754	0.099166	0	0		0
K+1	1.6286	0.083279	0	0		0
KSO4-1	0.24383	3.61E-03	0	0		0
NaCO3-1	0.20912	5.04E-03	0	0		0
Na+1	16.185	1.4058	0	0		0
NaSO4-1	4.6465	0.07803	0	0		0
SO4-2	3.0759	0.064017	0	0		0

Molecular Output (Apparent Species)

	Total g	Aqueous mol/kg H2(	Vapor mol	Solid mol	2nd Liquid n/a	
H2O	495.47	54.987	0	0		0
NaHCO3	2.6976	0	0	0.032111		0
NaOH	32.903	1.6447	0	0		0
CO2	23.843	1.0832	0	0		0
HCl	3.262	0.17997	0	0		0
HF	0.7433	0.074261	0	0		0
HNO3	3.2435	0.10291	0	0		0
KOH	2.4391	0.086917	0	0		0
SO3	5.8327	0.14565	0	0		0

Element Balance

	Total mol	Aqueous mol	Vapor mol	Solid mol	2nd Liquid n/a	
C(+4)	0	1.0832	0	0.032111		0
CL(-1)	0	0.17997	0	0		0
F(-1)	0	0.074262	0	0		0
H(+1)	0	112.06	0	0.032111		0
K(+1)	0	0.086918	0	0		0
N(+5)	0	0.10291	0	0		0
NA(+1)	0	1.6447	0	0.032111		0
O(-2)	0	59.63	0	0.096334		0
S(+6)	0	0.14565	0	0		0

Species Activity Coefficients

H2O	0.94956 Activity
HCO3-1	0.54978 Act-Coef
HSO4-1	0.66435 Act-Coef
CO2 - Aq	1.2565 Act-Coef
CO3-2	0.064713 Act-Coef
Cl-1	0.6555 Act-Coef
Na2F+1	0.51972 Act-Coef
F-1	0.59329 Act-Coef
(HF)2 - Aq	1.2562 Act-Coef
HCl - Aq	1.2562 Act-Coef
HF2-1	0.66435 Act-Coef
HF - Aq	1.2979 Act-Coef
H+1	0.7708 Act-Coef
OH-1	0.79383 Act-Coef
NO3-1	0.59917 Act-Coef
HNO3 - Aq	1.3899 Act-Coef
KHSO4 - A	1.2562 Act-Coef
KCl - Aq	1.2562 Act-Coef
K+1	0.49877 Act-Coef
KSO4-1	0.5269 Act-Coef
NaHCO3 -	1.2562 Act-Coef
NaCO3-1	0.65529 Act-Coef
NaF - Aq	1.2562 Act-Coef
Na+1	0.57331 Act-Coef
NaNO3 - A	0.73369 Act-Coef
NaSO4-1	0.52055 Act-Coef
SO4-2	0.094541 Act-Coef
SO3 - Aq	1.2562 Act-Coef
H2SO4 - A	1.2562 Act-Coef
H2O - Vap	1 Fug-Coef
CO2 - Vap	1 Fug-Coef
(HF)2 - Va	1 Fug-Coef
HCl - Vap	1 Fug-Coef
HF - Vap	1 Fug-Coef
HNO3 - Va	1 Fug-Coef
SO3 - Vap	1 Fug-Coef
H2SO4 - V	1 Fug-Coef

Species K(eq)-Values

H2O	1.01E-14 mol^0
H2O - Vap	31.857 mol^0
HCO3-1	4.70E-11 mol^0
HSO4-1	0.010515 mol^0
CO2 - Aq	4.54E-07 mol^0
CO2 - Vap	0.03392 mol^0
Na2F+1	92.494 mol^0
K2SO4.KN	9.29E-05 mol^0
2Na2SO4.I	3.44E-03 mol^0

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Na2SO4	1.90E-07 mol*0
Na2SO4.N	162.44 mol*0
Na2SO4.1(	0.046844 mol*0
NaSO4-1	0.12009 mol*0
SO3 - Aq	7726 mol*0
SO3 - Vap	1.64E+09 mol*0
H2SO4 - A	2.57E+10 mol*0
H2SO4 - V	3.86E+06 mol*0

Species Mobilities

HCO3-1	2.64E-04 m2/ohm-mol
CO3-2	4.40E-04 m2/ohm-mol
H+1	2.08E-03 m2/ohm-mol
OH-1	1.17E-03 m2/ohm-mol
NaCO3-1	1.96E-04 m2/ohm-mol
Na+1	2.98E-04 m2/ohm-mol

Species Self Diffusivities

H2O	2.39E-09 m2/s
HCO3-1	1.15E-09 m2/s
HSO4-1	1.31E-09 m2/s
CO2 - Aq	1.98E-09 m2/s
CO3-2	9.63E-10 m2/s
Cl-1	1.92E-09 m2/s
Na2F+1	1.53E-09 m2/s
F-1	1.41E-09 m2/s
(HF)2 - Aq	1.20E-09 m2/s
HCl - Aq	2.10E-09 m2/s
HF2-1	1.89E-09 m2/s
HF - Aq	1.32E-10 m2/s
H+1	7.97E-09 m2/s
OH-1	4.86E-09 m2/s
NO3-1	1.80E-09 m2/s
HNO3 - Aq	1.96E-09 m2/s
KHSO4 - A	1.55E-09 m2/s
KCl - Aq	1.80E-09 m2/s
K+1	1.84E-09 m2/s
KSO4-1	9.91E-10 m2/s
NaHCO3 -	1.02E-09 m2/s
NaCO3-1	8.63E-10 m2/s
NaF - Aq	1.15E-09 m2/s
Na+1	1.29E-09 m2/s
NaNO3 - A	1.26E-09 m2/s
NaSO4-1	9.11E-10 m2/s
SO4-2	1.04E-09 m2/s
SO3 - Aq	1.12E-10 m2/s
H2SO4 - A	1.10E-09 m2/s

Na2SO4	1.90E-07 mol*0
Na2SO4.N	162.44 mol*0
Na2SO4.1(	0.046844 mol*0
NaSO4-1	0.12009 mol*0
SO3 - Aq	7726 mol*0
SO3 - Vap	1.64E+09 mol*0
H2SO4 - A	2.57E+10 mol*0
H2SO4 - V	3.86E+06 mol*0

Species Mobilities

HCO3-1	2.52E-04 m2/ohm-mol
CO3-2	4.19E-04 m2/ohm-mol
H+1	1.98E-03 m2/ohm-mol
OH-1	1.12E-03 m2/ohm-mol
NaCO3-1	1.87E-04 m2/ohm-mol
Na+1	2.84E-04 m2/ohm-mol

Species Self Diffusivities

H2O	2.34E-09 m2/s
HCO3-1	1.13E-09 m2/s
HSO4-1	1.29E-09 m2/s
CO2 - Aq	1.94E-09 m2/s
CO3-2	9.44E-10 m2/s
Cl-1	1.89E-09 m2/s
Na2F+1	1.50E-09 m2/s
F-1	1.38E-09 m2/s
(HF)2 - Aq	1.18E-09 m2/s
HCl - Aq	2.06E-09 m2/s
HF2-1	1.85E-09 m2/s
HF - Aq	1.29E-10 m2/s
H+1	7.92E-09 m2/s
OH-1	4.80E-09 m2/s
NO3-1	1.77E-09 m2/s
HNO3 - Aq	1.92E-09 m2/s
KHSO4 - A	1.51E-09 m2/s
KCl - Aq	1.58E-09 m2/s
K+1	1.81E-09 m2/s
KSO4-1	9.71E-10 m2/s
NaHCO3 -	1.00E-09 m2/s
NaCO3-1	8.46E-10 m2/s
NaF - Aq	1.12E-09 m2/s
Na+1	1.26E-09 m2/s
NaNO3 - A	1.22E-09 m2/s
NaSO4-1	8.93E-10 m2/s
SO4-2	1.02E-09 m2/s
SO3 - Aq	1.09E-10 m2/s
H2SO4 - A	1.08E-09 m2/s

Na2SO4.N	156.99 mol*0
Na2SO4.1(	26.308 mol*0
NaSO4-1	0.090006 mol*0
SO3 - Aq	1922.2 mol*0
SO3 - Vap	78679 mol*0
H2SO4 - A	3.19E+10 mol*0
H2SO4 - V	248.07 mol*0

Species Mobilities

HCO3-1	6.77E-04 m2/ohm-mol
CO3-2	1.20E-03 m2/ohm-mol
H+1	3.35E-03 m2/ohm-mol
OH-1	2.33E-03 m2/ohm-mol
NaCO3-1	5.28E-04 m2/ohm-mol
Na+1	7.73E-04 m2/ohm-mol

Species Self Diffusivities

H2O	7.89E-09 m2/s
HCO3-1	3.92E-09 m2/s
HSO4-1	4.17E-09 m2/s
CO2 - Aq	6.84E-09 m2/s
CO3-2	3.49E-09 m2/s
Cl-1	6.15E-09 m2/s
Na2F+1	5.54E-09 m2/s
F-1	4.91E-09 m2/s
(HF)2 - Aq	4.14E-09 m2/s
HCl - Aq	6.58E-09 m2/s
HF2-1	6.87E-09 m2/s
HF - Aq	4.77E-10 m2/s
H+1	1.80E-08 m2/s
OH-1	1.28E-08 m2/s
NO3-1	5.53E-09 m2/s
HNO3 - Aq	5.91E-09 m2/s
KHSO4 - A	5.59E-09 m2/s
KCl - Aq	5.04E-09 m2/s
K+1	5.75E-09 m2/s
KSO4-1	3.33E-09 m2/s
NaHCO3 -	3.50E-09 m2/s
NaCO3-1	3.09E-09 m2/s
NaF - Aq	3.95E-09 m2/s
Na+1	4.47E-09 m2/s
NaNO3 - A	4.14E-09 m2/s
NaSO4-1	3.13E-09 m2/s
SO4-2	3.58E-09 m2/s
SO3 - Aq	4.04E-10 m2/s
H2SO4 - A	3.74E-09 m2/s

(HF)2 - Aq	51387 mol*0
(HF)2 - Vap	19124 mol*0
HCl - Aq	1.69E+05 mol*0
HCl - Vap	0.92796 mol*0
HF2-1	4.1247 mol*0
HF - Aq	6.17E-04 mol*0
HF - Vap	19019 mol*0
HNO3 - Aq	20.085 mol*0
HNO3 - Va	1.40E+05 mol*0
KHCO3	1.8452 mol*0
KHSO4 - A	51.933 mol*0
KHSO4	3.3683 mol*0
K2CO3	54473 mol*0
K2CO3.1 E	859.86 mol*0
KCl - Aq	120.41 mol*0
KCl	7.5444 mol*0
KF	7251.8 mol*0
KF.2H2O	395.96 mol*0
KF.4H2O	63.719 mol*0
KOH	4.63E+10 mol*0
KOH.2H2C	1572.6 mol*0
KOH.1H2C	17545 mol*0
KNO3	0.78972 mol*0
K2SO4	0.011589 mol*0
KSO4-1	0.13228 mol*0
K2SO4.1H	0.010377 mol*0
NaHCO3 -	2.369 mol*0
NaHCO3	0.40374 mol*0
NaHSO4	356.65 mol*0
Na2CO3	7.3005 mol*0
Na2CO3.1(	0.11036 mol*0
Na2CO3.7	0.22364 mol*0
NaCO3-1	0.26348 mol*0
Na2CO3.1	1.0111 mol*0
NaCl	36.197 mol*0
NaF - Aq	1.2908 mol*0
NaF	0.2625 mol*0
NaF.Na2SI	3.16E-03 mol*0
NaHF2	7.28E-03 mol*0
NaOH	8.05E+06 mol*0
NaOH.1H2	64322 mol*0
NaNO3 - A	17.412 mol*0
NaNO3	28.746 mol*0
Na2SO4	0.44942 mol*0
Na2SO4	1.90E-07 mol*0
Na2SO4.N	162.44 mol*0
Na2SO4.1(	0.046844 mol*0
NaSO4-1	0.12009 mol*0
SO3 - Aq	7726 mol*0
SO3 - Vap	1.64E+09 mol*0
H2SO4 - A	2.57E+10 mol*0
H2SO4 - V	3.86E+06 mol*0

Species Mobilities

HCO3-1	2.48E-04 m2/ohm-mol
HSO4-1	2.85E-04 m2/ohm-mol
CO3-2	4.12E-04 m2/ohm-mol
Cl-1	4.25E-04 m2/ohm-mol
Na2F+1	3.34E-04 m2/ohm-mol
F-1	3.08E-04 m2/ohm-mol
HF2-1	4.17E-04 m2/ohm-mol
H+1	1.95E-03 m2/ohm-mol
OH-1	1.10E-03 m2/ohm-mol
NO3-1	3.97E-04 m2/ohm-mol
K+1	4.07E-04 m2/ohm-mol
KSO4-1	2.13E-04 m2/ohm-mol
NaCO3-1	1.84E-04 m2/ohm-mol
Na+1	2.79E-04 m2/ohm-mol
NaSO4-1	1.95E-04 m2/ohm-mol
SO4-2	4.48E-04 m2/ohm-mol

Species Self Diffusivities

H2O	2.24E-09 m2/s
HCO3-1	1.09E-09 m2/s
HSO4-1	1.24E-09 m2/s
CO2 - Aq	1.86E-09 m2/s
CO3-2	9.10E-10 m2/s
Cl-1	1.83E-09 m2/s
Na2F+1	1.45E-09 m2/s
F-1	1.34E-09 m2/s
(HF)2 - Aq	1.12E-09 m2/s
HCl - Aq	1.98E-09 m2/s
HF2-1	1.80E-09 m2/s
HF - Aq	1.23E-10 m2/s
H+1	7.69E-09 m2/s
OH-1	4.54E-09 m2/s
NO3-1	1.71E-09 m2/s
HNO3 - Aq	1.83E-09 m2/s
KHSO4 - A	1.44E-09 m2/s
KCl - Aq	1.54E-09 m2/s
K+1	1.78E-09 m2/s
KSO4-1	9.33E-10 m2/s
NaHCO3 -	9.56E-10 m2/s
NaCO3-1	8.14E-10 m2/s
NaF - Aq	1.07E-09 m2/s
Na+1	1.23E-09 m2/s
NaNO3 - A	1.16E-09 m2/s
NaSO4-1	8.57E-10 m2/s
SO4-2	9.82E-10 m2/s
SO3 - Aq	1.04E-10 m2/s
H2SO4 - A	1.03E-09 m2/s

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SCW15

Calculation Summary

SinglePoint_NaOH Calculation for Work1

Automatic Chemistry Model
Databanks:
Public

Unit Set: Default

Isothermal Calculation
Temperatu 25 °C
Pressure 1 atm

Stream Inflows

Water	500 g
Sodium chl	2.72 g
Potassium	3.241 g
Sodium nitr	4.375 g
Sodium sul	10.348 g
Sodium bic	48.21 g
Sodium flu	1.56 g
Sodium hyc	3.5 g

Speciation Summary

Total number of species: 113

User Inflows	Related Inflows	Aqueous Species	Vapor Species	Solid Species	Second Liquid Spe
H2O	CO2	H2O	H2O - Vap	K2SO4.KNaSO4	
NaCl	H2CO3	HCO3-1	CO2 - Vap	2Na2SO4.Na2CO3	
KCl	K2SO4.KN	HSO4-1	(HF)2 - Va	KHCO3	
NaNO3	2Na2SO4.I	CO2 - Aq	HCl - Vap	KHSO4	
Na2SO4	(HF)2	CO3-2	HF - Vap	K2CO3	
NaHCO3	HCl	Cl-1	HNO3 - Va	K2CO3.1.5H2O	
NaF	HF	Na2F+1	SO3 - Vap	KCl	
NaOH	(HF)6	F-1	H2SO4 - V	KF	
	HNO3	(HF)2 - Aq		KF.2H2O	
	KHCO3	HCl - Aq		KF.4H2O	
	KHSO4	HF2-1		KOH	
	K2CO3	HF - Aq		KOH.2H2O	
	K2CO3.1.5	H+1		KOH.1H2O	
	KF	OH-1		KNO3	
	KF.2H2O	NO3-1		K2SO4	
	KF.4H2O	HNO3 - Aq		K2SO4.1H2O	
	KOH	KHSO4 - Aq		NaHCO3	
	KOH.2H2C	KCl - Aq		NaHSO4	
	KOH.1H2C	K+1		Na2CO3	
	KNO3	KSO4-1		Na2CO3.10H2O	
	K2SO4	NaHCO3 - Aq		Na2CO3.7H2O	
	K2SO4.1H	NaCO3-1		Na2CO3.1H2O	
	NaHSO4	NaF - Aq		NaCl	
	Na2CO3	Na+1		NaF	
	Na2CO3.1	NaNO3 - Aq		NaF.Na2SO4	
	Na2CO3.7I	NaSO4-1		NaHF2	
	Na2CO3.1I	SO4-2		NaOH	
	NaF.Na2S	SO3 - Aq		NaOH.1H2O	
	NaHF2	H2SO4 - Aq		NaNO3	
	NaOH.1H2O			Na2SO4	
	Na2SO4			Na2SO4	
	Na2SO4.NaHSO4			Na2SO4.NaHSO4	
	Na2SO4.10H2O			Na2SO4.10H2O	
	SO3				
	H2SO4				

Stream Parameters

Stream Am	573.95	g
Temperatu	25	°C
Pressure	1	atm
pH	8.6601	pH
Ionic Stren	1.8796	mol/kg H2O
Osmotic Pr	73.049	atm
WaterActiv	0.9483	Activity
Electrical C	0.087592	1/ohm
Electrical C	50.348	cm2/ohm-mol
Viscosity, e	1.4539	cP
Viscosity, r	1.6323	cP/cP H2O

	Total	Aqueous	Vapor	Solid	2nd Liquid	
	--	g/ml	g/ml	g/ml	g/ml	
Density	--	1.0938	0	2.1997	0	
	Total	Aqueous	Vapor	Solid	2nd Liquid	
	cal	cal	cal	cal	cal	
Enthalpy	-2.08E+06	-2.08E+06	0	-98.437	0	

Total and Phase Flows (Amounts)

	Total	Aqueous	Vapor	Solid	2nd Liquid	
	mol	mol	mol	mol	mol	
Mole	29.513	29.513	0	4.34E-04	0	
	Total	Aqueous	Vapor	Solid	2nd Liquid	
	g	g	g	g	g	
Mass	573.95	573.92	0	0.036455	0	
	Total	Aqueous	Vapor	Solid	2nd Liquid	
	L	L	L	L	L	
Volume	0.52473	0.52472	0	1.66E-06	0	

Scaling Tendencies

solids with Temperature Range

Sodium bic	1	0	200.00 °C	inside range
Sodium flu	0.11222	0	100.00 °C	inside range
Sodium sul	0.053937	0	32.400 °C	inside range
Sodium car	0.041483	0	32.000 °C	inside range
Sodium flu	0.040045	20	40.000 °C	inside range
Potassium	0.010335	0	70.000 °C	inside range
Sodium sul	9.56E-03	19	241.00 °C	inside range
Potassium	3.13E-03	0	110.00 °C	inside range
Sodium chl	2.76E-03	0	350.00 °C	inside range
Sodium nitr	1.82E-03	0	300.00 °C	inside range
Potassium	8.27E-04	9.7	292.00 °C	inside range
Potassium	6.59E-04	0	200.00 °C	inside range

Calculation Summary

SinglePoint_NaOH_95oC Calculation for Work1

Automatic Chemistry Model
Databanks:
Public

Unit Set: Default

Isothermal Calculation
Temperatu 95 °C
Pressure 1 atm

Stream Inflows

Water	500 g
Sodium chl	2.72 g
Potassium	3.241 g
Sodium nitr	4.375 g
Sodium sul	10.348 g
Sodium bic	48.21 g
Sodium flu	1.56 g
Sodium hyc	3.5 g

Speciation Summary

Total number of species: 113

User Inflows	Related Inflows	Aqueous Species	Vapor Species	Solid Species	Second Liquid Spe
H2O	CO2	H2O	H2O - Vap	K2SO4.KNaSO4	
NaCl	H2CO3	HCO3-1	CO2 - Vap	2Na2SO4.Na2CO3	
KCl	K2SO4.KN	HSO4-1	(HF)2 - Va	KHCO3	
NaNO3	2Na2SO4.I	CO2 - Aq	HCl - Vap	KHSO4	
Na2SO4	(HF)2	CO3-2	HF - Vap	K2CO3	
NaHCO3	HCl	Cl-1	HNO3 - Va	K2CO3.1.5H2O	
NaF	HF	Na2F+1	SO3 - Vap	KCl	
NaOH	(HF)6	F-1	H2SO4 - V	KF	
	HNO3	(HF)2 - Aq		KF.2H2O	
	KHCO3	HCl - Aq		KF.4H2O	
	KHSO4	HF2-1		KOH	
	K2CO3	HF - Aq		KOH.2H2O	
	K2CO3.1.5	H+1		KOH.1H2O	
	KF	OH-1		KNO3	
	KF.2H2O	NO3-1		K2SO4	
	KF.4H2O	HNO3 - Aq		K2SO4.1H2O	
	KOH	KHSO4 - Aq		NaHCO3	
	KOH.2H2C	KCl - Aq		NaHSO4	
	KOH.1H2C	K+1		Na2CO3	
	KNO3	KSO4-1		Na2CO3.10H2O	
	K2SO4	NaHCO3 - Aq		Na2CO3.7H2O	
	K2SO4.1H	NaCO3-1		Na2CO3.1H2O	
	NaHSO4	NaF - Aq		NaCl	
	Na2CO3	Na+1		NaF	
	Na2CO3.1	NaNO3 - Aq		NaF.Na2SO4	
	Na2CO3.7I	NaSO4-1		NaHF2	
	Na2CO3.1I	SO4-2		NaOH	
	NaF.Na2S	SO3 - Aq		NaOH.1H2O	
	NaHF2	H2SO4 - Aq		NaNO3	
	NaOH.1H2O			Na2SO4	
	Na2SO4			Na2SO4	
	Na2SO4.NaHSO4			Na2SO4.NaHSO4	
	Na2SO4.10H2O			Na2SO4.10H2O	
	SO3				
	H2SO4				

Stream Parameters

Stream Am	573.95	g
Temperatu	95	°C
Pressure	1	atm
pH	8.5819	pH
Ionic Stren	1.7917	mol/kg H2O
Osmotic Pr	81.664	atm
WaterActiv	0.95112	Activity
Electrical C	0.21215	1/ohm
Electrical C	126.82	cm2/ohm-mol
Viscosity, e	0.51803	cP
Viscosity, r	1.7436	cP/cP H2O

	Total	Aqueous	Vapor	Solid	2nd Liquid	
	--	g/ml	g/ml	g/ml	g/ml	
Density	--	1.0518	0	0	0	
	Total	Aqueous	Vapor	Solid	2nd Liquid	
	cal	cal	cal	cal	cal	
Enthalpy	-2.04E+06	-2.04E+06	0	0	0	

Total and Phase Flows (Amounts)

	Total	Aqueous	Vapor	Solid	2nd Liquid	
	mol	mol	mol	mol	mol	
Mole	29.433	29.433	0	0	0	
	Total	Aqueous	Vapor	Solid	2nd Liquid	
	g	g	g	g	g	
Mass	573.95	573.95	0	0	0	
	Total	Aqueous	Vapor	Solid	2nd Liquid	
	L	L	L	L	L	
Volume	0.5457	0.5457	0	0	0	

Scaling Tendencies

solids with Temperature Range

Sodium bic	0.3671	0	200.00 °C	inside range
Sodium flu	0.075788	0	100.00 °C	inside range
Sodium sul	0.023623	0	241.00 °C	inside range
Sodium car	6.00E-03	35.37	109.00 °C	inside range
Hexahydrit	3.92E-03	30	150.00 °C	inside range
Sodium chl	3.09E-03	0	350.00 °C	inside range
Sodium nitr	6.95E-04	0	300.00 °C	inside range
Potassium	6.50E-04	0	110.00 °C	inside range
Potassium	3.59E-04	9.7	292.00 °C	inside range
Potassium	3.51E-04	0	200.00 °C	inside range
Glaserite	3.17E-05	35	150.00 °C	inside range
Sodium hyc	1.11E-07	data valid t		inside range

SCW16

Calculation Summary

SinglePoint1 Calculation for Work1

Automatic Chemistry Model
Databanks:
Public

Unit Set: Default

Isothermal Calculation
Temperatu 25 °C
Pressure 1 atm

Stream Inflows

Water	500 g
Sodium chl	2.726 g
Potassium	3.252 g
Sodium nitr	4.372 g
Sodium sul	0 g
Sodium bic	48.18 g
Sodium flu	0 g
Sodium hyc	0 g

Speciation Summary

Total number of species: 113

User Inflows	Related Inflows	Aqueous Species	Vapor Species	Solid Species	Second Liquid Spe
H2O	CO2	H2O	H2O - Vap	K2SO4.KNaSO4	
NaCl	H2CO3	HCO3-1	CO2 - Vap	2Na2SO4.Na2CO3	
KCl	K2SO4.KN	HSO4-1	(HF)2 - Va	KHCO3	
NaNO3	2Na2SO4.I	CO2 - Aq	HCl - Vap	KHSO4	
Na2SO4	(HF)2	CO3-2	HF - Vap	K2CO3	
NaHCO3	HCl	Cl-1	HNO3 - Va	K2CO3.1.5H2O	
NaF	HF	Na2F+1	SO3 - Vap	KCl	
NaOH	(HF)6	F-1	H2SO4 - V	KF	
	HNO3	(HF)2 - Aq		KF.2H2O	
	KHCO3	HCl - Aq		KF.4H2O	
	KHSO4	HF2-1		KOH	
	K2CO3	HF - Aq		KOH.2H2O	
	K2CO3.1.5	H+1		KOH.1H2O	
	KF	OH-1		KNO3	
	KF.2H2O	NO3-1		K2SO4	
	KF.4H2O	HNO3 - Aq		K2SO4.1H2O	
	KOH	KHSO4 - Aq		NaHCO3	
	KOH.2H2C	KCl - Aq		NaHSO4	
	KOH.1H2C	K+1		Na2CO3	
	KNO3	KSO4-1		Na2CO3.10H2O	
	K2SO4	NaHCO3 - Aq		Na2CO3.7H2O	
	K2SO4.1H	NaCO3-1		Na2CO3.1H2O	
	NaHSO4	NaF - Aq		NaCl	
	Na2CO3	Na+1		NaF	
	Na2CO3.1	NaNO3 - Aq		NaF.Na2SO4	
	Na2CO3.7I	NaSO4-1		NaHF2	
	Na2CO3.1I	SO4-2		NaOH	
	NaF.Na2S	SO3 - Aq		NaOH.1H2O	
	NaHF2	H2SO4 - Aq		NaNO3	
	NaOH.1H2O			Na2SO4	
	Na2SO4			Na2SO4	
	Na2SO4.NaHSO4			Na2SO4.NaHSO4	
	Na2SO4.10H2O			Na2SO4.10H2O	
	SO3				
	H2SO4				

Stream Parameters

Stream Am	558.53	g
Temperatu	25	°C
Pressure	1	atm
pH	7.7294	pH
Ionic Stren	1.3016	mol/kg H2O
Osmotic Pr	65.011	atm
WaterActiv	0.96339	Activity
Electrical C	0.072125	1/ohm
Electrical C	52.752	cm2/ohm-mol
Viscosity, e	1.3466	cP
Viscosity, r	1.5118	cP/cP H2O

	Total	Aqueous	Vapor	Solid	2nd Liquid	
	--	g/ml	g/ml	g/ml	g/ml	
Density	--	1.0677	0	0	0	
	Total	Aqueous	Vapor	Solid	2nd Liquid	
	cal	cal	cal	cal	cal	
Enthalpy	-2.04E+06	-2.04E+06	0	0	0	

Total and Phase Flows (Amounts)

	Total	Aqueous	Vapor	Solid	2nd Liquid	
	mol	mol	mol	mol	mol	
Mole	29.123	29.123	0	0	0	
	Total	Aqueous	Vapor	Solid	2nd Liquid	
	g	g	g	g	g	
Mass	558.53	558.53	0	0	0	
	Total	Aqueous	Vapor	Solid	2nd Liquid	
	L	L	L	L	L	
Volume	0.52312	0.52312	0	0	0	

Scaling Tendencies

solids with Temperature Range

Sodium bic	0.95667	0	200.00 °C	inside range
Potassium	0.01313	0	70.000 °C	inside range
Sodium car	3.86E-03	0	32.000 °C	inside range
Potassium	3.98E-03	0	110.00 °C	inside range
Sodium chl	2.10E-03	0	350.00 °C	inside range
Sodium nitr	1.48E-03	0	300.00 °C	inside range
Potassium	6.66E-04	0	200.00 °C	inside range
Potassium	2.93E-09	0	80.000 °C	inside range
Potassium	1.33E-11	0	33.000 °C	inside range
Sodium hyc	5.43E-12	12	60.000 °C	inside range
Potassium	4.76E-19	data valid t		inside range

Calculation Summary

SinglePoint_NaOH Calculation for Work1

Automatic Chemistry Model
Databanks:
Public

Unit Set: Default

Isothermal Calculation
Temperatu 25 °C
Pressure 1 atm

Stream Inflows

Water	500 g
Sodium chl	2.726 g
Potassium	3.252 g
Sodium nitr	4.372 g
Sodium sul	0 g
Sodium bic	48.18 g
Sodium flu	0 g
Sodium hyc	3.1 g

Speciation Summary

Total number of species: 113

User Inflows	Related Inflows	Aqueous Species	Vapor Species	Solid Species	Second Liquid Spe
H2O	CO2	H2O	H2O - Vap	K2SO4.KNaSO4	
NaCl	H2CO3	HCO3-1	CO2 - Vap	2Na2SO4.Na2CO3	
KCl	K2SO4.KN	HSO4-1	(HF)2 - Va	KHCO3	
NaNO3	2Na2SO4.I	CO2 - Aq	HCl - Vap	KHSO4	
Na2SO4	(HF)2	CO3-2	HF - Vap	K2CO3	
NaHCO3	HCl	Cl-1	HNO3 - Va	K2CO3.1.5H2O	
NaF	HF	Na2F+1	SO3 - Vap	KCl	
NaOH	(HF)6	F-1	H2SO4 - V	KF	
	HNO3	(HF)2 - Aq		KF.2H2O	
	KHCO3	HCl - Aq		KF.4H2O	
	KHSO4	HF2-1		KOH	
	K2CO3	HF - Aq		KOH.2H2O	
	K2CO3.1.5	H+1		KOH.1H2O	
	KF	OH-1		KNO3	
	KF.2H2O	NO3-1		K2SO4	
	KF.4H2O	HNO3 - Aq		K2SO4.1H2O	
	KOH	KHSO4 - Aq		NaHCO3	
	KOH.2H2C	KCl - Aq		NaHSO4	
	KOH.1H2C	K+1		Na2CO3	
	KNO3	KSO4-1		Na2CO3.10H2O	
	K2SO4	NaHCO3 - Aq		Na2CO3.7H2O	
	K2SO4.1H	NaCO3-1		Na2CO3.1H2O	
	NaHSO4	NaF - Aq		NaCl	
	Na2CO3	Na+1		NaF	
	Na2CO3.1	NaNO3 - Aq		NaF.Na2SO4	
	Na2CO3.7I	NaSO4-1		NaHF2	
	Na2CO3.1I	SO4-2		NaOH	
	NaF.Na2S	SO3 - Aq		NaOH.1H2O	
	NaHF2	H2SO4 - Aq		NaNO3	
	NaOH.1H2O			Na2SO4	
	Na2SO4			Na2SO4	
	Na2SO4.NaHSO4			Na2SO4.NaHSO4	
	Na2SO4.10H2O			Na2SO4.10H2O	
	SO3				
	H2SO4				

Stream Parameters

Stream Am	561.63	g
Temperatu	25	°C
Pressure	1	atm
pH	8.6481	pH
Ionic Stren	1.5296	mol/kg H2O
Osmotic Pr	63.862	atm
WaterActiv	0.95444	Activity
Electrical C	0.077826	1/ohm
Electrical C	51.31	cm2/ohm-mol
Viscosity, e	1.3661	cP
Viscosity, r	1.5337	cP/cP H2O

	Total	Aqueous	Vapor	Solid	2nd Liquid	
	--	g/ml	g/ml	g/ml	g/ml	
Density	--	1.0746	0	0	0	
	Total	Aqueous	Vapor	Solid	2nd Liquid	
	cal	cal	cal	cal	cal	
Enthalpy	-2.05E+06	-2.05E+06	0	0	0	

Total and Phase Flows (Amounts)

	Total	Aqueous	Vapor	Solid	2nd Liquid	
	mol	mol	mol	mol	mol	
Mole	29.257	29.257	0	0	0	
	Total	Aqueous	Vapor	Solid	2nd Liquid	
	g	g	g	g	g	
Mass	561.63	561.63	0	0	0	
	Total	Aqueous	Vapor	Solid	2nd Liquid	
	L	L	L	L	L	
Volume	0.52264	0.52264	0	0	0	

Scaling Tendencies

solids with Temperature Range

Sodium bic	0.89901	0	200.00 °C	inside range
Sodium car	0.032957	0	32.000 °C	inside range
Potassium	0.011639	0	70.000 °C	inside range
Potassium	3.39E-03	0	110.00 °C	inside range
Sodium chl	2.25E-03	0	350.00 °C	inside range
Sodium nitr	1.57E-03	0	300.00 °C	inside range
Potassium	6.75E-04	0	200.00 °C	inside range
Potassium	2.20E-08	0	80.000 °C	inside range
Potassium	1.13E-10	0	33.000 °C	inside range
Sodium hyc	4.89E-11	12	60.000 °C	inside range
Potassium	4.04E-18	data valid t		inside range

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Potassium	3.16E-06	17 7	40.200 °C	inside range
Sodium hyd	1.14E-07	data valid t		inside range
Potassium	1.87E-08	0	80.000 °C	inside range
Potassium	1.07E-10	0	33.000 °C	inside range
Sodium hyd	5.82E-11	12	60.000 °C	inside range
Potassium	1.40E-11	data valid t		inside range
Sodium bis	2.79E-12	data valid t		inside range
Sodium sul	2.63E-14	0	82.500 °C	inside range
Potassium	3.66E-16	data valid t		inside range

Species Output (True Species)

	Total g	Aqueous mol/kg H2O	Vapor mol	Solid mol	2nd Liquid n/a	
H2O	501.59	55.508	0	0		0
KCl	1.18E-03	3.15E-05	0	0		0
NaNO3	0.18028	4.23E-03	0	0		0
NaHCO3	5.4633	0.12879	0	4.34E-04		0
NaF	0.36633	0.017394	0	0		0
CO2	0.038434	1.74E-03	0	0		0
(HF)2	4.03E-18	2.01E-19	0	0		0
HCl	2.12E-15	1.16E-16	0	0		0
HF	8.61E-07	8.58E-08	0	0		0
HNO3	1.37E-10	4.33E-12	0	0		0
KHSO4	4.71E-11	6.90E-13	0	0		0
SO3	3.94E-31	9.60E-33	0	0		0
H2SO4	3.53E-27	7.16E-29	0	0		0
HCO3-1	25.603	0.83654	0	0		0
HSO4-1	8.15E-06	1.67E-09	0	0		0
CO3-2	3.8952	0.12941	0	0		0
Cl-1	3.1907	0.17943	0	0		0
Na2F+1	0.014285	4.38E-04	0	0		0
F-1	0.53583	0.05624	0	0		0
HF2-1	2.73E-08	1.40E-09	0	0		0
H+1	1.45E-09	2.87E-09	0	0		0
OH-1	4.64E-05	5.44E-06	0	0		0
NO3-1	3.0601	0.098393	0	0		0
K+1	1.6338	0.08331	0	0		0
KSO4-1	0.22578	3.33E-03	0	0		0
NaCO3-1	1.9478	0.046787	0	0		0
Na+1	18.474	1.6021	0	0		0
NaSO4-1	4.6298	0.07753	0	0		0
SO4-2	3.1021	0.06438	0	0		0

Molecular Output (Apparent Species)

	Total g	Aqueous mol/kg H2O	Vapor mol	Solid mol	2nd Liquid n/a	
H2O	495.47	54.831	0	0		0
NaHCO3	0.036455	0	0	4.34E-04		0
NaOH	37.67	1.8777	0	0		0
CO2	25.237	1.1432	0	0		0
HCl	3.282	0.17946	0	0		0
HF	0.7433	0.07407	0	0		0
HNO3	3.2435	0.10262	0	0		0
KOH	2.4391	0.086671	0	0		0
SO3	5.8327	0.14524	0	0		0

Element Balance

	Total mol	Aqueous mol	Vapor mol	Solid mol	2nd Liquid n/a	
C(+4)	0	1.1433	0	4.34E-04		0
CL(-1)	0	0.17946	0	0		0
F(-1)	0	0.074071	0	0		0
H(+1)	0	111.98	0	4.34E-04		0
K(+1)	0	0.086672	0	0		0
N(+5)	0	0.10262	0	0		0
NA(+1)	0	1.8777	0	4.34E-04		0
O(-2)	0	59.825	0	1.30E-03		0
S(+6)	0	0.14524	0	0		0

Species Activity Coefficients

H2O	0.9483	Activity
HCO3-1	0.53753	Act-Coef
HSO4-1	0.66242	Act-Coef
CO2 - Aq	1.3122	Act-Coef
CO3-2	0.074617	Act-Coef
Cl-1	0.65356	Act-Coef
Na2F+1	0.50624	Act-Coef
F-1	0.58336	Act-Coef
(HF)2 - Aq	1.3123	Act-Coef
HCl - Aq	1.3123	Act-Coef
HF2-1	0.66242	Act-Coef
HF - Aq	1.3554	Act-Coef
H+1	0.76098	Act-Coef
OH-1	0.80792	Act-Coef
NO3-1	0.59274	Act-Coef
HNO3 - Aq	1.4696	Act-Coef
KHSO4 - A	1.3123	Act-Coef
KCl - Aq	1.3123	Act-Coef
K+1	0.50905	Act-Coef
KSO4-1	0.51302	Act-Coef
NaHCO3 -	1.3123	Act-Coef
NaCO3-1	0.65367	Act-Coef
NaF - Aq	1.3123	Act-Coef
Na+1	0.56045	Act-Coef
NaNO3 - A	0.71118	Act-Coef
NaSO4-1	0.51391	Act-Coef
SO4-2	0.082776	Act-Coef
SO3 - Aq	1.3123	Act-Coef
H2SO4 - A	1.3123	Act-Coef
H2O - Vap	1	Fug-Coef
CO2 - Vap	1	Fug-Coef
(HF)2 - Vaj	1	Fug-Coef
HCl - Vap	1	Fug-Coef
HF - Vap	1	Fug-Coef
HNO3 - Va	1	Fug-Coef
SO3 - Vap	1	Fug-Coef
H2SO4 - V	1	Fug-Coef

Species K(eq)-Values

H2O	1.01E-14	mol^0
H2O - Vap	31.857	mol^0
HCO3-1	4.70E-11	mol^0
HSO4-1	0.010515	mol^0
CO2 - Aq	4.54E-07	mol^0
CO2 - Vap	0.03392	mol^0
Na2F+1	92.494	mol^0
K2SO4.KN	9.29E-05	mol^0
2Na2SO4.I	3.44E-03	mol^0

Potassium	2.77E-10	33	143.00 °C	inside range
Potassium	3.80E-11	data valid t		inside range
Sodium bis	2.67E-11	data valid t		inside range
Potassium	1.75E-14	data valid t		inside range

Ionic Strength 1.7917 mol/kg H2O SCW 15 95C

Species Output (True Species)

	Total g	Aqueous mol/kg H2O	Vapor mol	Solid mol	2nd Liquid n/a	
H2O	501.59	55.508	0	0		0
KCl	6.25E-03	1.67E-04	0	0		0
NaNO3	0.52143	0.012231	0	0		0
NaHCO3	14.975	0.35539	0	0		0
NaF	0.32446	0.015406	0	0		0
CO2	0.035059	1.59E-03	0	0		0
(HF)2	8.73E-16	4.35E-17	0	0		0
HCl	1.59E-13	8.71E-15	0	0		0
HF	3.61E-06	3.80E-07	0	0		0
HNO3	7.33E-10	2.32E-11	0	0		0
KHSO4	1.61E-09	2.65E-11	0	0		0
SO3	1.84E-29	4.59E-31	0	0		0
H2SO4	4.13E-26	8.39E-28	0	0		0
HCO3-1	18.712	0.6114	0	0		0
HSO4-1	1.10E-06	2.25E-08	0	0		0
CO3-2	4.7757	0.15866	0	0		0
Cl-1	3.1883	0.17929	0	0		0
Na2F+1	0.030908	9.48E-04	0	0		0
F-1	0.55001	0.057717	0	0		0
HF2-1	2.47E-07	1.26E-08	0	0		0
H+1	2.02E-09	4.00E-09	0	0		0
OH-1	2.46E-03	2.88E-04	0	0		0
NO3-1	2.8113	0.090391	0	0		0
K+1	1.5482	0.078945	0	0		0
KSO4-1	0.51255	7.56E-03	0	0		0
NaCO3-1	0.71187	0.017099	0	0		0
Na+1	16.675	1.446	0	0		0
NaSO4-1	1.8234	0.030535	0	0		0
SO4-2	5.1628	0.10715	0	0		0

Molecular Output (Apparent Species)

	Total g	Aqueous mol/kg H2O	Vapor mol	Solid mol	2nd Liquid n/a	
H2O	495.47	54.831	0	0		0
NaOH	37.688	1.8785	0	0		0
CO2	25.256	1.1441	0	0		0
HCl	3.282	0.17946	0	0		0
HF	0.7433	0.074071	0	0		0
HNO3	3.2435	0.10262	0	0		0
KOH	2.4391	0.086672	0	0		0
SO3	5.8327	0.14524	0	0		0

Element Balance

	Total mol	Aqueous mol	Vapor mol	Solid mol	2nd Liquid n/a	
C(+4)	0	1.1441	0	0		0
CL(-1)	0	0.17946	0	0		0
F(-1)	0	0.074072	0	0		0
H(+1)	0	111.98	0	0		0
K(+1)	0	0.086672	0	0		0
N(+5)	0	0.10262	0	0		0
NA(+1)	0	1.8786	0	0		0
O(-2)	0	59.828	0	0		0
S(+6)	0	0.14524	0	0		0

Species Activity Coefficients

H2O	0.95112	Activity
HCO3-1	0.51911	Act-Coef
HSO4-1	0.58785	Act-Coef
CO2 - Aq	1.2774	Act-Coef
CO3-2	0.062825	Act-Coef
Cl-1	0.60534	Act-Coef
Na2F+1	0.46018	Act-Coef
F-1	0.5434	Act-Coef
(HF)2 - Aq	1.2925	Act-Coef
HCl - Aq	1.2925	Act-Coef
HF2-1	0.58785	Act-Coef
HF - Aq	1.3521	Act-Coef
H+1	0.65528	Act-Coef
OH-1	0.57844	Act-Coef
NO3-1	0.57549	Act-Coef
HNO3 - Aq	1.4684	Act-Coef
KHSO4 - A	1.2925	Act-Coef
KCl - Aq	1.2925	Act-Coef
K+1	0.51162	Act-Coef
KSO4-1	0.46605	Act-Coef
NaHCO3 -	1.2925	Act-Coef
NaCO3-1	0.58044	Act-Coef
NaF - Aq	1.2925	Act-Coef
Na+1	0.52554	Act-Coef
NaNO3 - A	0.70775	Act-Coef
NaSO4-1	1.6338	Act-Coef
SO4-2	0.055146	Act-Coef
SO3 - Aq	1.2925	Act-Coef
H2SO4 - A	1.2925	Act-Coef
H2O - Vap	1	Fug-Coef
CO2 - Vap	1	Fug-Coef
(HF)2 - Vaj	1	Fug-Coef
HCl - Vap	1	Fug-Coef
HF - Vap	1	Fug-Coef
HNO3 - Va	1	Fug-Coef
SO3 - Vap	1	Fug-Coef
H2SO4 - V	1	Fug-Coef

Species K(eq)-Values

H2O	4.59E-13	mol^0
H2O - Vap	1.2097	mol^0
HCO3-1	8.22E-11	mol^0
HSO4-1	1.17E-03	mol^0
CO2 - Aq	4.31E-07	mol^0
CO2 - Vap	0.011137	mol^0
Na2F+1	34.675	mol^0
K2SO4.KN	5.51E-05	mol^0
2Na2SO4.I	1.71E-05	mol^0
(HF)2 - Aq	4686.1	mol^0
(HF)2 - Vaj	499.84	mol^0
HCl - Aq	33570	mol^0
HCl - Vap	0.12142	mol^0
HF2-1	2.1685	mol^0
HF - Aq	1.60E-04	mol^0

Species Output (True Species)

	Total g	Aqueous mol/kg H2O	Vapor mol	Solid mol	2nd Liquid n/a	
H2O	500.18	55.508	0	0		0
KCl	1.29E-03	3.46E-05	0	0		0
NaNO3	0.13634	3.21E-03	0	0		0
NaHCO3	5.6384	0.13419	0	0		0
CO2	0.43064	0.019563	0	0		0
HCl	1.90E-14	1.04E-15	0	0		0
HNO3	1.34E-09	4.25E-11	0	0		0
HCO3-1	29.706	0.97333	0	0		0
CO3-2	0.43011	0.01433	0	0		0
Cl-1	3.1996	0.18043	0	0		0
H+1	1.14E-08	2.27E-08	0	0		0
OH-1	5.67E-06	6.66E-07	0	0		0
NO3-1	3.09	0.099634	0	0		0
K+1	1.7046	0.087177	0	0		0
NaCO3-1	0.21724	5.23E-03	0	0		0
Na+1	13.8	1.2001	0	0		0

Molecular Output (Apparent Species)

	Total g	Aqueous mol/kg H2O	Vapor mol	Solid mol	2nd Liquid n/a	
H2O	497.45	55.205	0	0		0
NaOH	26.862	1.3427	0	0		0
CO2	25.241	1.1466	0	0		0
HCl	3.2911	0.18047	0	0		0
HNO3	3.2413	0.10284	0	0		0
KOH	2.4474	0.087211	0	0		0

Element Balance

	Total mol	Aqueous mol	Vapor mol	Solid mol	2nd Liquid n/a	
C(+4)	0	1.1466	0	0		0
CL(-1)	0	0.18047	0	0		0
F(-1)	0	0	0	0		0
H(+1)	0	112.12	0	0		0
K(+1)	0	0.087212	0	0		0
N(+5)	0	0.10284	0	0		0
NA(+1)	0	1.3427	0	0		0
O(-2)	0	59.237	0	0		0
S(+6)	0	0	0	0		0

Species Activity Coefficients

H2O	0.95339	Activity
HCO3-1	0.56223	Act-Coef
HSO4-1	0.66573	Act-Coef
CO2 - Aq	1.2052	Act-Coef
CO3-2	0.096195	Act-Coef
Na2F+1	0.52905	Act-Coef
F-1	0.53389	Act-Coef
(HF)2 - Aq	1.2049	Act-Coef
HCl - Aq	1.2049	Act-Coef
HF2-1	0.66572	Act-Coef
HF - Aq	1.245	Act-Coef
H+1	0.8229	Act-Coef
OH-1	0.77811	Act-Coef
NO3-1	0.60472	Act-Coef
HNO3 - Aq	1.3163	Act-Coef
KHSO4 - A	1.2049	Act-Coef
KCl - Aq	1.2049	Act-Coef
K+1	0.50784	Act-Coef
KSO4-1	0.54203	Act-Coef
NaHCO3 -	1.2049	Act-Coef
NaCO3-1	0.55586	Act-Coef
NaF - Aq	1.2049	Act-Coef
Na+1	0.58812	Act-Coef
NaNO3 - A	0.76152	Act-Coef
NaSO4-1	0.5334	Act-Coef
SO4-2	0.10708	Act-Coef
SO3 - Aq	1.2049	Act-Coef
H2SO4 - A	1.2049	Act-Coef
H2O - Vap	1	Fug-Coef
CO2 - Vap	1	Fug-Coef
(HF)2 - Vaj	1	Fug-Coef
HCl - Vap	1	Fug-Coef
HF - Vap	1	Fug-Coef
HNO3 - Va	1	Fug-Coef
SO3 - Vap	1	Fug-Coef
H2SO4 - V	1	Fug-Coef

Species K(eq)-Values

H2O	1.01E-14	mol^0
H2O - Vap	31.857	mol^0
HCO3-1	4.70E-11	mol^0
HSO4-1	0.010515	mol^0
CO2 - Aq	4.54E-07	mol^0
CO2 - Vap	0.03392	mol^0
Na2F+1	92.494	mol^0
K2SO4.KN	9.29E-05	mol^0
2Na2SO4.I	3.44E-03	mol^0
(HF)2 - Aq	51387	mol^0
(HF)2 - Vaj	19124	mol^0
HCl - Aq	1.69E+06	mol^0
HCl - Vap	0.92796	mol^0
HF2-1	4.1247	mol^0
HF - Aq	6.17E-04	mol^0
HF - Vap	19019	mol^0
HNO3 - Aq	20.065	mol^0
HNO3 - Va	1.40E+05	mol^0
KHCO3	1.6452	mol^0
KHSO4 - A	51.933	mol^0
KHSO4	3.3683	mol^0
K2CO3	54473	mol^0
K2CO3.1.5	859.86	mol^0
KCl - Aq	120.41	mol^0
KCl	7.5444	mol^0
KF	7251.8	mol^0
KF.2H2O	395.96	mol^0
KF.4H2O	63.719	mol^0
KOH	4.83E+10	mol^0
KOH.2H2C	1572.6	mol^0
KOH.1H2C	17545	mol^0
KNO3	0.78972	mol^0
K2SO4	0.011589	mol^0
KSO4-1	0.13228	mol^0
K2SO4.1H	0.010377	mol^0

Species Output (True Species)

	Total g	Aqueous mol/kg H2O	Vapor mol	Solid mol	2nd Liquid n/a	
H2O	501.41	55.508	0	0		0
KCl	1.27E-03	3.40E-05	0	0		0
NaNO3	0.1477	3.47E-03	0	0		0
NaHCO3	5.1457	0.12215	0	0		0
CO2	0.043704	1.98E-03	0	0		0
HCl	2.20E-15	1.21E-16	0	0		0
HNO3	1.53E-10	4.83E-12	0	0		0
HCO3-1	26.407	0.86313	0	0		0
CO3-2	3.4721	0.11539	0	0		0
Cl-1	3.1996	0.17999	0	0		0
H+1	1.41E-09	2.79E-09	0	0		0
OH-1	4.70E-05	5.51E-06	0	0		0
NO3-1	3.0817	0.099122	0	0		0
K+1	1.7049	0.086963	0	0		0
NaCO3-1	1.7128	0.041156	0	0		0
Na+1	15.3	1.3272	0	0		0

Molecular Output (Apparent Species)

	Total g	Aqueous mol/kg H2O	Vapor mol	Solid mol	2nd Liquid n/a	
H2O	497.45	55.069	0	0		0
NaOH	29.962	1.494	0	0		0
CO2	25.241	1.1438	0	0		0
HCl	3.2911	0.18002	0	0		0
HNO3	3.2413	0.10259	0	0		0
KOH	2.4474	0.086996	0	0		0

Element Balance

	Total mol	Aqueous mol	Vapor mol	Solid mol	2nd Liquid n/a	
C(+4)	0	1.1438	0	0		0
CL(-1)	0	0.18002	0	0		0
F(-1)	0	0	0	0		0
H(+1)	0	112	0	0		0
K(+1)	0	0.086997	0	0		0
N(+5)	0	0.10259	0	0		0
NA(+1)	0	1.494	0	0		0
O(-2)	0	59.245	0	0		0
S(+6)	0	0	0	0		0

Species Activity Coefficients

H2O	0.95444	Activity
HCO3-1	0.54968	Act-Coef
HSO4-1	0.65924	Act-Coef
CO2 - Aq	1.2437	Act-Coef
CO3-2	0.085907	Act-Coef
Cl-1	0.62515	Act-Coef
Na2F+1	0.52155	Act-Coef
F-1	0.53241	Act-Coef
(HF)2 - Aq	1.2437	Act-Coef
HCl - Aq	1.2437	Act-Coef
HF2-1	0.65924	Act-Coef
HF - Aq	1.285	Act-Coef
H+1	0.80471	Act-Coef
OH-1	0.7806	Act-Coef
NO3-1	0.59602	Act-Coef
HNO3 - Aq	1.3695	Act-Coef
KHSO4 - A	1.2437	Act-Coef
KCl - Aq	1.2437	Act-Coef
K+1	0.52032	Act-Coef
KSO4-1	0.52912	Act-Coef
NaHCO3 -	1.2437	Act-Coef
NaCO3-1	0.64961	Act-Coef
NaF - Aq	1.2437	Act-Coef
Na+1	0.57621	Act-Coef
NaNO3 - A	0.7487	Act-Coef
NaSO4-1	0.52364	Act-Coef
SO4-2	0.095236	Act-Coef
SO3 - Aq	1.2437	Act-Coef
H2SO4 - A	1.2437	Act-Coef
H2O - Vap	1	Fug-Coef
CO2 - Vap	1	Fug-Coef
(HF)2 - Vaj	1	Fug-Coef
HCl - Vap	1	Fug-Coef
HF - Vap	1	Fug-Coef
HNO3 - Va	1	Fug-Coef
SO3 - Vap	1	Fug-Coef
H2SO4 - V	1	Fug-Coef

Species K(eq)-Values

H2O	1.01E-14	mol^0
H2O - Vap	31.857	mol^0
HCO3-1	4.70E-11	mol^0
HSO4-1	0.010515	mol^0
CO2 - Aq	4.54E-07	mol^0
CO2 - Vap	0.03392	mol^0
Na2F+1	92.494	mol^0
K2SO4.KN	9.29E-05	mol^0
2Na2SO4.I	3.44E-03	mol^0
(HF)2 - Aq	51387	mol^0
(HF)2 - Vaj	19124	mol^0
HCl - Aq	1.69E+06	mol^0
HCl - Vap	0.92796	mol^0
HF2-1	4.1247	mol^0
HF - Aq	6.17E-04	mol^0
HF - Vap	19019	mol^0
HNO3 - Aq	20.065	mol^0
HNO3 - Va	1.40E+05	mol^0
KHCO3	1.6452	mol^0
KHSO4 - A	51.933	mol^0
KHSO4	3.3683	mol^0
K2CO3	54473	mol^0
K2CO3.1.5	859.86	mol^0
KCl - Aq	120.41	mol^0
KCl	7.5444	mol^0
KF	7251.8	mol^0
KF.2H2O	395.96	mol^0
KF.4H2O	63.719	mol^0
KOH	4.83E+10	mol^0
KOH.2H2C	1572.6	mol^0
KOH.1H2C	17545	mol^0
KNO3	0.78972	mol^0
K2SO4	0.011589	mol^0
KSO4-1	0.13228	mol^0
K2SO4.1H	0.010377	mol^0

H2O
KCl
NaNO3
NaHCO3
CO2
HCl
HNO3
HCO3-1
CO3-2
Cl-1
H+1
OH-1
NO3-1
K+1
NaCO3-1
Na+1
Molecular C
H2O
NaOH
CO2
HCl
HNO3
KOH
Element Ba
C(+4)
CL(-1)
F(-1)
H(+1)
K(+1)
N(+5)
NA(+1)
O(-2)
S(+6)
Species Ac
H2O
HCO3-1
HSO4-1
CO2 - Aq
CO3-2
Cl-1
Na2F+1
F-1
(HF)2 - Aq
HCl - Aq
HF2-1
HF - Aq
H+1
OH-1
NO3-1
HNO3 - Aq
KHSO4 - A
KCl - Aq
K+1
KSO4-1
NaHCO3 -
NaCO3-1
NaF - Aq
Na+1
NaNO3 - A
NaSO4-1
SO4-2
SO3 - Aq
H2SO4 - A
H2O - Vap
CO2 - Vap
(HF)2 - Vaj
HCl - Vap
HF - Vap
HNO3 - Va
SO3 - Vap
H2SO4 - V
Species K(e
H2O
H2O - Vap
HCO3-1
HSO4-1
CO2 - Aq
CO2 - Vap
Na2F+1
K2SO4.KN
2Na2SO4.I
(HF)2 - Aq
(HF)2 - Vaj
HCl - Aq
HCl - Vap
HF2-1
HF - Aq
HF - Vap
HNO3 - Aq
HNO3 - Va
KHCO3
KHSO4 - A
KHSO4
K2CO3
K2CO3.1.5
KCl - Aq
KCl
KF
KF.2H2O
KF.4H2O
KOH
KOH.2H2C
KOH.1H2C
KNO3
K2SO4
KSO4-1
K2SO4.1H
NaHCO3 -
NaHCO3
NaHSO4

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(HF)2 - Aq	51387	mol^0
(HF)2 - Vap	19124	mol^0
HCl - Aq	1.69E+06	mol^0
HCl - Vap	0.92796	mol^0
HF2-1	4.1247	mol^0
HF - Aq	6.17E-04	mol^0
HF - Vap	19019	mol^0
HNO3 - Aq	20.065	mol^0
HNO3 - Va	1.40E+05	mol^0
KHCO3	1.8452	mol^0
KHSO4 - A	51.933	mol^0
KHSO4	3.3683	mol^0
K2CO3	54473	mol^0
K2CO3.1.5	859.86	mol^0
KCl - Aq	120.41	mol^0
KCl	7.5444	mol^0
KF	7251.8	mol^0
KF.2H2O	395.96	mol^0
KF.4H2O	63.719	mol^0
KOH	4.83E+10	mol^0
KOH.2H2C	1572.6	mol^0
KOH.1H2C	17545	mol^0
KNO3	0.78972	mol^0
K2SO4	0.011589	mol^0
KSO4-1	0.13228	mol^0
K2SO4.1H	0.010377	mol^0
NaHCO3 -	2.389	mol^0
NaHCO3	0.40374	mol^0
NaHSO4	356.65	mol^0
Na2CO3	7.3005	mol^0
Na2CO3.1I	0.11036	mol^0
Na2CO3.7I	0.22354	mol^0
NaCO3-1	0.28348	mol^0
Na2CO3.1I	1.0111	mol^0
NaCl	38.197	mol^0
NaF - Aq	1.2906	mol^0
NaF	0.2625	mol^0
NaF.Na2Si	3.16E-03	mol^0
NaHF2	7.28E-03	mol^0
NaOH	8.05E+06	mol^0
NaOH.1H2	64322	mol^0
NaNO3 - A	17.412	mol^0
NaNO3	28.746	mol^0
Na2SO4	0.44942	mol^0
Na2SO4	1.90E-07	mol^0
Na2SO4.N	162.44	mol^0
Na2SO4.1I	0.046844	mol^0
NaSO4-1	0.12009	mol^0
SO3 - Aq	7726	mol^0
SO3 - Vap	1.64E+09	mol^0
H2SO4 - A	2.57E+10	mol^0
H2SO4 - V	3.86E+05	mol^0

Species Mobilities

HCO3-1	2.33E-04	m2/ohm-mol
HSO4-1	2.68E-04	m2/ohm-mol
CO3-2	3.88E-04	m2/ohm-mol
Cl-1	4.00E-04	m2/ohm-mol
Na2F+1	3.14E-04	m2/ohm-mol
F-1	2.88E-04	m2/ohm-mol
HF2-1	3.93E-04	m2/ohm-mol
H+1	1.83E-03	m2/ohm-mol
OH-1	1.03E-03	m2/ohm-mol
NO3-1	3.74E-04	m2/ohm-mol
K+1	3.83E-04	m2/ohm-mol
KSO4-1	2.00E-04	m2/ohm-mol
NaCO3-1	1.73E-04	m2/ohm-mol
Na+1	2.62E-04	m2/ohm-mol
NaSO4-1	1.83E-04	m2/ohm-mol
SO4-2	4.21E-04	m2/ohm-mol

Species Self Diffusivities

H2O	2.17E-09	m2/s
HCO3-1	1.05E-09	m2/s
HSO4-1	1.20E-09	m2/s
CO2 - Aq	1.61E-09	m2/s
CO3-2	8.81E-10	m2/s
Cl-1	1.78E-09	m2/s
Na2F+1	1.40E-09	m2/s
F-1	1.30E-09	m2/s
(HF)2 - Aq	1.09E-09	m2/s
HCl - Aq	1.90E-09	m2/s
HF2-1	1.74E-09	m2/s
HF - Aq	1.20E-10	m2/s
H+1	7.69E-09	m2/s
OH-1	4.41E-09	m2/s
NO3-1	1.66E-09	m2/s
HNO3 - Aq	1.77E-09	m2/s
KHSO4 - A	1.39E-09	m2/s
KCl - Aq	1.51E-09	m2/s
K+1	1.71E-09	m2/s
KSO4-1	9.02E-10	m2/s
NaHCO3 -	9.26E-10	m2/s
NaCO3-1	7.88E-10	m2/s
NaF - Aq	1.03E-09	m2/s
Na+1	1.19E-09	m2/s
NaNO3 - A	1.13E-09	m2/s
NaSO4-1	8.29E-10	m2/s
SO4-2	9.49E-10	m2/s
SO3 - Aq	1.01E-10	m2/s
H2SO4 - A	9.94E-10	m2/s

HF - Vap	379.93	mol^0
HNO3 - Aq	4.002	mol^0
HNO3 - Va	920.44	mol^0
KHCO3	7.7419	mol^0
KHSO4 - A	15.597	mol^0
KHSO4	14.067	mol^0
K2CO3	2670	mol^0
K2CO3.1.5	2055.7	mol^0
KCl - Aq	26.988	mol^0
KCl	16.596	mol^0
KF	54667	mol^0
KF.2H2O	1732.1	mol^0
KF.4H2O	6.69E+09	mol^0
KOH	3.85E+08	mol^0
KOH.2H2C	7614.8	mol^0
KOH.1H2C	23065	mol^0
KNO3	3.2319	mol^0
K2SO4	0.02685	mol^0
KSO4-1	0.067733	mol^0
K2SO4.1H	0.087869	mol^0
NaHCO3 -	0.52509	mol^0
NaHCO3	0.65701	mol^0
NaHSO4	376.35	mol^0
Na2CO3	1.316	mol^0
Na2CO3.1I	0.23607	mol^0
Na2CO3.7I	1.3745	mol^0
NaCO3-1	0.7632	mol^0
Na2CO3.1I	0.91296	mol^0
NaCl	35.518	mol^0
NaF - Aq	1.197	mol^0
NaF	0.31449	mol^0
NaF.Na2Si	3.16E-03	mol^0
NaHF2	0.051038	mol^0
NaOH	1.94E+05	mol^0
NaOH.1H2	16297	mol^0
NaNO3 - A	4.5667	mol^0
NaNO3	56.88	mol^0
Na2SO4	0.14445	mol^0
Na2SO4	2.13E-03	mol^0
Na2SO4.N	155.99	mol^0
Na2SO4.1I	26.308	mol^0
NaSO4-1	0.090006	mol^0
SO3 - Aq	1922.2	mol^0
SO3 - Vap	75679	mol^0
H2SO4 - A	3.19E+10	mol^0
H2SO4 - V	248.07	mol^0

Species Mobilities

HCO3-1	6.19E-04	m2/ohm-mol
HSO4-1	6.62E-04	m2/ohm-mol
CO3-2	1.10E-03	m2/ohm-mol
Cl-1	9.88E-04	m2/ohm-mol
Na2F+1	8.89E-04	m2/ohm-mol
F-1	7.79E-04	m2/ohm-mol
HF2-1	1.11E-03	m2/ohm-mol
H+1	3.07E-03	m2/ohm-mol
OH-1	2.13E-03	m2/ohm-mol
NO3-1	8.87E-04	m2/ohm-mol
K+1	9.23E-04	m2/ohm-mol
KSO4-1	5.24E-04	m2/ohm-mol
NaCO3-1	4.83E-04	m2/ohm-mol
Na+1	7.07E-04	m2/ohm-mol
NaSO4-1	4.90E-04	m2/ohm-mol
SO4-2	1.12E-03	m2/ohm-mol

Species Self Diffusivities

H2O	7.40E-09	m2/s
HCO3-1	3.70E-09	m2/s
HSO4-1	3.92E-09	m2/s
CO2 - Aq	6.42E-09	m2/s
CO3-2	3.29E-09	m2/s
Cl-1	5.82E-09	m2/s
Na2F+1	5.23E-09	m2/s
F-1	4.66E-09	m2/s
(HF)2 - Aq	3.86E-09	m2/s
HCl - Aq	6.15E-09	m2/s
HF2-1	6.51E-09	m2/s
HF - Aq	4.47E-10	m2/s
H+1	1.74E-08	m2/s
OH-1	1.22E-08	m2/s
NO3-1	5.22E-09	m2/s
HNO3 - Aq	5.52E-09	m2/s
KHSO4 - A	5.20E-09	m2/s
KCl - Aq	4.83E-09	m2/s
K+1	5.46E-09	m2/s
KSO4-1	3.12E-09	m2/s
NaHCO3 -	3.27E-09	m2/s
NaCO3-1	2.90E-09	m2/s
NaF - Aq	3.68E-09	m2/s
Na+1	4.25E-09	m2/s
NaNO3 - A	3.86E-09	m2/s
NaSO4-1	2.93E-09	m2/s
SO4-2	3.34E-09	m2/s
SO3 - Aq	3.76E-10	m2/s
H2SO4 - A	3.48E-09	m2/s

NaHCO3 -	2.389	mol^0
NaHCO3	0.40374	mol^0
NaHSO4	356.65	mol^0
Na2CO3	7.3005	mol^0
Na2CO3.1I	0.11036	mol^0
Na2CO3.7I	0.22354	mol^0
NaCO3-1	0.28348	mol^0
Na2CO3.1I	1.0111	mol^0
NaCl	38.197	mol^0
NaF - Aq	1.2906	mol^0
NaF	0.2625	mol^0
NaF.Na2Si	3.16E-03	mol^0
NaHF2	7.28E-03	mol^0
NaOH	8.05E+06	mol^0
NaOH.1H2	64322	mol^0
NaNO3 - A	17.412	mol^0
NaNO3	28.746	mol^0
Na2SO4	0.44942	mol^0
Na2SO4	1.90E-07	mol^0
Na2SO4.N	162.44	mol^0
Na2SO4.1I	0.046844	mol^0
NaSO4-1	0.12009	mol^0
SO3 - Aq	7726	mol^0
SO3 - Vap	1.64E+09	mol^0
H2SO4 - A	2.57E+10	mol^0
H2SO4 - V	3.86E+05	mol^0

Species Mobilities

HCO3-1	2.62E-04	m2/ohm-mol
CO3-2	4.35E-04	m2/ohm-mol
Cl-1	4.49E-04	m2/ohm-mol
H+1	2.05E-03	m2/ohm-mol
OH-1	1.16E-03	m2/ohm-mol
NO3-1	4.20E-04	m2/ohm-mol
K+1	4.30E-04	m2/ohm-mol
NaCO3-1	1.94E-04	m2/ohm-mol
Na+1	2.94E-04	m2/ohm-mol

Species Self Diffusivities

H2O	2.36E-09	m2/s
HCO3-1	1.14E-09	m2/s
HSO4-1	1.31E-09	m2/s
CO2 - Aq	1.96E-09	m2/s
CO3-2	9.59E-10	m2/s
Cl-1	1.92E-09	m2/s
Na2F+1	1.52E-09	m2/s
F-1	1.41E-09	m2/s
(HF)2 - Aq	1.19E-09	m2/s
HCl - Aq	2.06E-09	m2/s
HF2-1	1.89E-09	m2/s
HF - Aq	1.30E-10	m2/s
H+1	8.12E-09	m2/s
OH-1	4.71E-09	m2/s
NO3-1	1.80E-09	m2/s
HNO3 - Aq	1.94E-09	m2/s
KHSO4 - A	1.53E-09	m2/s
KCl - Aq	1.59E-09	m2/s
K+1	1.84E-09	m2/s
KSO4-1	9.86E-10	m2/s
NaHCO3 -	1.01E-09	m2/s
NaCO3-1	8.59E-10	m2/s
NaF - Aq	1.13E-09	m2/s
Na+1	1.29E-09	m2/s
NaNO3 - A	1.23E-09	m2/s
NaSO4-1	9.06E-10	m2/s
SO4-2	1.04E-09	m2/s
SO3 - Aq	1.10E-10	m2/s
H2SO4 - A	1.09E-09	m2/s

NaHCO3 -	2.389	mol^0
NaHCO3	0.40374	mol^0
NaHSO4	356.65	mol^0
Na2CO3	7.3005	mol^0
Na2CO3.1I	0.11036	mol^0
Na2CO3.7I	0.22354	mol^0
NaCO3-1	0.28348	mol^0
Na2CO3.1I	1.0111	mol^0
NaCl	38.197	mol^0
NaF - Aq	1.2906	mol^0
NaF	0.2625	mol^0
NaF.Na2Si	3.16E-03	mol^0
NaHF2	7.28E-03	mol^0
NaOH	8.05E+06	mol^0
NaOH.1H2	64322	mol^0
NaNO3 - A	17.412	mol^0
NaNO3	28.746	mol^0
Na2SO4	0.44942	mol^0
Na2SO4	1.90E-07	mol^0
Na2SO4.N	162.44	mol^0
Na2SO4.1I	0.046844	mol^0
NaSO4-1	0.12009	mol^0
SO3 - Aq	7726	mol^0
SO3 - Vap	1.64E+09	mol^0
H2SO4 - A	2.57E+10	mol^0
H2SO4 - V	3.86E+05	mol^0

Species Mobilities

HCO3-1	2.49E-04	m2/ohm-mol
CO3-2	4.13E-04	m2/ohm-mol
Cl-1	4.27E-04	m2/ohm-mol
H+1	1.95E-03	m2/ohm-mol
OH-1	1.10E-03	m2/ohm-mol
NO3-1	3.99E-04	m2/ohm-mol
K+1	4.09E-04	m2/ohm-mol
NaCO3-1	1.85E-04	m2/ohm-mol
Na+1	2.80E-04	m2/ohm-mol

Species Self Diffusivities

H2O	2.30E-09	m2/s
HCO3-1	1.11E-09	m2/s
HSO4-1	1.27E-09	m2/s
CO2 - Aq	1.91E-09	m2/s
CO3-2	9.33E-10	m2/s
Cl-1	1.88E-09	m2/s
Na2F+1	1.48E-09	m2/s
F-1	1.37E-09	m2/s
(HF)2 - Aq	1.16E-09	m2/s
HCl - Aq	2.02E-09	m2/s
HF2-1	1.84E-09	m2/s
HF - Aq	1.27E-10	m2/s
H+1	7.99E-09	m2/s
OH-1	4.62E-09	m2/s
NO3-1	1.75E-09	m2/s
HNO3 - Aq	1.88E-09	m2/s
KHSO4 - A	1.48E-09	m2/s
KCl - Aq	1.57E-09	m2/s
K+1	1.80E-09	m2/s
KSO4-1	9.59E-10	m2/s
NaHCO3 -	9.85E-10	m2/s
NaCO3-1	8.36E-10	m2/s
NaF - Aq	1.10E-09	m2/s
Na+1	1.26E-09	m2/s
NaNO3 - A	1.20E-09	m2/s
NaSO4-1	8.81E-10	m2/s
SO4-2	1.01E-09	m2/s
SO3 - Aq	1.07E-10	m2/s
H2SO4 - A	1.06E-09	m2/s

Na2CO3
Na2CO3.1I
Na2CO3.7I
NaCO3-1
Na2CO3.1I
NaCl
NaF - Aq
NaF
NaF.Na2Si
NaHF2
NaOH
NaOH.1H2
NaNO3 - A
NaNO3
Na2SO4
Na2SO4
Na2SO4.N
Na2SO4.1I
NaSO4-1
SO3 - Aq
SO3 - Vap
H2SO4 - A
H2SO4 - V

Species Mc

HCO3-1
CO3-2
Cl-1
H+1
OH-1
NO3-1
K+1
NaCO3-1
Na+1

Species Se

H2O
HCO3-1
HSO4-1
CO2 - Aq
CO3-2
Cl-1
Na2F+1
F-1
(HF)2 - Aq
HCl - Aq
HF2-1
HF - Aq
H+1
OH-1
NO3-1
HNO3 - Aq
KHSO4 - A
KCl - Aq
K+1
KSO4-1
NaHCO3 -
NaCO3-1
NaF - Aq
Na+1
NaNO3 - A
NaSO4-1
SO4-2
SO3 - Aq
H2SO4 - A

K.T. Chiang

12/19/04

SCW18

```
ı Summary

t_NaOH_95oC Calculation for Work1

Chemistry Model
 Databanks:
              Public

ıefault

 Calculation
 Temperatu       95 °C
 Pressure         1 atm


ows

      500 g
    2.726 g
    3.252 g
    4.372 g
        0 g
    48.18 g
        0 g
      3 1 g


 Summary

ıer of species:  113

 Related   Aqueous   Vapor      Solid      Second
 Inflows   Species   Species    Species    Liquid Spe
 CO2       H2O       H2O - Vap  K2SO4.KNaSO4
 H2CO3     HCO3-1    CO2 - Vap  2Na2SO4 Na2CO3
 K2SO4.KN  HSO4-1    (HF)2 - Va KHCO3
 2Na2SO4.I CO2 - Aq  HCl - Vap  KHSO4
 (HF)2     CO3-2     HF - Vap   K2CO3
 HCl       Cl-1      HNO3 - Va  K2CO3.1.5H2O
 HF        Na2F+1    SO3 - Vap  KCl
 (HF)6     F-1       H2SO4 - V  KF
 HNO3      (HF)2 - Aq           KF.2H2O
 KHCO3     HCl - Aq             KF.4H2O
 KHSO4     HF2-1                KOH
 K2CO3     HF - Aq              KOH.2H2O
 K2CO3.1.5 H+1                  KOH 1H2O
 KF        OH-1                 KNO3
 KF.2H2O   NO3-1                K2SO4
 KF.4H2O   HNO3 - Aq            K2SO4.1H2O
 KOH       KHSO4 - Aq           NaHCO3
 KOH.2H2C  KCl - Aq             NaHSO4
 KOH.1H2C  K+1                  Na2CO3
 KNO3      KSO4-1               Na2CO3.10H2O
 K2SO4     NaHCO3 - Aq          Na2CO3.7H2O
 K2SO4.1H  NaCO3-1              Na2CO3 1H2O
 NaHSO4    NaF - Aq             NaCl
 Na2CO3    Na+1                 NaF
 Na2CO3.1( NaNO3 - Aq           NaF Na2SO4
 Na2CO3.7I NaSO4-1              NaHF2
 Na2CO3.1I SO4-2                NaOH
 NaF.Na2S( SO3 - Aq             NaOH.1H2O
 NaHF2     H2SO4 - Aq           NaNO3
 NaOH 1H2O                      Na2SO4
 Na2SO4                         Na2SO4
 Na2SO4.NaHSO4                  Na2SO4.NaHSO4
 Na2SO4.10H2O                   Na2SO4.10H2O
 SO3
 H2SO4


rameters

   561 63 g
       95 °C
        1 atm
   8.5751 pH
   1.3618 mol/kg H2( SCW16, 95C
   70.042 atm
  0.95778 Activity
  0.18117 1/ohm
   123.97 cm2/ohm-mol
  0 47262 cP
   1.5908 cP/cP H2O

 Total       Aqueous    Vapor      Solid      2nd Liquid
 --          g/ml       g/ml       g/ml       g/ml
 --              1.0352  7.75E-04          0          0

 Total       Aqueous    Vapor      Solid      2nd Liquid
 cal         cal        cal        cal        cal
 -2.01E+06   -2.01E+06    -197.09          0          0


ʾhase Flows (Amounts)

 Total       Aqueous    Vapor      Solid      2nd Liquid
 mol         mol        mol        mol        mol
     29.16     29.157   3.05E-03          0          0

 Total       Aqueous    Vapor      Solid      2nd Liquid
 g           g          g          g          g
    561.63     561.56   0.071011          0          0

 Total       Aqueous    Vapor      Solid      2nd Liquid
 L           L          L          L          L
   0.63407    0.54247   0.091603          0          0


ndencies

 Temperature Range
   0.32756           0 200.00 °C  inside range
  4.32E-03       35.37 109.00 °C  inside range
  2.06E-03           0 350.00 °C  inside range
  7.60E-04           0 110.00 °C  inside range
  5.86E-04           0 300.00 °C  inside range
  3.24E-04           0 200.00 °C  inside range
  3.13E-10          33 143.00 °C  inside range
  1.96E-14 data valid tl inside range

   1.3618 mol/kg H2( SCW16, 95C
utput (True Species)
```

```
Calculation Summary

SinglePoint1 Calculation for Work1

Automatic Chemistry Model
           Databanks:
                      Public

Unit Set: Default

Isothermal Calculation
           Temperatu        25 °C
           Pressure          1 atm


Stream Inflows

Water         1000 g
Sodium chl   5.444 g
Potassium    6.487 g
Sodium nitı      0 g
Sodium sul       0 g
Sodium bic   96.38 g
Sodium flu       0 g
Sodium hy(       0 g


Speciation Summary

Total number of species:  113

User      Related   Aqueous   Vapor      Solid      Second
Inflows   Inflows   Species   Species    Species    Liquid Spe
H2O       CO2       H2O       H2O - Vap  K2SO4.KNaSO4
NaCl      H2CO3     HCO3-1    CO2 - Vap  2Na2SO4.Na2CO3
KCl       K2SO4.KN  HSO4-1    (HF)2 - Va KHCO3
NaNO3     2Na2SO4 I CO2 - Aq  HCl - Vap  KHSO4
Na2SO4    (HF)2     CO3-2     HF - Vap   K2CO3
NaHCO3    HCl       Cl-1      HNO3 - Va  K2CO3.1.5H2O
NaF       HF        Na2F+1    SO3 - Vap  KCl
NaOH      (HF)6     F-1       H2SO4 - V  KF
          HNO3      (HF)2 - Aq           KF.2H2O
          KHCO3     HCl - Aq             KF 4H2O
          KHSO4     HF2-1                KOH
          K2CO3     HF - Aq              KOH.2H2O
          K2CO3.1.5 H+1                  KOH.1H2O
          KF        OH-1                 KNO3
          KF.2H2O   NO3-1                K2SO4
          KF 4H2O   HNO3 - Aq            K2SO4.1H2O
          KOH       KHSO4 - Aq           NaHCO3
          KOH.2H2C  KCl - Aq             NaHSO4
          KOH.1H2C  K+1                  Na2CO3
          KNO3      KSO4-1               Na2CO3.10H2O
          K2SO4     NaHCO3 - Aq          Na2CO3.7H2O
          K2SO4.1H  NaCO3-1              Na2CO3.1H2O
          NaHSO4    NaF - Aq             NaCl
          Na2CO3    Na+1                 NaF
          Na2CO3.1( NaNO3 - Aq           NaF.Na2SO4
          Na2CO3.7I NaSO4-1              NaHF2
          Na2CO3 1I SO4-2                NaOH
          NaF.Na2S( SO3 - Aq             NaOH.1H2O
          NaHF2     H2SO4 - Aq           NaNO3
          NaOH.1H2O                      Na2SO4
          Na2SO4                         Na2SO4
          Na2SO4.NaHSO4                  Na2SO4 NaHSO4
          Na2SO4 10H2O                   Na2SO4.10H2O
          SO3
          H2SO4


Stream Parameters

Stream Am      1108.3 g
Temperatu          25 °C
Pressure            1 atm
pH             7 7419 pH
Ionic Stren    1.2091 mol/kg H2O
Osmotic Pı     61.057 atm
WaterActıv    0.95616 Activity
Electncal C  0.066813 1/ohm
Electncal C     52.49 cm2/ohm-mol
Viscosity, ε   1.3419 cP
Viscosity, r   1.5065 cP/cP H2O

          Total       Aqueous    Vapor      Solid      2nd Liquid
          --          g/ml       g/ml       g/ml       g/ml
Density   --              1.0627          0          0          0

          Total       Aqueous    Vapor      Solid      2nd Liquid
          cal         cal        cal        cal        cal
Enthalpy  -4.06E+06   -4.06E+06           0          0          0


Total and Phase Flows (Amounts)

          Total       Aqueous    Vapor      Solid      2nd Liquid
          mol         mol        mol        mol        mol
Mole          58.05       58.05           0          0          0

          Total       Aqueous    Vapor      Solid      2nd Liquid
          g           g          g          g          g
Mass         1108.3      1108.3           0          0          0

          Total       Aqueous    Vapor      Solid      2nd Liquid
          L           L          L          L          L
Volume       1.0429      1.0429           0          0          0


Scaling Tendencies

solids withi Temperature Range
Sodium bic     0.90033          0 200.00 °C  inside range
Potassium     0.013745          0 70.000 °C  inside range
Sodium cai    3.56E-03          0 32.000 °C  inside range
Sodium chl    1.94E-03          0 350.00 °C  inside range
Potassium     6.84E-04          0 200.00 °C  inside range
Potassium     3.26E-09          0 80.000 °C  inside range
Potassium     1.42E-11          0 33.000 °C  inside range
Sodium hy(    5.20E-12         12 60.000 °C  inside range
Potassium     5.06E-19 data valid tl inside range


Species Output (True Species)
```

```
Calculation Summary

SinglePoint_NaOH Calculation for Work1

Automatic Chemistry Model
           Databanks:
                      Public

Unit Set: Default

Isothermal Calculation
           Temperatu        25 °C
           Pressure          1 atm


Stream Inflows

Water         1000 g
Sodium chl   5.444 g
Potassium    6.487 g
Sodium nitı      0 g
Sodium sul       0 g
Sodium bic   96.38 g
Sodium flu       0 g
Sodium hy(       8 g


Speciation Summary

Total number of species:  113

User      Related   Aqueous   Vapor      Solid      Second
Inflows   Inflows   Species   Species    Species    Liquid Spe
H2O       CO2       H2O       H2O - Vap  K2SO4.KNaSO4
NaCl      H2CO3     HCO3-1    CO2 - Vap  2Na2SO4.Na2CO3
KCl       K2SO4.KN  HSO4-1    (HF)2 - Va KHCO3
NaNO3     2Na2SO4.I CO2 - Aq  HCl - Vap  KHSO4
Na2SO4    (HF)2     CO3-2     HF - Vap   K2CO3
NaHCO3    HCl       Cl-1      HNO3 - Va  K2CO3.1 5H2O
NaF       HF        Na2F+1    SO3 - Vap  KCl
NaOH      (HF)6     F-1       H2SO4 - V  KF
          HNO3      (HF)2 - Aq           KF.2H2O
          KHCO3     HCl - Aq             KF.4H2O
          KHSO4     HF2-1                KOH
          K2CO3     HF - Aq              KOH.2H2O
          K2CO3 1.5 H+1                  KOH 1H2O
          KF        OH-1                 KNO3
          KF.2H2O   NO3-1                K2SO4
          KF.4H2O   HNO3 - Aq            K2SO4.1H2O
          KOH       KHSO4 - Aq           NaHCO3
          KOH.2H2C  KCl - Aq             NaHSO4
          KOH.1H2C  K+1                  Na2CO3
          KNO3      KSO4-1               Na2CO3.10H2O
          K2SO4     NaHCO3 - Aq          Na2CO3.7H2O
          K2SO4.1H  NaCO3-1              Na2CO3.1H2O
          NaHSO4    NaF - Aq             NaCl
          Na2CO3    Na+1                 NaF
          Na2CO3.1( NaNO3 - Aq           NaF.Na2SO4
          Na2CO3 7I NaSO4-1              NaHF2
          Na2CO3 1I SO4-2                NaOH
          NaF.Na2S( SO3 - Aq             NaOH.1H2O
          NaHF2     H2SO4 - Aq           NaNO3
          NaOH.1H2O                      Na2SO4
          Na2SO4                         Na2SO4
          Na2SO4.NaHSO4                  Na2SO4.NaHSO4
          Na2SO4.10H2O                   Na2SO4 10H2O
          SO3
          H2SO4


Stream Parameters

Stream Am      1116.3 g
Temperatu          25 °C
Pressure            1 atm
pH             8.7798 pH
Ionic Stren    1.5081 mol/kg H2O
Osmotic Pı     59.515 atm
WaterActıv    0.95754 Activity
Electrical C  0.074557 1/ohm
Electrical C     50.84 cm2/ohm-mol
Viscosity, ε   1.3649 cP
Viscosity, r   1.5323 cP/cP H2O

          Total       Aqueous    Vapor      Solid      2nd Liquid
          --          g/ml       g/ml       g/ml       g/ml
Density   --              1.0718          0          0          0

          Total       Aqueous    Vapor      Solid      2nd Liquid
          cal         cal        cal        cal        cal
Enthalpy  -4.09E+06   -4.09E+06           0          0          0


Total and Phase Flows (Amounts)

          Total       Aqueous    Vapor      Solid      2nd Liquid
          mol         mol        mol        mol        mol
Mole         58.401      58.401           0          0          0

          Total       Aqueous    Vapor      Solid      2nd Liquid
          g           g          g          g          g
Mass         1116.3      1116.3           0          0          0

          Total       Aqueous    Vapor      Solid      2nd Liquid
          L           L          L          L          L
Volume       1.0416      1 0416           0          0          0


Scaling Tendencies

solids withi Temperature Range
Sodium bic     0.82424          0 200.00 °C  inside range
Sodium cai     0.04034          0 32.000 °C  inside range
Potassium     0.011592          0 70.000 °C  inside range
Sodium chl    2.13E-03          0 350.00 °C  inside range
Potassium     6.94E-04          0 200.00 °C  inside range
Potassium     3.09E-08          0 80.000 °C  inside range
Potassium     1.60E-10          0 33.000 °C  inside range
Sodium hy(    6.35E-11         12 60.000 °C  inside range
Potassium     5.69E-18 data valid tl inside range


Species Output (True Species)
```

```
Calculation Summary

SinglePoint_NaOH_95oC Calculation for Work1

Automatic Chemistry Model
           Databanks:
                      Public

Unit Set. Default

Isothermal Calculation
           Temperatu        95 °C
           Pressure          1 atm


Stream Inflows

Water         1000 g
Sodium chl   5.444 g
Potassium    6.487 g
Sodium nitı      0 g
Sodium sul       0 g
Sodium bic   96.38 g
Sodium flu       0 g
Sodium hy(       8 g


Speciation Summary

Total number of species:  113

User      Related   Aqueous   Vapor      Solid      Second
Inflows   Inflows   Species   Species    Species    Liquid Species
H2O       CO2       H2O       H2O - Vap  K2SO4.KNaSO4
NaCl      H2CO3     HCO3-1    CO2 - Vap  2Na2SO4.Na2CO3
KCl       K2SO4.KN  HSO4-1    (HF)2 - Va KHCO3
NaNO3     2Na2SO4.I CO2 - Aq  HCl - Vap  KHSO4
Na2SO4    (HF)2     CO3-2     HF - Vap   K2CO3
NaHCO3    HCl       Cl-1      HNO3 - Va  K2CO3.1.5H2O
NaF       HF        Na2F+1    SO3 - Vap  KCl
NaOH      (HF)6     F-1       H2SO4 - V  KF
          HNO3      (HF)2 - Aq           KF.2H2O
          KHCO3     HCl - Aq             KF.4H2O
          KHSO4     HF2-1                KOH
          K2CO3     HF - Aq              KOH.2H2O
          K2CO3.1.5 H+1                  KOH.1H2O
          KF        OH-1                 KNO3
          KF.2H2O   NO3-1                K2SO4
          KF.4H2O   HNO3 - Aq            K2SO4 1H2O
          KOH       KHSO4 - Aq           NaHCO3
          KOH.2H2C  KCl - Aq             NaHSO4
          KOH.1H2C  K+1                  Na2CO3
          KNO3      KSO4-1               Na2CO3.10H2O
          K2SO4     NaHCO3 - Aq          Na2CO3.7H2O
          K2SO4.1H  NaCO3-1              Na2CO3.1H2O
          NaHSO4    NaF - Aq             NaCl
          Na2CO3    Na+1                 NaF
          Na2CO3 1( NaNO3 - Aq           NaF.Na2SO4
          Na2CO3.7I NaSO4-1              NaHF2
          Na2CO3.1I SO4-2                NaOH
          NaF.Na2S( SO3 - Aq             NaOH.1H2O
          NaHF2     H2SO4 - Aq           NaNO3
          NaOH.1H2O                      Na2SO4
          Na2SO4                         Na2SO4
          Na2SO4.NaHSO4                  Na2SO4.NaHSO4
          Na2SO4.10H2O                   Na2SO4.10H2O
          SO3
          H2SO4


Stream Parameters

Stream Am      1116.3 g
Temperatu          95 °C
Pressure            1 atm
pH             8.6895 pH
Ionic Stren    1.3716 mol/kg H2( SCW1795C
Osmotic Pı     65.691 atm
WaterActiv    0.96045 Activity
Electrical C    0.1762 1/ohm
Electrical C    124.66 cm2/ohm-mol
Viscosity, ε  0.47109 cP
Viscosity, r   1.5856 cP/cP H2O

          Total       Aqueous    Vapor      Solid      2nd Liquid
          --          g/ml       g/ml       g/ml       g/ml
Density   --               1.033          0          0          0

          Total       Aqueous    Vapor      Solid      2nd Liquid
          cal         cal        cal        cal        cal
Enthalpy  -4 02E+06   -4.02E+06           0          0          0


Total and Phase Flows (Amounts)

          Total       Aqueous    Vapor      Solid      2nd Liquid
          mol         mol        mol        mol        mol
Mole         58.231      58.231           0          0          0

          Total       Aqueous    Vapor      Solid      2nd Liquid
          g           g          g          g          g
Mass         1116.3      1116.3           0          0          0

          Total       Aqueous    Vapor      Solid      2nd Liquid
          L           L          L          L          L
Volume       1 0806      1.0806           0          0          0


Scaling Tendencies

solids withi Temperature Range
Sodium bic     0.30742          0 200.00 °C  inside range
Sodium cai    5.14E-03      35.37 109.00 °C  inside range
Sodium chl    1.97E-03          0 350.00 °C  inside range
Potassium     3.30E-04          0 200.00 °C  inside range
Potassium     4.22E-10         33 143.00 °C  inside range
Potassium     2.63E-14 data valid tl inside range

Ionic Stren    1.3716 mol/kg H2( SCW1795C
Species Output (True Species)

          Total       Aqueous    Vapor      Solid      2nd Liquid
          g           mol/kg H2( mol        mol        n/a
```

K. T. Chiang

12/19/04

Total g	Aqueous mol/kg H2O	Vapor mol	Solid mol	2nd Liquid n/a
501.42	55.508	2.44E-03	0	0
6.13E-03	1.64E-04	0	0	0
0.4099	9.62E-03	0	0	0
14.198	0.33706	0	0	0
0.068204	1.86E-03	6.15E-04	0	0
1.49E-13	7.58E-15	2.35E-16	0	0
8.39E-10	2.65E-11	1.20E-16	0	0
19.773	0.64634	0	0	0
4.2864	0.14247	0	0	0
3.1973	0.17987	0	0	0
1.95E-09	3.86E-09	0	0	0
2.41E-03	2.82E-04	0	0	0
2.8904	0.092976	0	0	0
1.7023	0.086839	0	0	0
0.62125	0.014929	0	0	0
13.054	1.1325	0	0	0

Output (Apparent Species)

Total g	Aqueous mol/kg H2O	Vapor mol	Solid mol	2nd Liquid n/a
497.45	55.068	2.44E-03	0	0
29.962	1.4941	0	0	0
25.241	1.1427	5.15E-04	0	0
3.2911	0.18003	2.35E-16	0	0
3.2413	0.10259	1.20E-16	0	0
2.4474	0.087002	0	0	0

alance

Total mol	Aqueous mol	Vapor mol	Solid mol	2nd Liquid n/a
0	1.1427	5.15E-04	0	0
0	0.18003	2.35E-16	0	0
0	0	0	0	0
0	112	4.88E-03	0	0
0	0.087003	0	0	0
0	0.10259	1.20E-16	0	0
0	1.4941	0	0	0
0	59.242	3.67E-03	0	0
0	0	0	0	0

ctivity Coefficients

0.95778	Activity
0.53746	Act-Coef
0.59265	Act-Coef
1.2016	Act-Coef
0.075387	Act-Coef
0.65515	Act-Coef
0.4818	Act-Coef
0.55725	Act-Coef
1.2159	Act-Coef
1.2159	Act-Coef
0.59265	Act-Coef
1.2736	Act-Coef
0.68973	Act-Coef
0.58522	Act-Coef
0.57859	Act-Coef
1.3469	Act-Coef
1.2159	Act-Coef
1.2159	Act-Coef
0.52602	Act-Coef
0.46896	Act-Coef
1.2159	Act-Coef
0.56396	Act-Coef
1.2159	Act-Coef
0.54705	Act-Coef
0.75872	Act-Coef
1.7349	Act-Coef
0.069013	Act-Coef
1.2159	Act-Coef
1.2159	Act-Coef
0.99143	Fug-Coef
0.99859	Fug-Coef
0.9895	Fug-Coef
0.99802	Fug-Coef
0.98941	Fug-Coef
0.98506	Fug-Coef
0.97441	Fug-Coef
0.9405	Fug-Coef

eq)-Values

4.59E-13	mol^0
1.2097	mol^0
8.22E-11	mol^0
1.17E-03	mol^0
4.31E-07	mol^0
0.011137	mol^0
34.675	mol^0
5.51E-05	mol^0
1.71E-05	mol^0
4686.1	mol^0
499.84	mol^0
33570	mol^0
0.12142	mol^0
2.1685	mol^0
1.60E-04	mol^0
379.93	mol^0
4.002	mol^0
920.44	mol^0
7.7419	mol^0
15.597	mol^0
14.067	mol^0
2670	mol^0
2055.7	mol^0
26.986	mol^0
16.596	mol^0
54667	mol^0
1732.1	mol^0
6.69E+09	mol^0
3.85E+08	mol^0
7614.8	mol^0
23065	mol^0
3.2319	mol^0
0.02585	mol^0
0.067733	mol^0
0.087869	mol^0
0.52509	mol^0
0.65701	mol^0
376.35	mol^0

	Total g	Aqueous mol/kg H2O	Vapor mol	Solid mol	2nd Liquid n/a
H2O	1000.3	55.508	0	0	0
KCl	2.67E-03	3.58E-05	0	0	0
NaHCO3	10.679	0.12708	0	0	0
CO2	0.85332	0.019383	0	0	0
HCl	3.70E-14	1.01E-15	0	0	0
HCO3-1	59.882	0.98105	0	0	0
CO3-2	0.85867	0.014304	0	0	0
Cl-1	6.3862	0.18007	0	0	0
H+1	2.32E-08	2.30E-08	0	0	0
OH-1	1.18E-05	6.98E-07	0	0	0
K+1	3.4007	0.086948	0	0	0
NaCO3-1	0.42161	5.08E-03	0	0	0
Na+1	25.478	1.1079	0	0	0

Molecular Output (Apparent Species)

	Total g	Aqueous mol/kg H2O	Vapor mol	Solid mol	2nd Liquid n/a
H2O	996.75	55.309	0	0	0
NaOH	49.614	1.24	0	0	0
CO2	50.492	1.1469	0	0	0
HCl	6.569	0.1801	0	0	0
KOH	4.882	0.086964	0	0	0

Element Balance

	Total mol	Aqueous mol	Vapor mol	Solid mol	2nd Liquid n/a
C(+4)	0	1.1469	0	0	0
CL(-1)	0	0.1801	0	0	0
F(-1)	0	0	0	0	0
H(+1)	0	112.12	0	0	0
K(+1)	0	0.086984	0	0	0
N(+5)	0	0	0	0	0
NA(+1)	0	1.24	0	0	0
O(-2)	0	58.93	0	0	0
S(+6)	0	0	0	0	0

Species Activity Coefficients

H2O	0.95616 Activity
HCO3-1	0.5669 Act-Coef
HSO4-1	0.66463 Act-Coef
CO2 - Aq	1.1977 Act-Coef
CO3-2	0.1008 Act-Coef
Cl-1	0.6285 Act-Coef
Na2F+1	0.5398 Act-Coef
F-1	0.60679 Act-Coef
(HF)2 - Aq	1.1974 Act-Coef
HCl - Aq	1.1974 Act-Coef
HF2-1	0.66463 Act-Coef
HF - Aq	1.1974 Act-Coef
H+1	0.78694 Act-Coef
OH-1	0.76879 Act-Coef
NO3-1	0.60623 Act-Coef
HNO3 - Aq	1.2826 Act-Coef
KHSO4 - A	1.1974 Act-Coef
KCl - Aq	1.1974 Act-Coef
K+1	0.52449 Act-Coef
KSO4-1	0.54803 Act-Coef
NaHCO3 -	1.1974 Act-Coef
NaCO3-1	0.65465 Act-Coef
NaF - Aq	1.1974 Act-Coef
Na+1	0.58997 Act-Coef
NaNO3 - A	0.78052 Act-Coef
NaSO4-1	0.54033 Act-Coef
SO4-2	0.11185 Act-Coef
SO3 - Aq	1.1974 Act-Coef
H2SO4 - A	1.1974 Act-Coef
H2O - Vap	1 Fug-Coef
CO2 - Vap	1 Fug-Coef
(HF)2 - Vaq	1 Fug-Coef
HCl - Vap	1 Fug-Coef
HF - Vap	1 Fug-Coef
HNO3 - Va	1 Fug-Coef
SO3 - Vap	1 Fug-Coef
H2SO4 - V	1 Fug-Coef

Species K(eq)-Values

H2O	1.01E-14 mol^0
H2O - Vap	31.857 mol^0
HCO3-1	4.70E-11 mol^0
HSO4-1	0.010515 mol^0
CO2 - Aq	4.54E-07 mol^0
CO2 - Vap	0.03392 mol^0
Na2F+1	92.494 mol^0
K2SO4.KN	9.29E-05 mol^0
2Na2SO4.I	3.44E-03 mol^0
(HF)2 - Aq	51387 mol^0
(HF)2 - Vaq	19124 mol^0
HCl - Aq	1.69E+06 mol^0
HCl - Vap	0.92796 mol^0
HF2-1	4.1247 mol^0
HF - Aq	6.17E-04 mol^0
HF - Vap	19019 mol^0
HNO3 - Aq	20.065 mol^0
HNO3 - Va	1.40E+05 mol^0
KHCO3	1.8452 mol^0
KHSO4 - A	51.933 mol^0
KHSO4	3.3683 mol^0
K2CO3	54473 mol^0
K2CO3.1.5	859.86 mol^0
KCl - Aq	120.41 mol^0
KCl	7.5444 mol^0
KF	7251.8 mol^0
KF.2H2O	395.96 mol^0
KF.4H2O	63.719 mol^0
KOH	4.83E+10 mol^0
KOH.2H2O	1572.6 mol^0
KOH.1H2O	17545 mol^0
KNO3	0.78972 mol^0
K2SO4	0.011589 mol^0
KSO4-1	0.13226 mol^0
K2SO4.1H	0.010377 mol^0
NaHCO3 -	2.389 mol^0
NaHCO3	0.40374 mol^0
NaHSO4	356.65 mol^0
Na2CO3	7.3005 mol^0
Na2CO3.1(	0.11036 mol^0
Na2CO3.7(	0.22354 mol^0

	Total g	Aqueous mol/kg H2O	Vapor mol	Solid mol	2nd Liquid n/a
H2O	1003.6	55.508	0	0	0
KCl	2.61E-03	3.49E-05	0	0	0
NaHCO3	9.4085	0.11159	0	0	0
CO2	0.06163	1.40E-03	0	0	0
HCl	3.22E-15	8.80E-17	0	0	0
HCO3-1	50.796	0.82948	0	0	0
CO3-2	8.9685	0.14924	0	0	0
Cl-1	6.3862	0.17948	0	0	0
H+1	2.18E-09	2.16E-09	0	0	0
OH-1	1.30E-04	7.59E-06	0	0	0
K+1	3.4008	0.086665	0	0	0
NaCO3-1	4.2846	0.051436	0	0	0
Na+1	29.354	1.2722	0	0	0

Molecular Output (Apparent Species)

	Total g	Aqueous mol/kg H2O	Vapor mol	Solid mol	2nd Liquid n/a
H2O	996.75	55.128	0	0	0
NaOH	57.614	1.4352	0	0	0
CO2	50.492	1.1431	0	0	0
HCl	6.569	0.17951	0	0	0
KOH	4.882	0.086699	0	0	0

Element Balance

	Total mol	Aqueous mol	Vapor mol	Solid mol	2nd Liquid n/a
C(+4)	0	1.1431	0	0	0
CL(-1)	0	0.17951	0	0	0
F(-1)	0	0	0	0	0
H(+1)	0	111.96	0	0	0
K(+1)	0	0.0867	0	0	0
N(+5)	0	0	0	0	0
NA(+1)	0	1.4352	0	0	0
O(-2)	0	58.936	0	0	0
S(+6)	0	0	0	0	0

Species Activity Coefficients

H2O	0.95754 Activity
HCO3-1	0.54975 Act-Coef
HSO4-1	0.65498 Act-Coef
CO2 - Aq	1.2483 Act-Coef
CO3-2	0.086432 Act-Coef
Cl-1	0.62251 Act-Coef
Na2F+1	0.52263 Act-Coef
F-1	0.59116 Act-Coef
(HF)2 - Aq	1.2483 Act-Coef
HCl - Aq	1.2483 Act-Coef
HF2-1	0.65498 Act-Coef
HF - Aq	1.2483 Act-Coef
H+1	0.77017 Act-Coef
OH-1	0.77047 Act-Coef
NO3-1	0.59383 Act-Coef
HNO3 - Aq	1.3508 Act-Coef
KHSO4 - A	1.2483 Act-Coef
KCl - Aq	1.2483 Act-Coef
K+1	0.54125 Act-Coef
KSO4-1	0.53021 Act-Coef
NaHCO3 -	1.2483 Act-Coef
NaCO3-1	0.64562 Act-Coef
NaF - Aq	1.2483 Act-Coef
Na+1	0.57363 Act-Coef
NaNO3 - A	0.76365 Act-Coef
NaSO4-1	0.52573 Act-Coef
SO4-2	0.095449 Act-Coef
SO3 - Aq	1.2483 Act-Coef
H2SO4 - A	1.2483 Act-Coef
H2O - Vap	1 Fug-Coef
CO2 - Vap	1 Fug-Coef
(HF)2 - Vaq	1 Fug-Coef
HCl - Vap	1 Fug-Coef
HF - Vap	1 Fug-Coef
HNO3 - Va	1 Fug-Coef
SO3 - Vap	1 Fug-Coef
H2SO4 - V	1 Fug-Coef

Species K(eq)-Values

H2O	1.01E-14 mol^0
H2O - Vap	31.857 mol^0
HCO3-1	4.70E-11 mol^0
HSO4-1	0.010515 mol^0
CO2 - Aq	4.54E-07 mol^0
CO2 - Vap	0.03392 mol^0
Na2F+1	92.494 mol^0
K2SO4.KN	9.29E-05 mol^0
2Na2SO4.I	3.44E-03 mol^0
(HF)2 - Aq	51387 mol^0
(HF)2 - Vaq	19124 mol^0
HCl - Aq	1.69E+06 mol^0
HCl - Vap	0.92796 mol^0
HF2-1	4.1247 mol^0
HF - Aq	6.17E-04 mol^0
HF - Vap	19019 mol^0
HNO3 - Aq	20.065 mol^0
HNO3 - Va	1.40E+05 mol^0
KHCO3	1.8452 mol^0
KHSO4 - A	51.933 mol^0
KHSO4	3.3683 mol^0
K2CO3	54473 mol^0
K2CO3.1.5	859.86 mol^0
KCl - Aq	120.41 mol^0
KCl	7.5444 mol^0
KF	7251.8 mol^0
KF.2H2O	395.96 mol^0
KF.4H2O	63.719 mol^0
KOH	4.83E+10 mol^0
KOH.2H2O	1572.6 mol^0
KOH.1H2O	17545 mol^0
KNO3	0.78972 mol^0
K2SO4	0.011589 mol^0
KSO4-1	0.13228 mol^0
K2SO4.1H	0.010377 mol^0
NaHCO3 -	2.389 mol^0
NaHCO3	0.40374 mol^0
NaHSO4	356.65 mol^0
Na2CO3	7.3005 mol^0
Na2CO3.1(	0.11036 mol^0
Na2CO3.7(	0.22354 mol^0

	Total g	Aqueous mol/kg H2O	Vapor mol	Solid mol	2nd Liquid n/a
H2O	1003.6	55.508	0	0	0
KCl	0.012374	1.65E-04	0	0	0
NaHCO3	26.456	0.31378	0	0	0
CO2	0.060542	1.37E-03	0	0	0
HCl	2.12E-13	5.78E-15	0	0	0
HCO3-1	38.439	0.6277	0	0	0
CO3-2	10.958	0.18194	0	0	0
Cl-1	6.3815	0.17935	0	0	0
H+1	3.03E-09	3.00E-09	0	0	0
OH-1	6.32E-03	3.71E-04	0	0	0
K+1	3.3956	0.086535	0	0	0
NaCO3-1	1.5289	0.018354	0	0	0
Na+1	25.453	1.1031	0	0	0

Molecular Output (Apparent Species)

	Total g	Aqueous mol/kg H2O	Vapor mol	Solid mol	2nd Liquid n/a
H2O	996.75	55.128	0	0	0
NaOH	57.614	1.4352	0	0	0
CO2	50.492	1.1431	0	0	0
HCl	6.569	0.17951	0	0	0
KOH	4.882	0.0867	0	0	0

Element Balance

	Total mol	Aqueous mol	Vapor mol	Solid mol	2nd Liquid n/a
C(+4)	0	1.1432	0	0	0
CL(-1)	0	0.17952	0	0	0
F(-1)	0	0	0	0	0
H(+1)	0	111.96	0	0	0
K(+1)	0	0.086701	0	0	0
N(+5)	0	0	0	0	0
NA(+1)	0	1.4353	0	0	0
O(-2)	0	58.937	0	0	0
S(+6)	0	0	0	0	0

Species Activity Coefficients

H2O	0.96045 Activity
HCO3-1	0.53549 Act-Coef
HSO4-1	0.58877 Act-Coef
CO2 - Aq	1.2116 Act-Coef
CO3-2	0.074338 Act-Coef
Cl-1	0.64884 Act-Coef
Na2F+1	0.48122 Act-Coef
F-1	0.55453 Act-Coef
(HF)2 - Aq	1.2259 Act-Coef
HCl - Aq	1.2259 Act-Coef
HF2-1	0.58877 Act-Coef
HF - Aq	1.2259 Act-Coef
H+1	0.68184 Act-Coef
OH-1	0.58165 Act-Coef
NO3-1	0.57486 Act-Coef
HNO3 - Aq	1.341 Act-Coef
KHSO4 - A	1.2259 Act-Coef
KCl - Aq	1.2259 Act-Coef
K+1	0.54327 Act-Coef
KSO4-1	0.48833 Act-Coef
NaHCO3 -	1.2259 Act-Coef
NaCO3-1	0.5802 Act-Coef
NaF - Aq	1.2259 Act-Coef
Na+1	0.54472 Act-Coef
NaNO3 - A	0.76559 Act-Coef
NaSO4-1	1.7285 Act-Coef
SO4-2	0.067186 Act-Coef
SO3 - Aq	1.2259 Act-Coef
H2SO4 - A	1.2259 Act-Coef
H2O - Vap	1 Fug-Coef
CO2 - Vap	1 Fug-Coef
(HF)2 - Vaq	1 Fug-Coef
HCl - Vap	1 Fug-Coef
HF - Vap	1 Fug-Coef
HNO3 - Va	1 Fug-Coef
SO3 - Vap	1 Fug-Coef
H2SO4 - V	1 Fug-Coef

Species K(eq)-Values

H2O	4.59E-13 mol^0
H2O - Vap	1.2097 mol^0
HCO3-1	8.22E-11 mol^0
HSO4-1	1.17E-03 mol^0
CO2 - Aq	4.31E-07 mol^0
CO2 - Vap	0.011137 mol^0
Na2F+1	34.675 mol^0
K2SO4.KN	5.51E-05 mol^0
2Na2SO4.I	1.71E-05 mol^0
(HF)2 - Aq	4686.1 mol^0
(HF)2 - Vaq	499.84 mol^0
HCl - Aq	33570 mol^0
HCl - Vap	0.12142 mol^0
HF2-1	2.1685 mol^0
HF - Aq	1.60E-04 mol^0
HF - Vap	379.93 mol^0
HNO3 - Aq	4.002 mol^0
HNO3 - Va	920.44 mol^0
KHCO3	7.7419 mol^0
KHSO4 - A	15.597 mol^0
KHSO4	14.067 mol^0
K2CO3	2670 mol^0
K2CO3.1.5	2055.7 mol^0
KCl - Aq	26.986 mol^0
KCl	16.596 mol^0
KF	54667 mol^0
KF.2H2O	1732.1 mol^0
KF.4H2O	6.69E+09 mol^0
KOH	3.85E+08 mol^0
KOH.2H2O	7614.8 mol^0
KOH.1H2O	23065 mol^0
KNO3	3.2319 mol^0
K2SO4	0.02685 mol^0
KSO4-1	0.067733 mol^0
K2SO4.1H	0.087869 mol^0
NaHCO3 -	0.52509 mol^0
NaHCO3	0.65701 mol^0
NaHSO4	376.35 mol^0
Na2CO3	1.316 mol^0
Na2CO3.1(	0.23607 mol^0
Na2CO3.7(	1.3745 mol^0
NaCO3-1	0.7632 mol^0
Na2CO3.1(	0.91296 mol^0
NaCl	35.518 mol^0

K. T. Chang
12/19/2024

	1.316 mol^0
	0.23607 mol^0
	1.3745 mol^0
	0.7632 mol^0
	0.91296 mol^0
	35.518 mol^0
	1.197 mol^0
	0.31449 mol^0
	3.16E-03 mol^0
	0.051038 mol^0
	1.94E+05 mol^0
	16297 mol^0
	4.5667 mol^0
	56.88 mol^0
	0.14445 mol^0
	2.13E-03 mol^0
	155.99 mol^0
	26.308 mol^0
	0.090006 mol^0
	1922.2 mol^0
	76679 mol^0
	3.19E+10 mol^0
	248.07 mol^0

obilities

	6.76E-04 m2/ohm-mol
	1.20E-03 m2/ohm-mol
	1.08E-03 m2/ohm-mol
	3.35E-03 m2/ohm-mol
	2.33E-03 m2/ohm-mol
	9.68E-04 m2/ohm-mol
	1.01E-03 m2/ohm-mol
	5.27E-04 m2/ohm-mol
	7.72E-04 m2/ohm-mol

elf Diffusivities

	7.82E-09 m2/s
	3.91E-09 m2/s
	4.16E-09 m2/s
	6.78E-09 m2/s
	3.48E-09 m2/s
	6.15E-09 m2/s
	5.54E-09 m2/s
	4.91E-09 m2/s
	4.10E-09 m2/s
	6.52E-09 m2/s
	6.88E-09 m2/s
	4.73E-10 m2/s
	1.82E-08 m2/s
	1.29E-08 m2/s
	5.53E-09 m2/s
	5.85E-09 m2/s
	5.53E-09 m2/s
	5.01E-09 m2/s
	5.76E-09 m2/s
	3.32E-09 m2/s
	3.46E-09 m2/s
	3.07E-09 m2/s
	3.91E-09 m2/s
	4.47E-09 m2/s
	4.10E-09 m2/s
	3.11E-09 m2/s
	3.55E-09 m2/s
	4.00E-10 m2/s
	3.71E-09 m2/s

NaCO3-1	0.28348 mol^0
Na2CO3.1(	1.0111 mol^0
NaCl	38.197 mol^0
NaF - Aq	1.2906 mol^0
NaF	0.2625 mol^0
NaF.Na2S(	3.16E-03 mol^0
NaHF2	7.28E-03 mol^0
NaOH	8.05E+06 mol^0
NaOH.1H2	64322 mol^0
NaNO3 - A	17.412 mol^0
NaNO3	28.746 mol^0
Na2SO4	0.44942 mol^0
Na2SO4	1.90E-07 mol^0
Na2SO4.N	162.44 mol^0
Na2SO4.1(	0.046844 mol^0
NaSO4-1	0.12009 mol^0
SO3 - Aq	7726 mol^0
SO3 - Vap	1.64E+09 mol^0
H2SO4 - A	2.57E+10 mol^0
H2SO4 - V	3.86E+05 mol^0

Species Mobilities

HCO3-1	2.64E-04 m2/ohm-mol
CO3-2	4.39E-04 m2/ohm-mol
Cl-1	4.54E-04 m2/ohm-mol
H+1	2.08E-03 m2/ohm-mol
OH-1	1.17E-03 m2/ohm-mol
K+1	4.35E-04 m2/ohm-mol
NaCO3-1	1.98E-04 m2/ohm-mol
Na+1	2.98E-04 m2/ohm-mol

Species Self Diffusivities

H2O	2.37E-09 m2/s
HCO3-1	1.15E-09 m2/s
HSO4-1	1.31E-09 m2/s
CO2 - Aq	1.97E-09 m2/s
CO3-2	9.60E-10 m2/s
Cl-1	1.92E-09 m2/s
Na2F+1	1.52E-09 m2/s
F-1	1.41E-09 m2/s
(HF)2 - Aq	1.19E-09 m2/s
HCl - Aq	2.08E-09 m2/s
HF2-1	1.89E-09 m2/s
HF - Aq	1.31E-10 m2/s
H+1	8.08E-09 m2/s
OH-1	4.70E-09 m2/s
NO3-1	1.80E-09 m2/s
HNO3 - Aq	1.94E-09 m2/s
KHSO4 - A	1.53E-09 m2/s
KCl - Aq	1.60E-09 m2/s
K+1	1.84E-09 m2/s
KSO4-1	9.88E-10 m2/s
NaHCO3 -	1.02E-09 m2/s
NaCO3-1	8.80E-10 m2/s
NaF - Aq	1.14E-09 m2/s
Na+1	1.29E-09 m2/s
NaNO3 - A	1.24E-09 m2/s
NaSO4-1	9.08E-10 m2/s
SO4-2	1.04E-09 m2/s
SO3 - Aq	1.11E-10 m2/s
H2SO4 - A	1.09E-09 m2/s

NaCO3-1	0.28348 mol^0
Na2CO3.1(	1.0111 mol^0
NaCl	38.197 mol^0
NaF - Aq	1.2906 mol^0
NaF	0.2625 mol^0
NaF.Na2S(	3.16E-03 mol^0
NaHF2	7.28E-03 mol^0
NaOH	8.05E+06 mol^0
NaOH.1H2	64322 mol^0
NaNO3 - A	17.412 mol^0
NaNO3	28.746 mol^0
Na2SO4	0.44942 mol^0
Na2SO4	1.90E-07 mol^0
Na2SO4.N	162.44 mol^0
Na2SO4.1(	0.046844 mol^0
NaSO4-1	0.12009 mol^0
SO3 - Aq	7726 mol^0
SO3 - Vap	1.64E+09 mol^0
H2SO4 - A	2.57E+10 mol^0
H2SO4 - V	3.86E+05 mol^0

Species Mobilities

HCO3-1	2.47E-04 m2/ohm-mol
CO3-2	4.11E-04 m2/ohm-mol
Cl-1	4.24E-04 m2/ohm-mol
H+1	1.94E-03 m2/ohm-mol
OH-1	1.09E-03 m2/ohm-mol
K+1	4.06E-04 m2/ohm-mol
NaCO3-1	1.83E-04 m2/ohm-mol
Na+1	2.78E-04 m2/ohm-mol

Species Self Diffusivities

H2O	2.29E-09 m2/s
HCO3-1	1.11E-09 m2/s
HSO4-1	1.26E-09 m2/s
CO2 - Aq	1.90E-09 m2/s
CO3-2	9.27E-10 m2/s
Cl-1	1.86E-09 m2/s
Na2F+1	1.47E-09 m2/s
F-1	1.36E-09 m2/s
(HF)2 - Aq	1.15E-09 m2/s
HCl - Aq	2.01E-09 m2/s
HF2-1	1.83E-09 m2/s
HF - Aq	1.26E-10 m2/s
H+1	7.91E-09 m2/s
OH-1	4.58E-09 m2/s
NO3-1	1.74E-09 m2/s
HNO3 - Aq	1.87E-09 m2/s
KHSO4 - A	1.48E-09 m2/s
KCl - Aq	1.56E-09 m2/s
K+1	1.79E-09 m2/s
KSO4-1	9.53E-10 m2/s
NaHCO3 -	9.80E-10 m2/s
NaCO3-1	8.30E-10 m2/s
NaF - Aq	1.10E-09 m2/s
Na+1	1.25E-09 m2/s
NaNO3 - A	1.19E-09 m2/s
NaSO4-1	8.76E-10 m2/s
SO4-2	1.00E-09 m2/s
SO3 - Aq	1.07E-10 m2/s
H2SO4 - A	1.06E-09 m2/s

NaF - Aq	1.197 mol^0
NaF	0.31449 mol^0
NaF.Na2S(	3.16E-03 mol^0
NaHF2	0.051038 mol^0
NaOH	1.94E+05 mol^0
NaOH.1H2	16297 mol^0
NaNO3 - A	4.5667 mol^0
NaNO3	56.88 mol^0
Na2SO4	0.14445 mol^0
Na2SO4	2.13E-03 mol^0
Na2SO4.N	155.99 mol^0
Na2SO4.1(	26.308 mol^0
NaSO4-1	0.090006 mol^0
SO3 - Aq	1922.2 mol^0
SO3 - Vap	76679 mol^0
H2SO4 - A	3.19E+10 mol^0
H2SO4 - V	248.07 mol^0

Species Mobilities

HCO3-1	6.64E-04 m2/ohm-mol
CO3-2	1.18E-03 m2/ohm-mol
Cl-1	1.06E-03 m2/ohm-mol
H+1	3.29E-03 m2/ohm-mol
OH-1	2.29E-03 m2/ohm-mol
K+1	9.90E-04 m2/ohm-mol
NaCO3-1	5.18E-04 m2/ohm-mol
Na+1	7.58E-04 m2/ohm-mol

Species Self Diffusivities

H2O	7.77E-09 m2/s
HCO3-1	3.88E-09 m2/s
HSO4-1	4.12E-09 m2/s
CO2 - Aq	6.74E-09 m2/s
CO3-2	3.45E-09 m2/s
Cl-1	6.06E-09 m2/s
Na2F+1	5.48E-09 m2/s
F-1	4.86E-09 m2/s
(HF)2 - Aq	4.07E-09 m2/s
HCl - Aq	6.48E-09 m2/s
HF2-1	6.80E-09 m2/s
HF - Aq	4.70E-10 m2/s
H+1	1.80E-08 m2/s
OH-1	1.27E-08 m2/s
NO3-1	5.47E-09 m2/s
HNO3 - Aq	5.81E-09 m2/s
KHSO4 - A	5.49E-09 m2/s
KCl - Aq	4.99E-09 m2/s
K+1	5.69E-09 m2/s
KSO4-1	3.29E-09 m2/s
NaHCO3 -	3.44E-09 m2/s
NaCO3-1	3.04E-09 m2/s
NaF - Aq	3.89E-09 m2/s
Na+1	4.42E-09 m2/s
NaNO3 - A	4.07E-09 m2/s
NaSO4-1	3.08E-09 m2/s
SO4-2	3.52E-09 m2/s
SO3 - Aq	3.97E-10 m2/s
H2SO4 - A	3.68E-09 m2/s

K. J. Chang
12/19/04

Slow Strain Rate Testing of MA Alloy 22

Test ID	Solution Composition	pH Initial	pH Adj'd	pH Final	Eapp(mV)	Max Stres	TTF (hrs)	RA (%)	% Elong	Adj TTF (h	Tf/Tair	SCC
											70.73	
air	ambient air	NA	NA	NA	NA	729	70	77.7	81	70.21		
air2	ambient air	NA	NA	NA	NA	725	72	76.9	77.8	71.25		
air3	ambient air	NA	NA	NA	NA							
SSRMA22_SCW01	SCW	7.76	8.9	9.7	400	572	56	49.9	65.8	54.79	0.77	Y
SSRMA22_SCW02	SCW	7.76	8.9	9.7	400	560	47	38.5	52	46.67	0.66	Y
SSRMA22_SCW03	SCW minus NO3	7.34	8.73	9.02	400	618	64		70.2	54.58	0.77	Y
SSRMA22_SCW04	SCW minus SO4	7.45	8.73	9.99	400	572	60	52.2	68.8	59.58	0.84	Y
SSRMA22_SCW05	SCW minus F	7.37	8.72	10	400	573	58	50.4	62	54.58	0.77	Y
SSRMA22_SCW06	SCW minus NaCl	7.38	8.81	9.98	400	559	52	44.6	58.8	51.54	0.73	Y
SSRMA22_SCW07	3.8M NaCl + 0.38M NaNO3	4.1	9.8	10	400	663	70	76.2	79.8	69.92	0.99	N
SSRMA22_SCW08	3.8M NaCl + 0.38M NaNO3	4.1	9.8	10.09	200	645	72	68.6	78.8	71.25	1.01	N
SSRMA22_SCW09	3.8M NaCl + 0.38M NaNO3	8.18	not adj		400	657	74	69.5	79	71.67	1.01	N
SSRMA22_SCW10	3.8M NaCl + 0.38M NaNO3	8.18	not adj		200	663	69	73.7	78	68.86	0.97	N
SSRMA22_SCW11	7.6M NaCl + 0.38M NaNO3	6.98	not adj		400	669	72	73	80.2	71.67	1.01	N
SSRMA22_SCW12	NaCl+NaNO3 amts as in SCW	5.44	9.43	7.38	400	663	70	71.2	79.2	69.46	0.98	N
SSRMA22_SCW13	SCW minus NaHCO3	6.87	9.79	7.53	400	668	70	69.5	77	68.13	0.96	N
SSRMA22_SCW14	NaHCO3 as in SCW	6.5	8.58	10.38	400	663	69	61.6	77	68.89	0.97	N
SSRMA22_SCW15	SCW	7.71	8.66	10.18	400	595	56	49.3	59.8	54.59	0.77	Y
SSRMA22_SCW16	SCW minus F and SO4	7.76	8.68	9.78	400	578	47	52.7	53.6	47.79	0.68	Y
SSRMA22_SCW17	SCW minus F and SO4	8.45	8.7		400	590	49	42.2	56.8	48.52	0.69	Y
SSRMA22_SCW18	Cl and HCO3 as in SCW	7.806	8.726		400	601	54	45.8	67.8	53.89	0.76	Y
SSRMA22_SCW19	F and HCO3 as in SCW				400	601	56			54.98	0.78	Y

Slow Strain Rate Testing of MA Alloy 22

mol/kg H2O

Test ID	Solution Composition	pH Adj'd	K+	Na+	Cl-	NO3-	SO4-2	HCO3-	F-	I (Ionic Strength)
air	ambient air	NA								
air2	ambient air	NA								
air3	ambient air	NA								
SSRMA22_SCW01	SCW	8.9	0.083148	1.7168	0.17878	0.097914	0.065232	0.71667	0.055389	2.0957
SSRMA22_SCW02	SCW	8.9	0.083148	1.7168	0.17878	0.097914	0.065232	0.71667	0.055389	2.0957
SSRMA22_SCW03	SCW minus NO3	8.73	0.083016	1.5528	0.17919		0.065678	0.79793	0.056213	1.8686
SSRMA22_SCW04	SCW minus SO4	8.73	0.086535	1.4386	0.17907	0.098792		0.79948	0.05685	1.6915
SSRMA22_SCW05	SCW minus F	8.72	0.081648	1.6888	0.17727	0.098118	0.096518	0.79169		2.0332
SSRMA22_SCW06	SCW minus NaCl	8.81	0.082948	1.5564	0.086285	0.098616	0.064409	0.79674	0.056304	1.8711
SSRMA22_SCW07	3.8M NaCl + 0.38M NaNO3	9.8		4.1096	3.8032	0.30638				4.1096
SSRMA22_SCW08	3.8M NaCl + 0.38M NaNO3	9.8								
SSRMA22_SCW09	3.8M NaCl + 0.38M NaNO3	not adj								
SSRMA22_SCW10	3.8M NaCl + 0.38M NaNO3	not adj								
SSRMA22_SCW11	7.6M NaCl + 0.38M NaNO3	not adj		75.397	6.0912	0.46797				6.5592
SSRMA22_SCW12	NaCl+NaNO3 amts as in SCW	9.43		0.19466	0.093083	0.10154				0.19466
SSRMA22_SCW13	SCW minus NaHCO3	9.79	0.079153	0.49637	0.17963	0.10178	0.083606			0.65919
SSRMA22_SCW14	NaHCO3 as in SCW	8.58		1.1202				0.89747		1.2156
SSRMA22_SCW15	SCW	8.66	0.08331	1.6021	0.17943	0.098393	0.06438	0.083654	0.05624	1.8796
SSRMA22_SCW16	SCW minus F and SO4	8.68	0.086963	1.3272	0.17999	0.099122		0.86313		1.5296
SSRMA22_SCW17	SCW minus F and SO4	8.7								
SSRMA22_SCW18	Cl and HCO3 as in SCW	8.726	0.086665	1.2722	0.17948			0.82948		1.5081
SSRMA22_SCW19										

Slow Strain Rate Testing of MA Alloy 22

mol/kg H2O at 95C

Test ID	Solution Composition	pH Final	K+	Na+	Cl-	NO3-	SO4-2	HCO3-	F-	I (Ionic Strength)
air	ambient air	NA								
air2	ambient air	NA								
air3	ambient air	NA								
SSRMA22_SCW01	SCW	9.7	0.079147	1.6068	0.17866	0.088945	0.10743	0.51845	0.056501	2.0753
SSRMA22_SCW02	SCW	9.7	0.079147	1.6068	0.17866	0.088945	0.10743	0.51845	0.056501	2.0753
SSRMA22_SCW03	SCW minus NO3	9.02	0.07868	1.4249	0.17906		0.1077	0.58635	0.057501	1.8158
SSRMA22_SCW04	SCW minus SO4	9.99	0.086412	1.2638	0.17895	0.091904		0.59322	0.058436	1.5541
SSRMA22_SCW05	SCW minus F	10	0.076119	1.5676	0.17713	0.089361	0.1598	0.57367		2.0068
SSRMA22_SCW06	SCW minus NaCl	9.98	0.079732	1.4074	0.086208	0.090939	0.089888	0.589	0.057705	1.7814
SSRMA22_SCW07	3.8M NaCl + 0.38M NaNO3	10		4.1096	3.8032	0.30638				4.1096
SSRMA22_SCW08	3.8M NaCl + 0.38M NaNO3	10.09								
SSRMA22_SCW09	3.8M NaCl + 0.38M NaNO3									
SSRMA22_SCW10	3.8M NaCl + 0.38M NaNO3									
SSRMA22_SCW11	7.6M NaCl + 0.38M NaNO3			75.397	6.0912	0.46797				6.5592
SSRMA22_SCW12	NaCl+NaNO3 amts as in SCW	7.38		0.19311	0.093083	0.099994				0.19311
SSRMA22_SCW13	SCW minus NaHCO3	7.53	0.073321	0.52866	0.17949	0.098534	0.11346			0.71561
SSRMA22_SCW14	NaHCO3 as in SCW	10.38		0.95501				0.65907		1.0961
SSRMA22_SCW15	SCW	10.18	0.078945	1.446	0.17943	0.090391	0.10715	0.6114	0.057717	1.8796
SSRMA22_SCW16	SCW minus F and SO4	9.78	0.086839	1.1325	0.17987	0.092976		0.64634		1.3618
SSRMA22_SCW17	SCW minus F and SO4									
SSRMA22_SCW18	Cl and HCO3 as in SCW		0.086535	1.1031	0.17935			0.6277		1.3716
SSRMA22_SCW19										

K. T. Chiang
1/3/05

SLOW STRAIN RATE TEST

Objective: see page #5 Notebook #695

Specimen: MA Alloy 22 SwRI Drawing # 20-03704-042-001

Heat # ~~2277-8-3266~~ 2277-3-3266 BIO 6/27/06

* **Solution:** α 1/2 L

14,928 g NaCl #041475

264.58 g KCl #006242

Reagents measured with **Model:** OHAUS **SN:** 2883

Cal: ~~15 JUL 04~~ 15 JAN 05 BIO 6/27/06 **Due:** ~~15 JAN 05~~ 14 JUL 05 BIO 6/27/06

Counter Electrode: Pt flag **Reference Electrode:** Ag/AgCl w/ 3M KCl in house

Gas: N_2 (99.999) **Ecorr:** −263 mV

* **Eapplied:** +415 mV **Potentiostat:** EG&G 440-2 **SN:** 920913 8

Specimen Visual: metallic silver-gray ductile fracture

$\dot{\epsilon}^0 = 3.2 \times 10^{-6}\ s^{-1}$

* above saturation * problem w/ probes, Eapp not accurate (see data)

data file: SSRMA22_SCW30

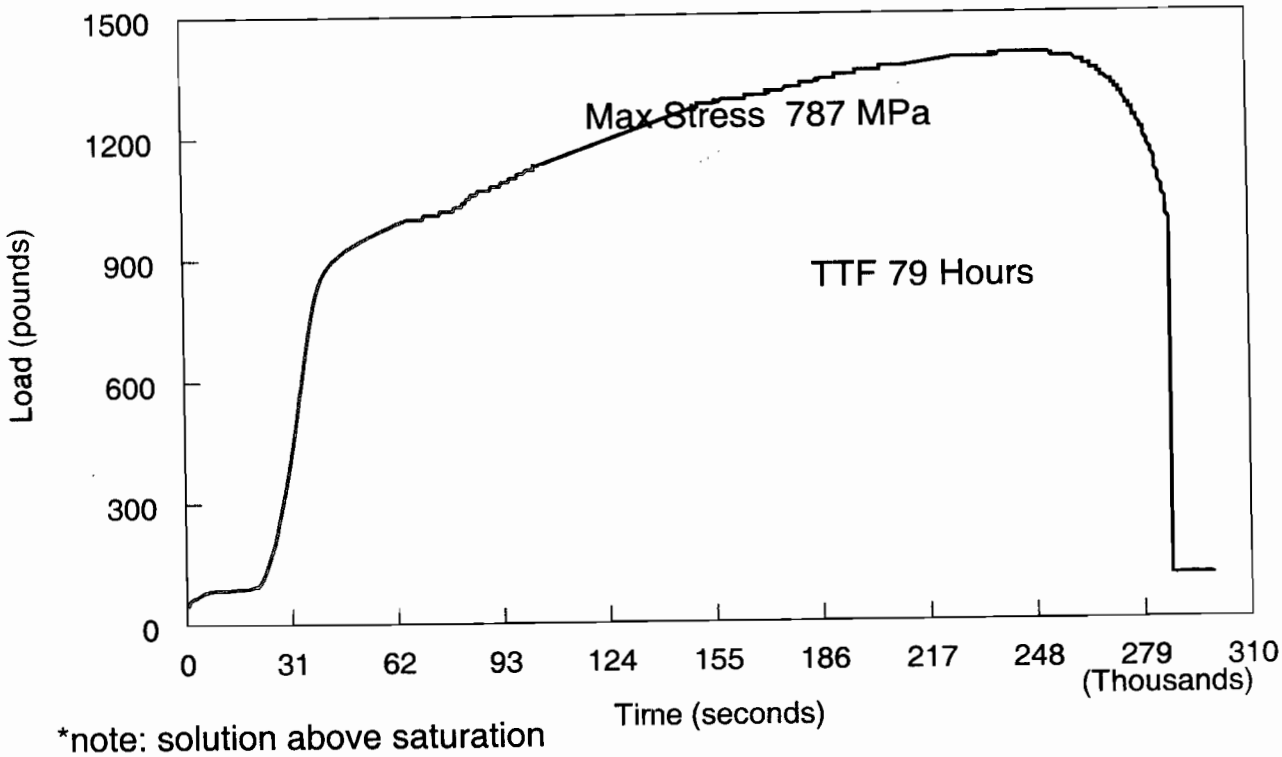
Walter J. Mackowiak

2/1/2005

Slow Strain Rate Test

0.5 M NaCl; 7.1* M KCl

SSRMA22_SCW30



*note: solution above saturation

Walter J. Mackerle
2/1/2005

POTENTIODYNAMIC TEST

Objective: see page #5

Specimen: C-22 Cylinder Heat # 2277-3-3266 polishes To A 600 Grit Finish

Initial Weight: 12.70363g
Final Weight: 12.69287g
Model: Sartorius Genius
Cal 11/10/04
SN: 12809099
Due: 5/10/05

SOLUTION: 0.5 m NaCl + 7.1 m KCl
58.45g NaCl Lot # 041475
1058.79g KCl Lot # 035662
+ DI To 2000 mls
* Not Soluable

Reagents measured with
Model: OHAUS
Cal: 7/15/04
SN: 2883
Due: 1/15/05

Initial pH: 7.013
Final pH: 7.647
Model: orion
CAL: 7/21/04
pH Probe: #13-620-296
SN: 2330
DUE: 7/21/05
SN: 4079126

TEST TEMPERATURE: 95°C
Measured with Hg Thermometer SN: 188304
Cal: 1/6/05
Due: 7/6/05

Counter Electrode: Platinum Flag

Reference Electrode: Fisher SCE 13-620-51 **SN:** 9214081

Gas: 99.999% Nitrogen

Ecorr: -322 mv
Ept: -56 mv
Model: Keithley 614
Cal: 6/7/04
SN: 0704936
Due: 6/7/05

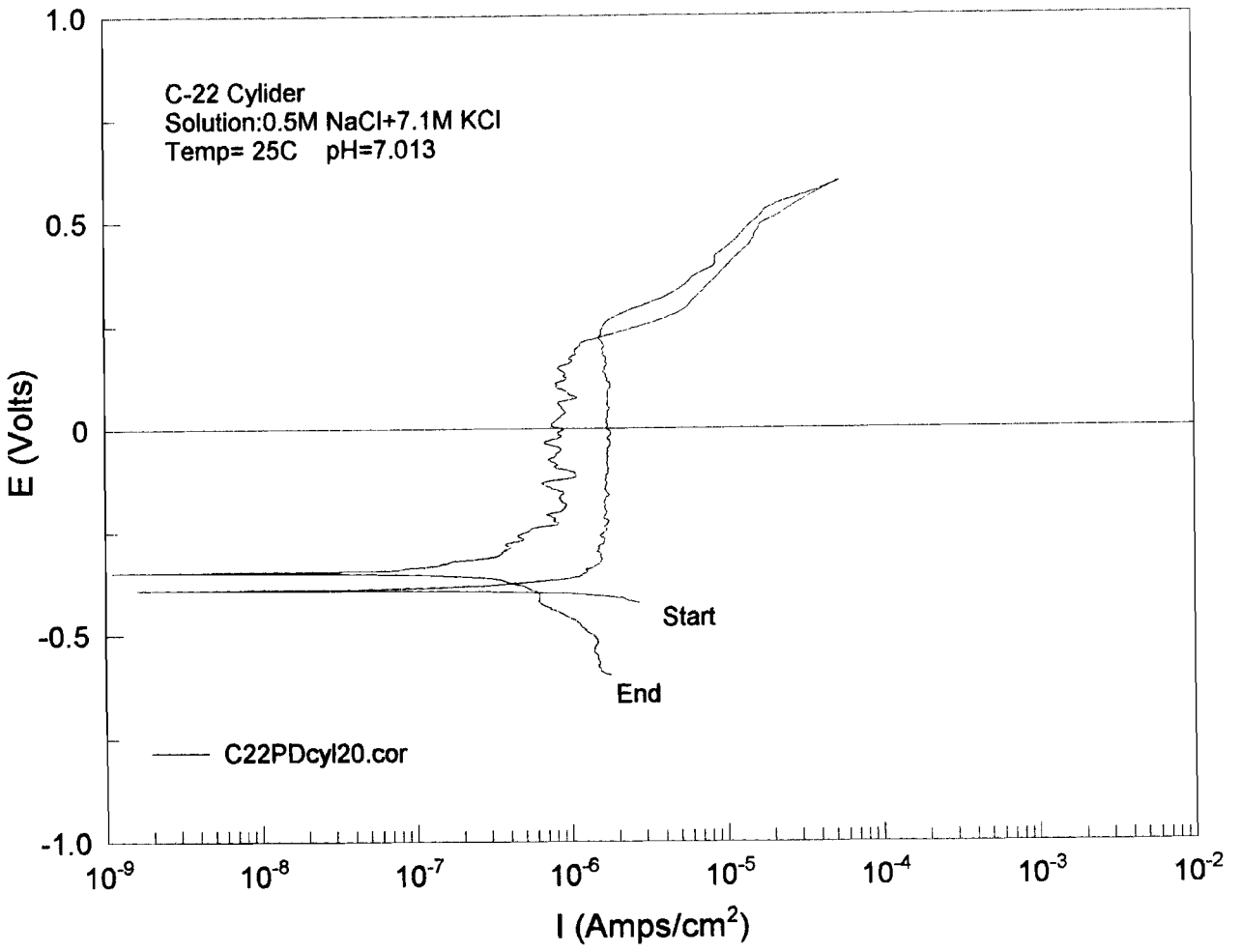
Potentiostat: Solartron 1287. **SN#** 00148500

Specimen Examination: No Visual Sign of Corrosion or Pitting Very Mild Surface Staining mainly At Solution Vapor Interface

* Solution Above Saturation - Solid In Bottom of Test Cell

Data C22PDcyl20

2/3/05


C-22 Cylider
Solution:0.5M NaCl+7.1M KCl
Temp= 25C pH=7.013
1.0
0.5
0
-0.5
-1.0
E (Volts)
Start
End
C22PDcyl20.cor
10-9
10-8
10-7
10-6
10-5
10-4
10-3
10-2
I (Amps/cm2)

2/3/05

POTENTIODYNAMIC TEST

Objective: see page #5

Specimen: C-22 Cylinder Heat # 2277-J-3266 polished To A 600 Grit Finish.

Initial Weight: 12.57937g
Final Weight: 12.58221g
Model: Sartorius Genius **SN:** 12809099
Cal 11/10/04 **Due:** 5/10/05

SOLUTION: 0.5 M NaCl + 7.1 M KCl + 1.147M $NaHCO_3$
58.46g NaCl Lot # 041475
1058.82g KCl Lot # 035662
192.82g $NaHCO_3$ Lot # 028924
+ DI To 2000 mls * Not Soluble

Reagents measured with
Model: OHAUS **SN:** 2883
Cal: 7/15/04 **Due:** 1/15/05

Initial pH: 7.962
Final pH: 8.907
Model: orion **SN:** 2330
CAL: 7/21/04 **DUE:** 7/21/05
pH Probe: #13-620-296 **SN:** 4079126

TEST TEMPERATURE: 95C
Measured with Hg Thermometer SN: 188304
Cal: 1/6/05 **Due:** 7/6/05

Counter Electrode: Platinum Flag
Reference Electrode: Fisher SCE 13-620-51 **SN:** 9214081

Gas: 99.999% Nitrogen
Ecorr: -655 mv
Ept: -5 mv
Model: Keithley 614 **SN:** 0704936
Cal: 6/7/04 **Due:** 6/7/05

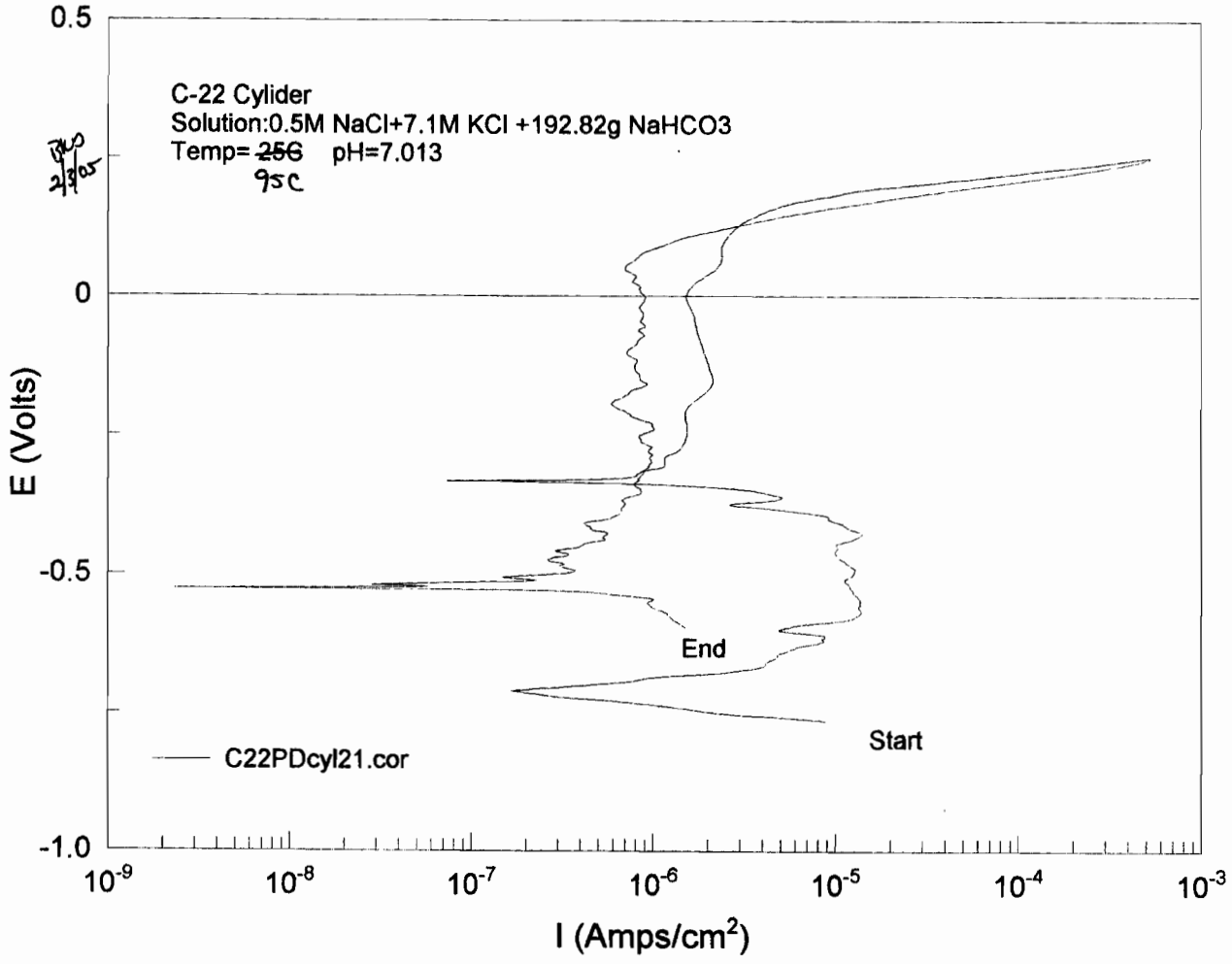
Potentiostat: Solartron 1287 **SN#** 0014850O

Specimen Examination: No Visual Sign of Corrosion / Pitting Very Mild Staining on Specimen At solution Vapor Interface

* Solution Above Saturation - Solid In Bottom of Test cell

Data ~~C22PDcyl 21~~ C22PDcyl21
2/3/05

2/3/05


C-22 Cylider
Solution:0.5M NaCl+7.1M KCl +192.82g NaHCO3
Temp= ~~25C~~ 95C pH=7.013
0.5
0
-0.5
-1.0
E (Volts)
End
Start
C22PDcyl21.cor
10-9
10-8
10-7
10-6
10-5
10-4
10-3
I (Amps/cm2)

2/3/05

Ken Chiang
SwRI-CNWRA
Phone: (210) 522-2308
Fax: (210) 522-5184
e-mail: Kchiang@swri.org

ALLOY 22
NICKEL
CHROMIUM
MOLY
IRON

176

PERPEN-
DICULAR
TO
ROLLING

Procedure TOS-WI-821
Project # 731
TOTAL PCS. INSPECTED 11
TOTAL PCS. ACCEPTED 11
TOTAL PCS. REJECTED 0
"NR #" IF REJECTS NA

INSPECTOR
SwRI 24 QA

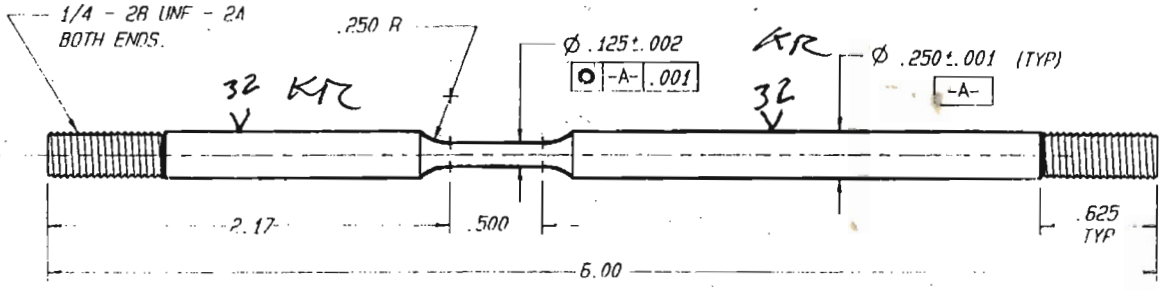
LOCATION Q31 MS
J.C. # 08168
EQUIPMENT Optical Comp. Tbl Gage

DATE JAN 10 2005

K.J. Chiang 2/4/05

SwRI DRAWING # 20-03704-042-001

LTR	DESCRIPTION	DATE	APPROVED



NOTE:
1. DO NOT UNDERCUT RADII
2. USE LOW STRESS MACHINING PROCEDURE

FIND NO.	QTY REQ.	ZONE	CODE IDENT NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION

PARTS LIST

MATERIAL 0.5 THICK PLATE SUPPLIED
FINISH 16 RMS

BASIC DIMENSIONS	DECIMALS 2 PLACE	DECIMALS 3 PLACE	FRACTIONS	CONTRACT		
UNDER 6	± .01	± .005	± 1/32	DWN	4-10-1992	A. NAGY
6-84 INCL	± .03	± .010	± 1/16	CKD		
OVER 84	± .06	± .015	± 1/8	MECH		
ANGLES	± 0° 30'		± 1° 0'	ELECT		

D: \20\SSRSPEC1

SOUTHWEST RESEARCH INSTITUTE
SLOW STRAIN RATE SPECIMEN
B
DRAWING NO. 20-3704-042-1
SCALE 2 = 1
SHEET

K.J. Chiang 1-13-04
Initiator: K. Chiang Date

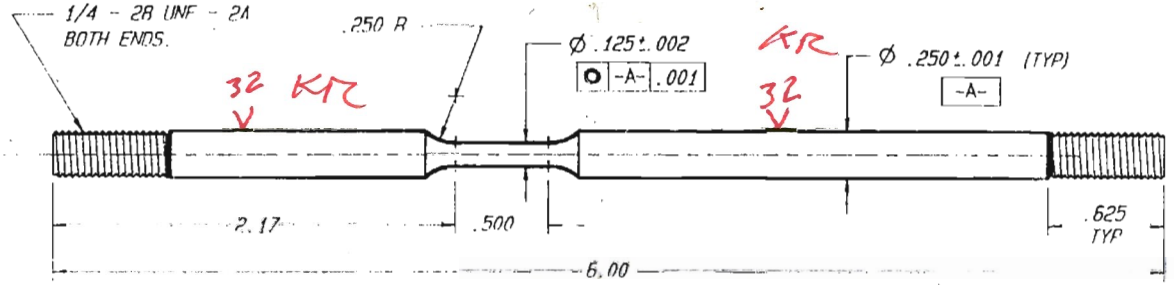
Vinod Jain for V. Jain
Reviewer: V. Jain Date 1/13/04

Mark R. Shinstine for 1/13/04
QA Approval: R. Brient Date

Ken Chiang
SwRI-CNWRA
Phone: (210) 522-2308
Fax: (210) 522-5184
e-mail: Kchiang@swri.org

SwRI DRAWING # 20-03704-042-001

LTR	DESCRIPTION	DATE	APPROVED



NOTE:
1. DO NOT UNDERCUT RADII
2. USE LOW STRESS MACHINING PROCEDURE

FIND NO.	QTY REQ.	SIZE	CODE IDENT NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION

PARTS LIST

BASIC DIMENSIONS	DECIMALS 2 PLACE	DECIMALS 3 PLACE	FRACTIONS	CONTRACT		
UNDER 6	± .01	± .005	± 1/32	DWN	4-10-1992	A. NAGY
6-24 INCL	± .03	± .010	± 1/16	CKD		
OVER 24	± .06	± .015	± 1/8	MECH		
ANGLES	± 0°30'		± 1°0'	ELECT		

MATERIAL: 0.5 THICK PLATE SUPPLIED
FINISH: 16 RMS
USED ON
QTY. REQ.
IT 120 SSPECI

SOUTHWEST RESEARCH INSTITUTE
SLOW STRAIN RATE SPECIMEN
B
DRAWING NO. 20-3704-042-1
SCALE 2 = 1
SHEET

K. J. Chiang 1-13-04
Initiator: K. Chiang Date

Daniel Dunn for V. Jain
Reviewer: V. Jain Date 1/13/04

Mark R. Shaw for
QA Approval: R. Brient Date 1/13/04

CC 30 M5
EQUIPMENT
O-1 Mic 5056
Cal 30-66-3
Surface Gage 7188

LOCATION
J.C. # 80498
Procedure
Project #
TOTAL PCS. INSPECTED 6 PC
TOTAL PCS. ACCEPTED 6
TOTAL PCS. REJECTED 0
"NR #" IF REJECTS NA

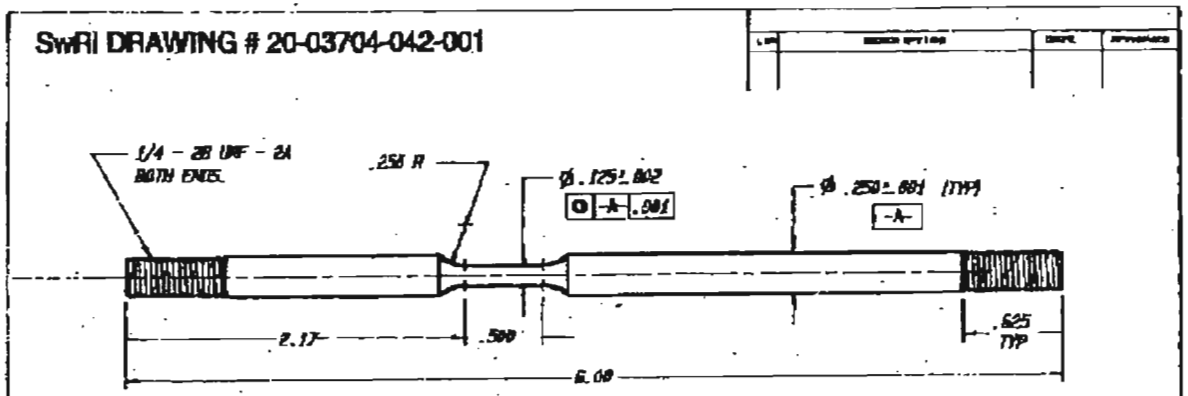
NOV 10 2004
DATE
INSPECTOR

K. J. Chiang 2/9/05

Post-it® Fax Note 7671	Date 1-9-04	# of pages ▶ 1
To Larry	From Gilbert Rodriguez	
Co./Dept.	Co. SwRI	
Phone #	Phone # 210-522-5704	
Fax # (713) 928-6004	Fax # 210-522-5084	

Ken Chiang
SwRI-CNWRA
Phone: (210) 522-2308
Fax: (210) 522-5184
e-mail: Kchiang@swri.org

SwRI DRAWING # 20-03704-042-001



NOTE: 1. DO NOT UNDERCUT ANGLE
2. USE LOW STRESS MACHINING PROCEDURE

MATERIAL	0.5 THICK PLATE SUPPLIED
FINISH	16 RMS
	SLOW STRAIN RATE SPECIMEN
	20-3704-042-1
	SCALE 2 = 1

K.J. Chiang 1-13-04
Initiator: K. Chiang Date

for V. Jain
Reviewer: V. Jain Date 1/13/04

for 1/13/04
QA Approval: R. Brient Date

LOCATION OC31 M-S
EQUIPMENT Mt Gage Stainless Tensile Rig 7182
Mtl SS6-01
DATE OCT 11 2004
INSPECTOR
Procedure
Project # J.C. # 90332
TOTAL PCS. INSPECTED 6
TOTAL PCS. ACCEPTED 0
TOTAL PCS. REJECTED 6
"NR #" IF REJECTS

2/8/05
Walter J. Machowski

SLOW STRAIN RATE TEST

Objective: see page #5 Notebook #695

Specimen: MA Alloy 22 SwRI Drawing # 20-03704-042-001

Heat # ~~2277-8-3266~~ 2277-3-3266 BD 6/27/06

Solution: 1/2 liter

KCl	3.276	# 035662	$NaHCO_3$	48.22	028924
NaCl	2.745	041425	NaF	1.548	006679
$NaNO_3$	4.371	020809			
Na_2SO_4	10.355	035461			

pH 7.74 adj → 8.31
final 9.03

Reagents measured with **Model:** ORION 5 **SN:** 2883
Cal: 14 JAN 05 **Due:** 14 JUL 05

Counter Electrode: Pt flag **Reference Electrode:** Ag/AgCl w/3M KCl in house

Gas: N_2 (99.999) **Ecorr:** −198 mV

Eapplied: +200 mV **Potentiostat:** ESC 440-2 **SN:** 9209138

Specimen Visual: gray-metallic; no evidence of cracking, ductile failure

$\dot{\epsilon}^{\circ} = 3.2 \times 10^{-6} s^{-1}$

data file: SSRMA22_SCW31

2/8/05

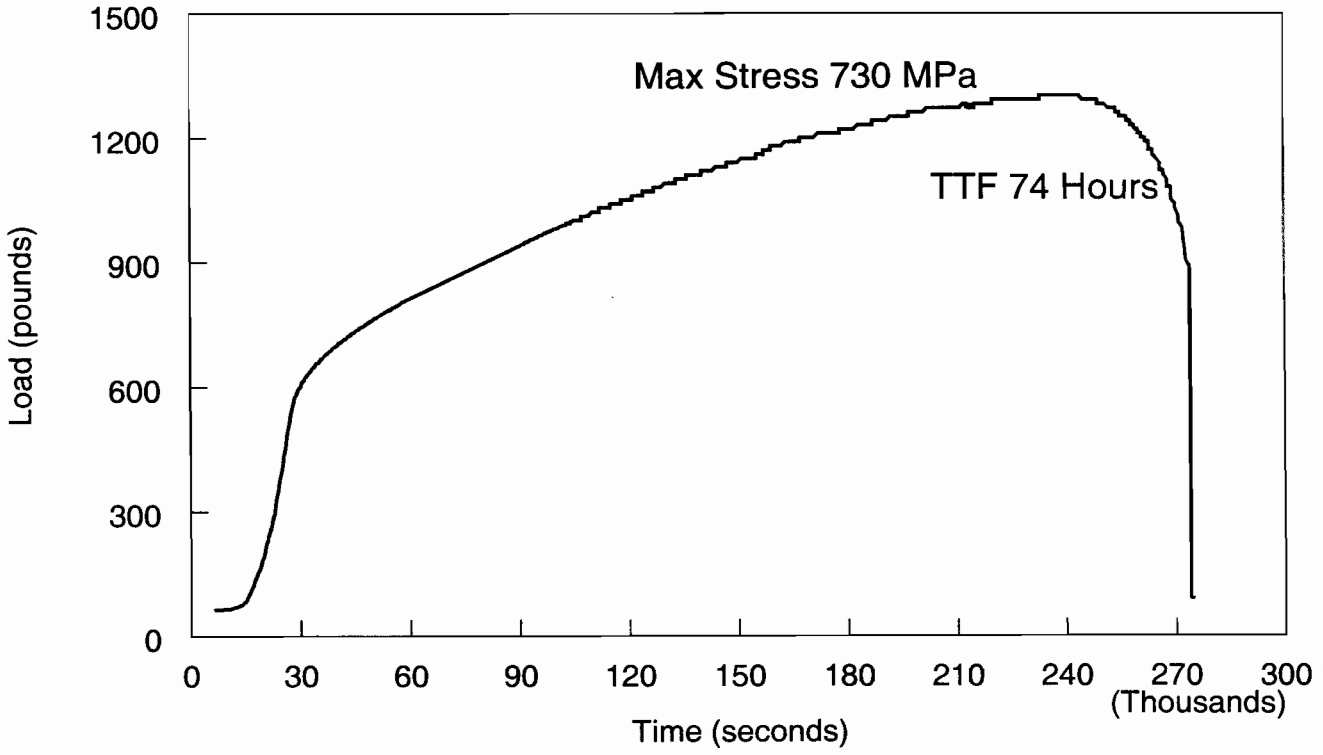
Walter J. Mackowiak

Slow Strain Rate Test

Simulated Concentrated Water

Test SSRMA22_SCW31

+200 mV



2/8/05

Walter J. Markowski

SLOW STRAIN RATE TEST

Notebook #695

Objective: see page #5 → GMAW "A"

Specimen: MA Alloy 22 SwRI Drawing # 20-03704-042-001

Welded Specimen Heat ~~#2277-8-~~ 3266 BP 6/27/06

Solution: 1/2 liter GMAW 2277-3-3292 ~~2277-3-3266~~ 5.11a WN813/XX19775611

used remainder of #SCW 31 solution

final pH 8.85

Reagents measured with **Model:** ORION 5 **SN:** 2883
Cal: 14 JAN 05 **Due:** 14 JUL 05

Counter Electrode: Pt flag **Reference Electrode:** $Ag/AgCl$ a/3M KCl in bridge

Gas: N_2 (99.999) **Ecorr:** −190 mV

* **Eapplied:** +415mV **Potentiostat:** ESC 440-2 **SN:** 9209138

Specimen Visual:

bright, shiny, no cracks evident, moment short TTF

$\dot{\epsilon}^o = 3.2 \times 10^{-6}\ s^{-1}$

*temp correction at 95°C

data file: SSRMA22_SCW32

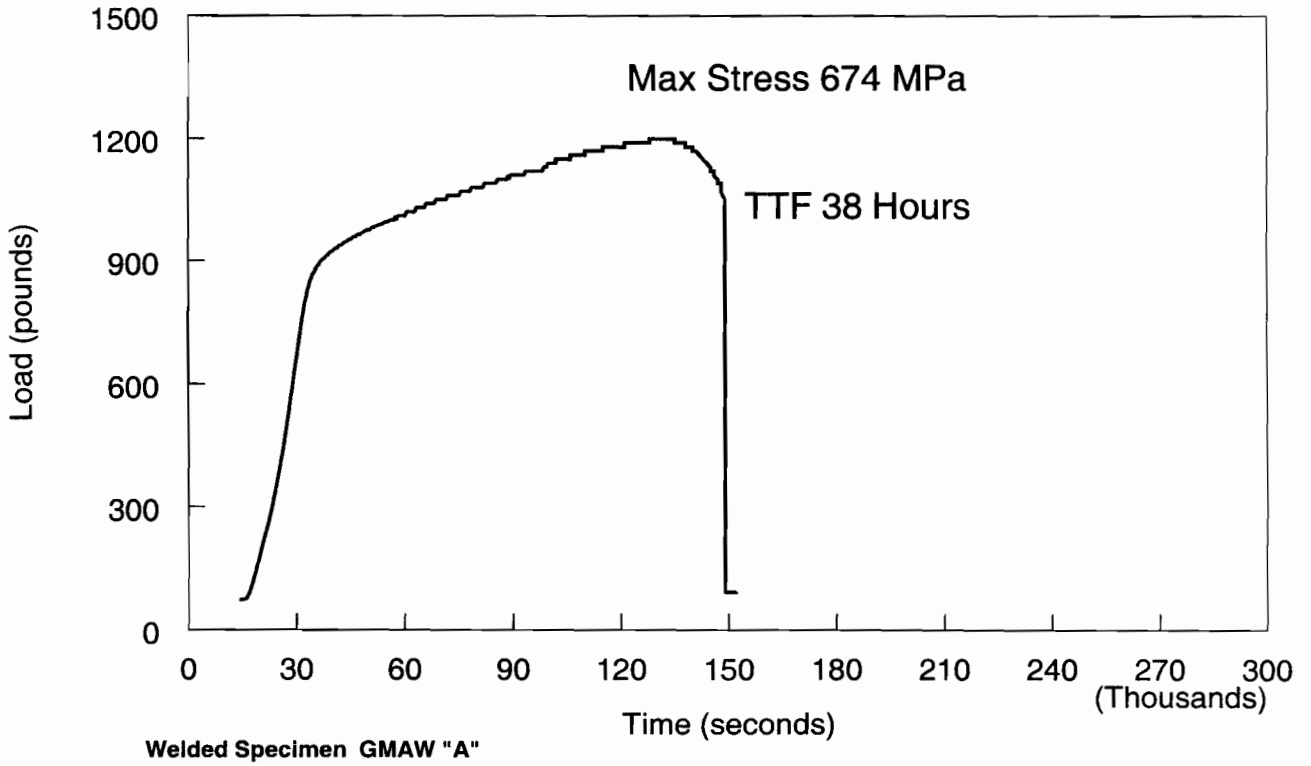
Walter J. Mackowski
2/14/06

Slow Strain Rate Test

Simulated Concentrated Water

Test SSRMA22_SCW32

+400 mV



Welded Specimen GMAW "A"

Walter D. Machowski
2/14/05

SLOW STRAIN RATE TEST

Objective: see page #5 → Notebook #695 welded spec # 11A

Specimen: MA Alloy 22 SwRI Drawing # 20-03704-042-001 Weldco DKD 6/27/06

Heat # ~~2277-5-3266~~ ~~2277-5-3266~~ DKD 6/27/06 2277-5-3292 filler WN813/XX1977BG11

Solution: K / L

88.71 g $NaHCO_3$ # 028924
29.25 " NaCl # 042966
7.68 g NaOH # 897895
111.79 g KCl # 035664

Reagents measured with **Model:** ~~ORION~~ **SN:** 2883
Cal: 14 JAN 05 **Due:** 14 JUL 05

Counter Electrode: Pt flg **Reference Electrode:** Ag/AgCl w/3M KCl in Luggin

Gas: N_2 (99.999) **Ecorr:** −188 mV

*Eapplied: +415 mV **Potentiostat:** EG&G 440-2 **SN:** 9209138

Specimen Visual:

$\dot{\epsilon}^{o} = 3.2 \times 10^{-6}\ s^{-1}$
* temp correction @ 95°C

data file: SSRMA22_SCW33

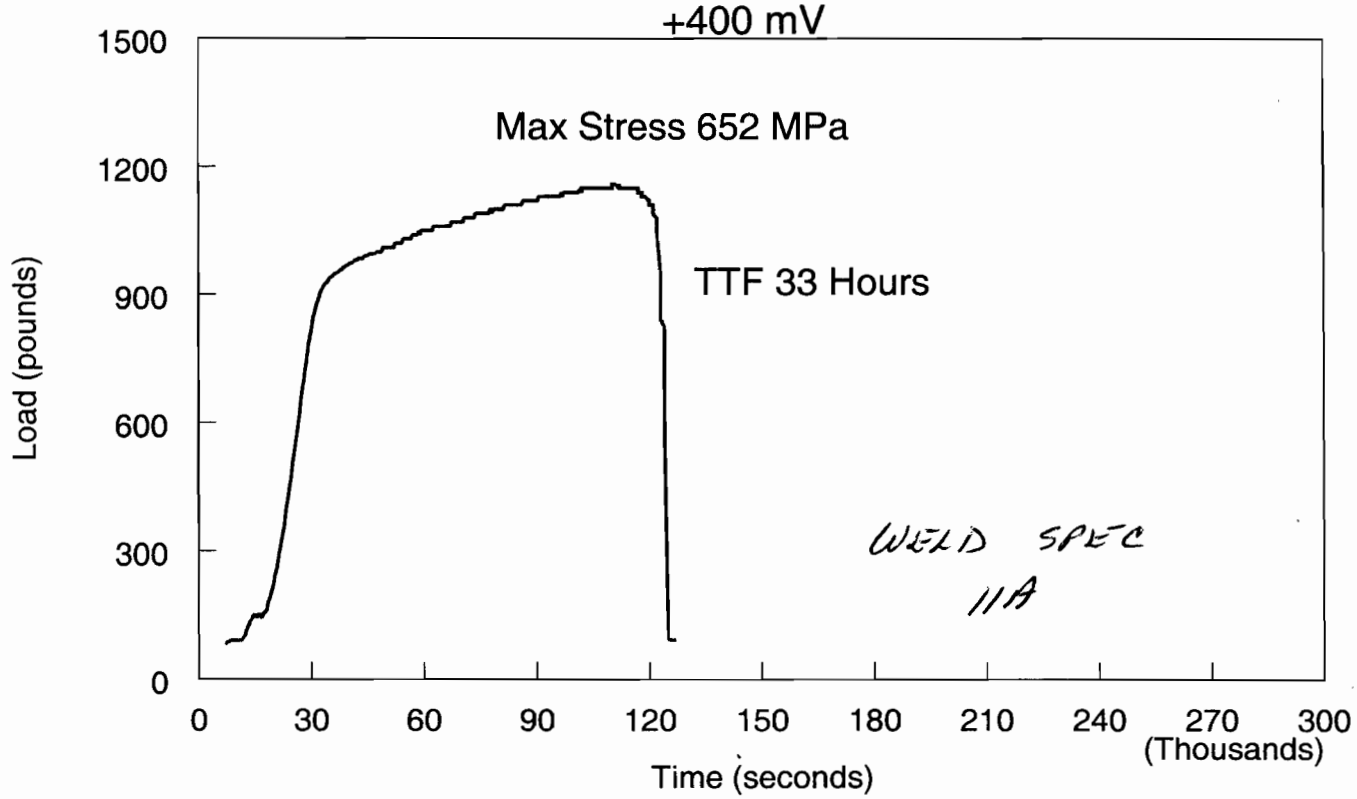
2/25/05
Walter J. Mackowiak

Slow Strain Rate Test

1.05M NaHCO3; 0.5M NaCl; 0.19M NaOH; 1.5M KCl

Test SSRMA22_SCW33

+400 mV



2/25/05

Walter J. Machowski

SLOW STRAIN RATE TEST

Notebook #695

Objective: see page #5 ① GMAW weld spec #12A

Specimen: MA Alloy 22 SwRI Drawing # 20-03704-042-001 Welded BWD 4/27/04

Heat ~~2278-8-3266~~ 2277-3-3292 filler WN813 XX19773611

Solution: ambient air

Reagents measured with **Model:** N/A **SN:**
Cal: **Due:**

Counter Electrode: **Reference Electrode:**

Gas: N/A **Ecorr:**

Eapplied: **Potentiostat:** N/A **SN:**

Specimen Visual: looks like ductile fracture

$\dot{\varepsilon}^o = 3.2 \times 10^{-6}\ s^{-1}$

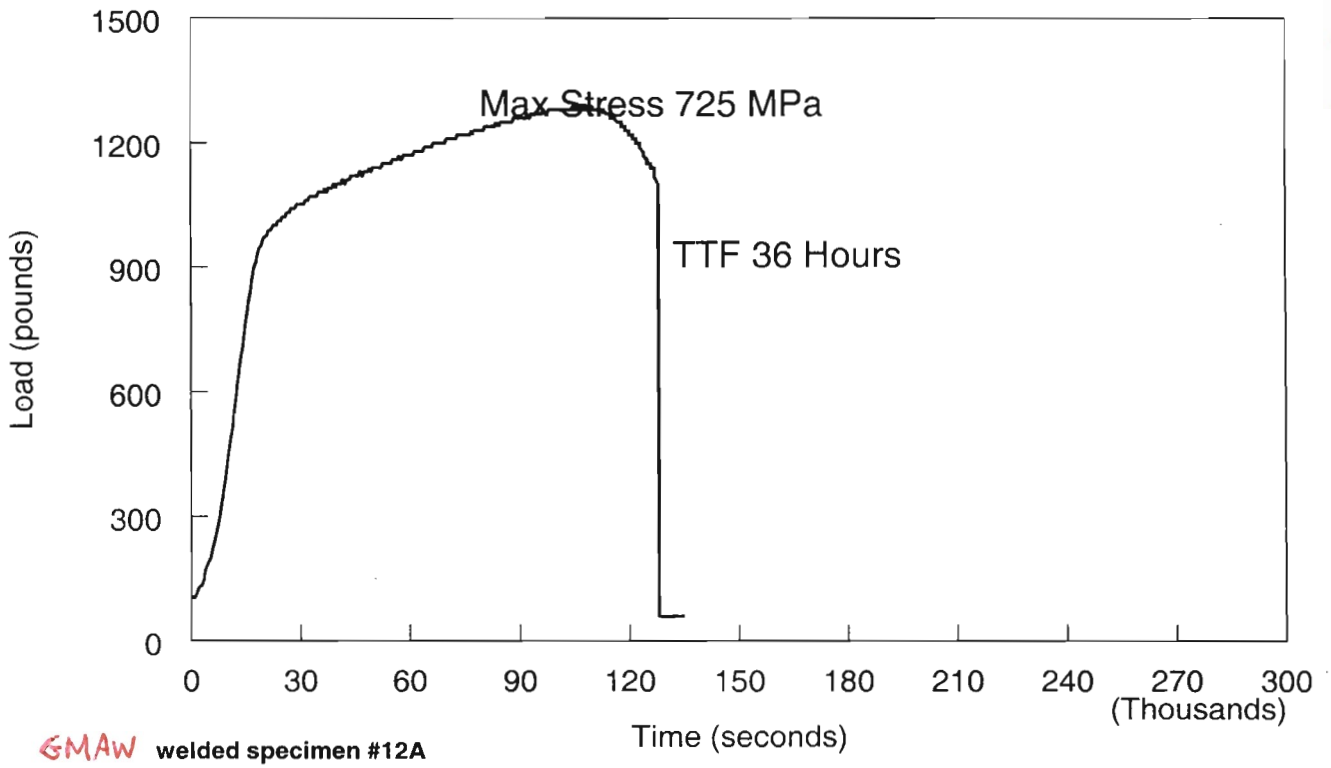
file : SSRMA22_SCW34

Walter J. Mackowski
3/9/05

Slow Strain Rate Test

Air @ Ambient Temperature

Test SSRMA22_SCW34



GMAW **welded specimen #12A**

Walter J. Mackowski
3/9/05

SLOW STRAIN RATE TEST

Objective: see page #5 Notebook #695 GMAW #12 B

Specimen: MA Alloy 22 SwRI Drawing # 20-03704-042-001 welded BKD 6/27/06

Heat ~~2236-8-3216~~ 2277-3-3292 WN 813/XX1977 3611

Solution:

ambient air

Reagents measured with **Model:** N/A **SN:**
Cal: **Due:**

Counter Electrode: **Reference Electrode:**

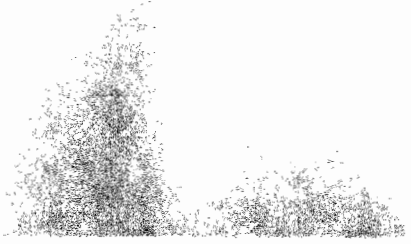
Gas: N/A **Ecorr:**

Eapplied: **Potentiostat:** N/A **SN:**

Specimen Visual:

looks like ductile fracture

$\dot{\epsilon} = 3.2 \times 10^{-6}\ s^{-1}$



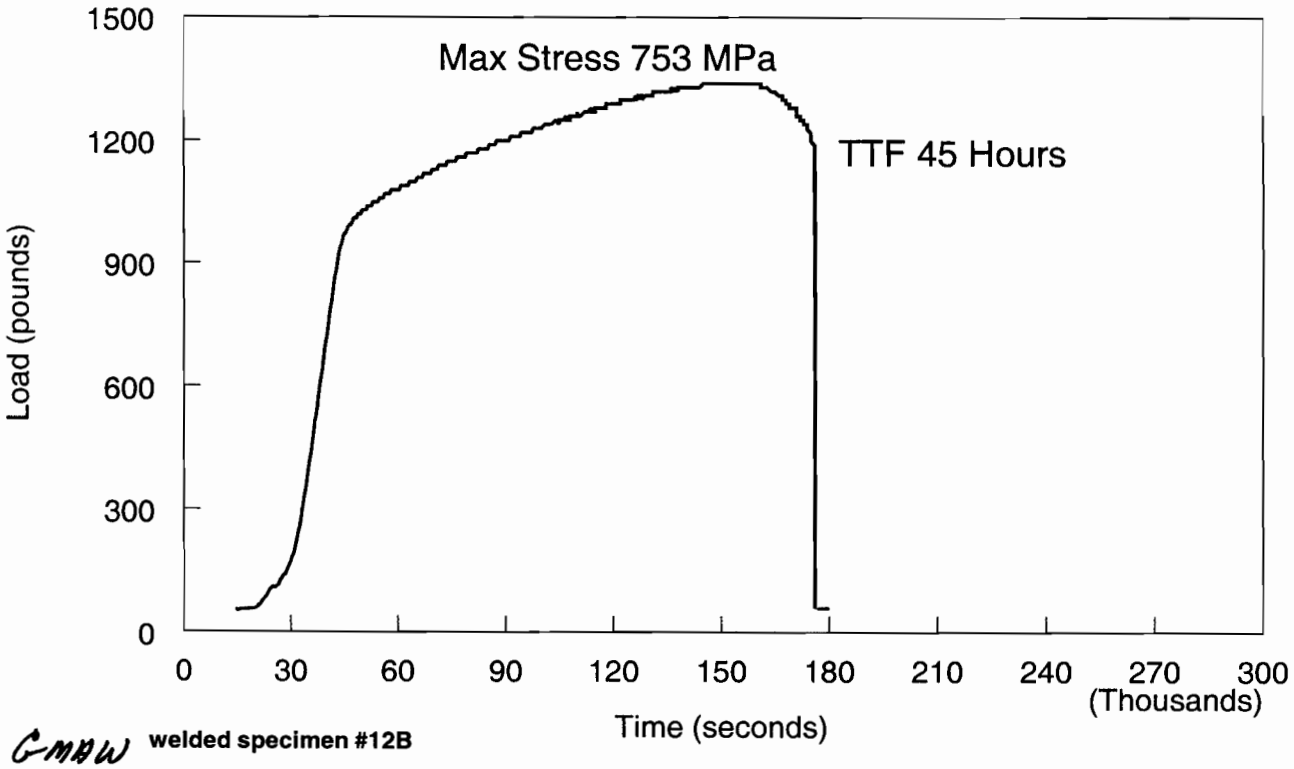
data file - SSRMA22-SCW35

Walter D. Mackowski
3/11/05

Slow Strain Rate Test

Air @ Ambient Temperature

Test SSRMA22_SCW35



CMBW welded specimen #12B

Walter J. Machowski
3/11/05

SLOW STRAIN RATE TEST

Objective: see page #5 Notebook #695 GTAW #10A

Specimen: MA Alloy 22 SwRI Drawing # 20-03704-042-001 welded BKD 4/27/04

Heat ~~2276-8-3264~~ 2277-3-3292 WN813/XX19770611

Solution:

ambient air

Reagents measured with **Model:** **SN:**
Cal: N/A **Due:**

Counter Electrode: N/A **Reference Electrode:**

Gas: **Ecorr:**

Eapplied: **Potentiostat:** N/A **SN:**

Specimen Visual:

looks like ductile fracture

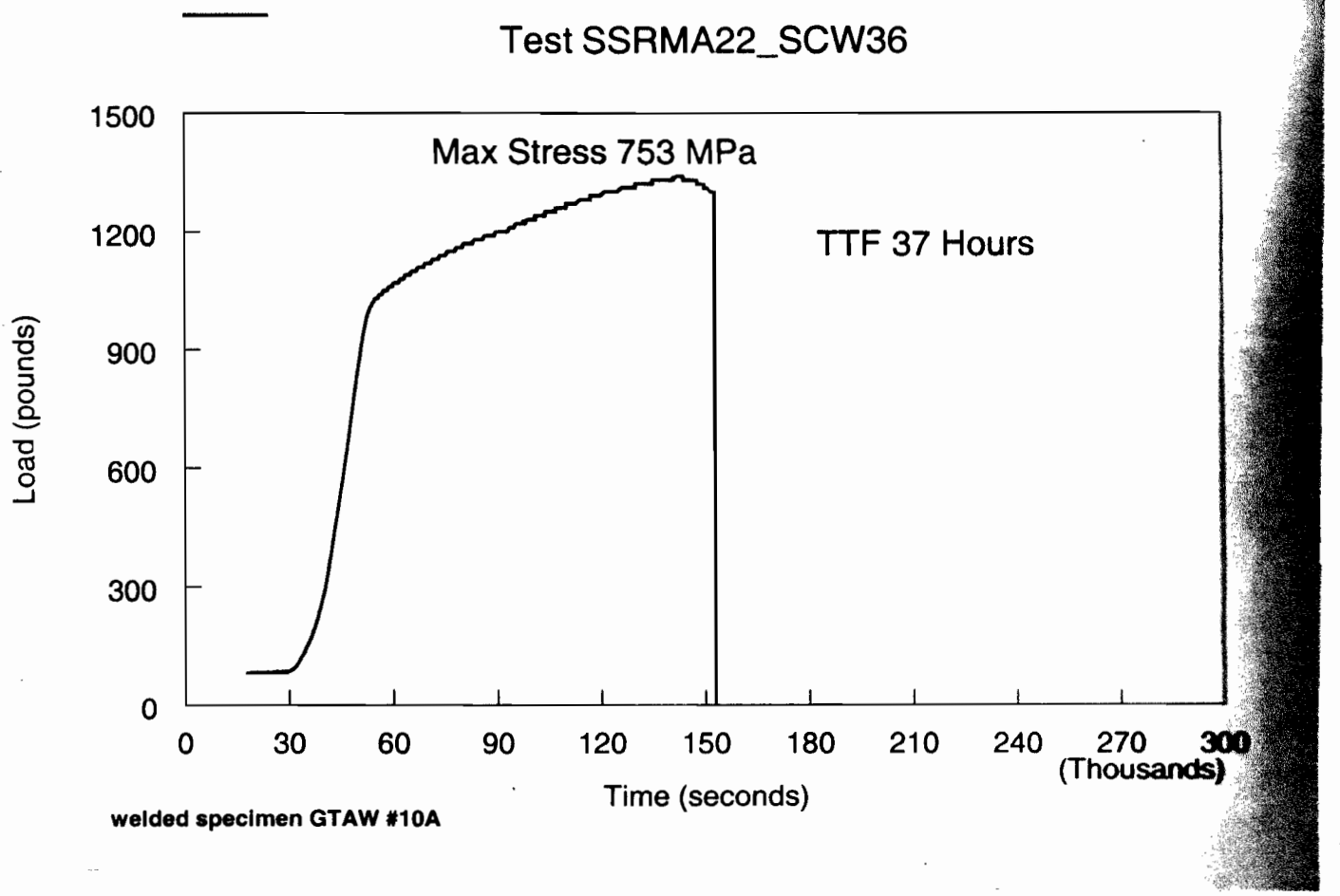
$\dot{\varepsilon}^0 = 3.2 \times 10^{-6}\ s^{-1}$

data file: SSRMA22_SCW36

Walter J. Mackowski
3/21/05

Slow Strain Rate Test

Air @ Ambient Temperature



Walter J. Mackowski
3/21/05

SLOW STRAIN RATE TEST

Objective: see page #5 Notebook #695 GTAW #10B

Specimen: MA Alloy 22 SwRI Drawing # 20-03704-042-001 weldes
~~2278-8-3266~~
2277-3-3292 WN/813 DKJ 6/27/06
XX1977 8611

Solution:
ambient air

Reagents measured with **Model:** N/A **SN:**
Cal: **Due:**

Counter Electrode: **Reference Electrode:**

Gas: N/A **Ecorr:**

Eapplied: **Potentiostat:** N/A **SN:**

Specimen Visual:
looks like ductile fracture

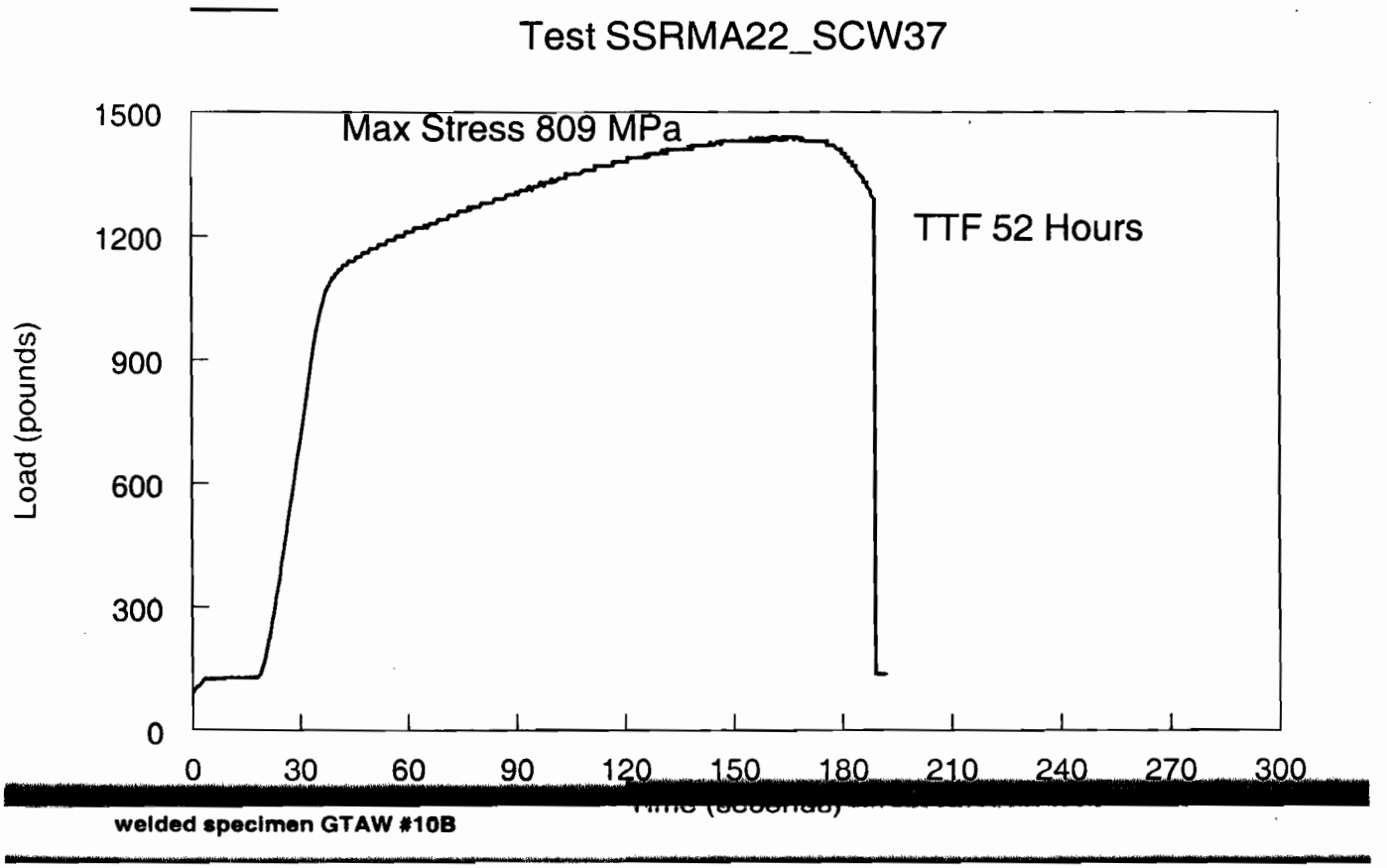
$\dot{\epsilon}^0 = 3.2 \times 10^{-6}\ s^{-1}$

data file: SSRMA22-SCW37

Walter J. Mackerras
3/21/06

Slow Strain Rate Test

Air @ Ambient Temperature



Walter J. Machowski

3/21/05

SLOW STRAIN RATE TEST

Objective: see page #5 Notebook #695 GMAM #13A

Specimen: MA Alloy 22 SwRI Drawing # 20-03704-042-001 welded BLP 6/27/06

Heat ~~2278-8-3266~~ 2277-3-3292 WN813/XY19770611

~~**Solution:**~~ BLP 6/27/06 thermally aged @ 1125°C for 20 min ambient air

Reagents measured with **Model:** **SN:** **Cal:** **Due:**

Counter Electrode: **Reference Electrode:**

Gas: N/A **Ecorr:**

Eapplied: **Potentiostat:** **SN:**

Specimen Visual:

looks like ductile fracture

Both 13 A's & B Specimen PS #194 & PS #195 PS #196 & #197

oven: Lindberg SN# 909172 model #51333

omega HH22 SN# T94140 Cal: 11/4/04 Due: 5/4/05

Thermocouple # 328 Cal: 2/7/05 Due: 8/05/05

Set point: 1125°C oven Temp: 1134°C 20 min H_2O Quenches

$\dot{\epsilon} = 3.2 \times 10^{-6}\ s^{-1}$

6/27/06

data file: SSRMA22_SCW38

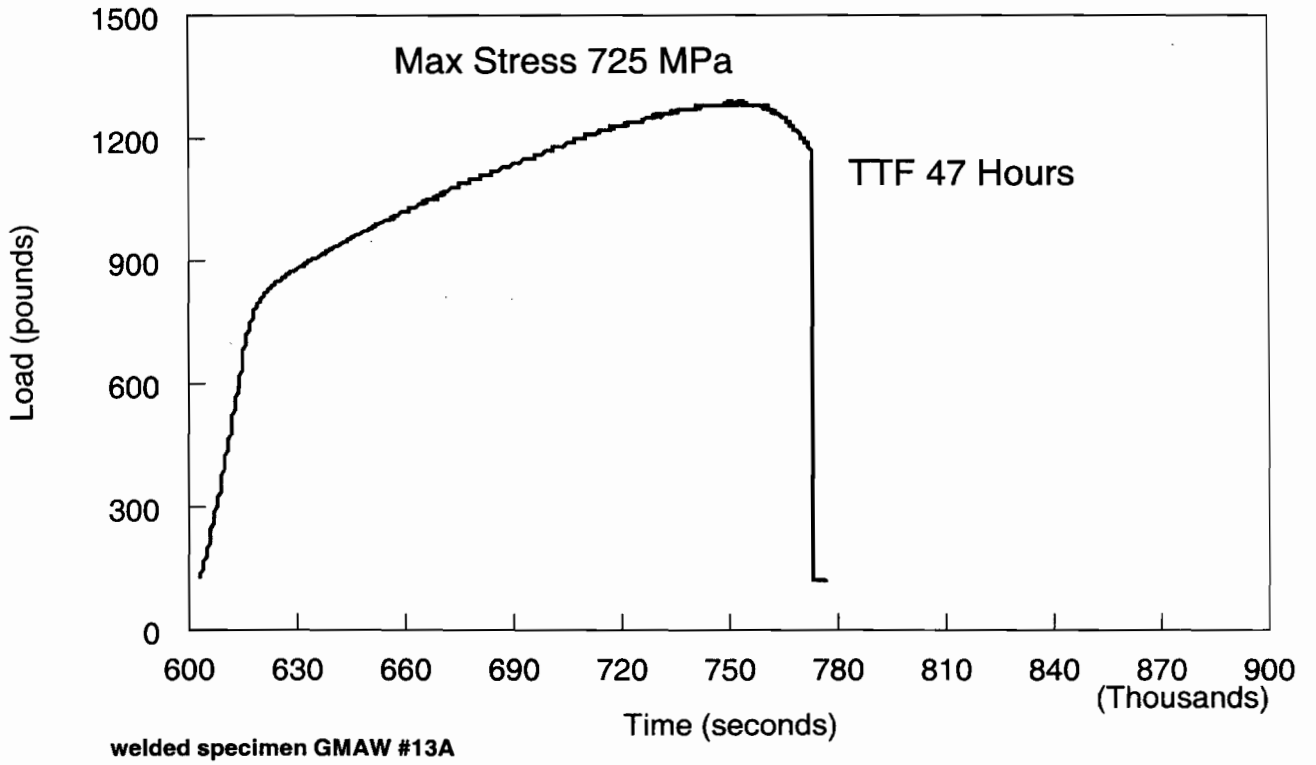
Walter J. Mackowiak

3/30/05

Slow Strain Rate Test

Air @ Ambient Temperature

Test SSRMA22_SCW38



welded specimen GMAW #13A

aged at 1125°C for 20 minutes

Walter J. Mackowski

3/30/05

SLOW STRAIN RATE TEST

Objective: see page #5 Notebook #695 GMAW #13B

Specimen: MA Alloy 22 SwRI Drawing # 20-03704-042-001 w/loc9

Heat ~~2278-8-3266~~ 2277-3-3292 WN813/XX1977 3G11 SKP 6/27/06

Solution:

thermally aged @ 1125°C / 20 min

ambient air

Reagents measured with **Model:** **SN:**
Cal: **Due:**

Counter Electrode: **Reference Electrode:**

Gas: **Ecorr:** N/A

Eapplied: **Potentiostat:** **SN:**

Specimen Visual:

looks like ductile fracture

$\dot{\epsilon}^0 = 3.2 \times 10^{-6} s^{-1}$

SKP 6/27/06 Test SSRmA22_SCW39

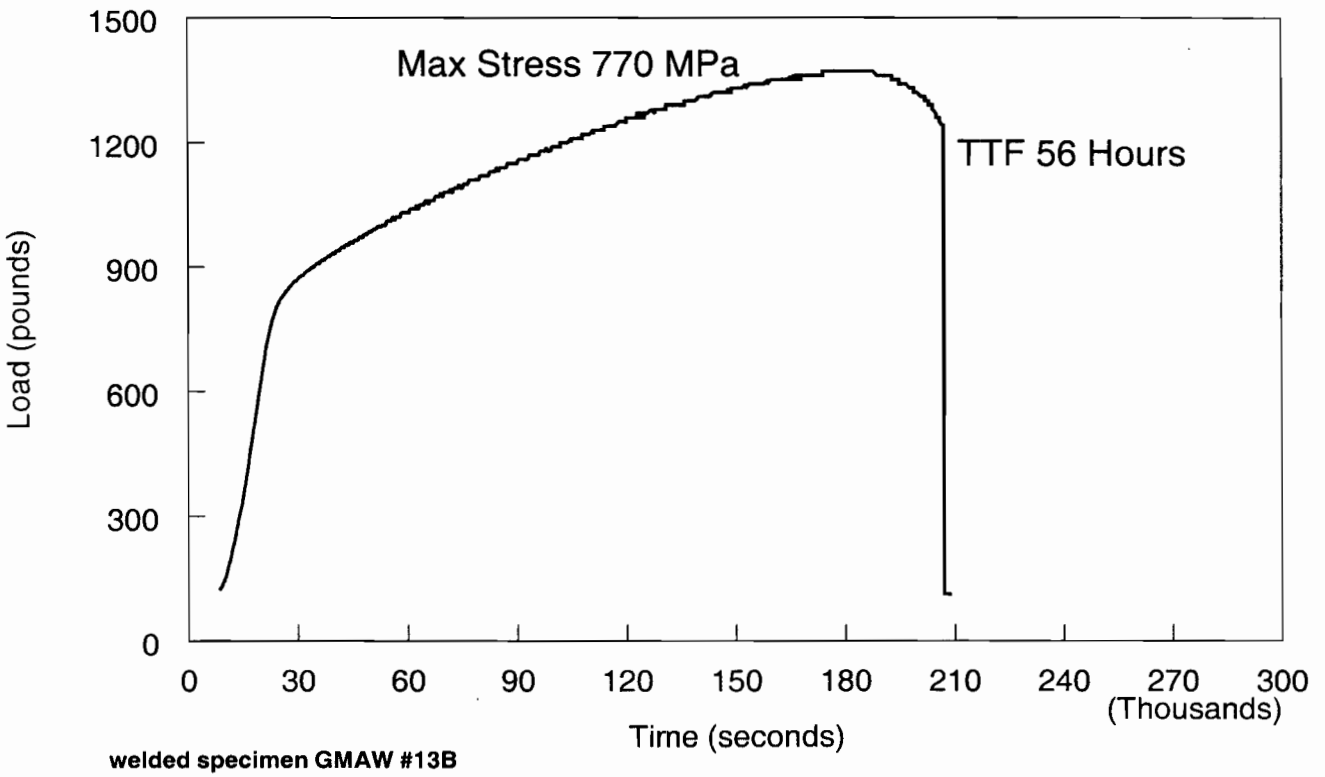
Walter J. Mackowiak

4/5/05

Slow Strain Rate Test

Air @ Ambient Temperature

Test SSRMA22_SCW39



welded specimen GMAW #13B

aged at 1125°C for 20 minutes

Walter J. Mackwork

4/5/05

SLOW STRAIN RATE TEST

Objective: see page #5 Notebook #695 PMHW #143

Specimen: MA Alloy 22 SwRI Drawing # 20-03704-042-001 welded

Heat ~~2378-8-82166~~ 2277-3-3292 WN843/VX19776611 DKP 6/27/06

Solution:

balance of solution - SCW33

on page 184

Reagents measured with **Model:** Orion 5 **SN:** 2883

Cal: as on p. 184 **Due:** as on p 184

Counter Electrode: Pt flag **Reference Electrode:** Ag/AgCl 0.3m KCl in bridge

Gas: N_2 (99.999) **Ecorr:** -200 mV

Eapplied: 415 mV **Potentiostat:** ESC440-2 **SN:** 9209138

Specimen Visual:

some cracks visible

maybe brittle fracture

$\epsilon^{\circ} = 3.2 \times 10^{-6} s^{-1}$

+ temp correction (+15 mV) @ 95°C

BJP 6/27/06 Test SSRMA22_SCW40

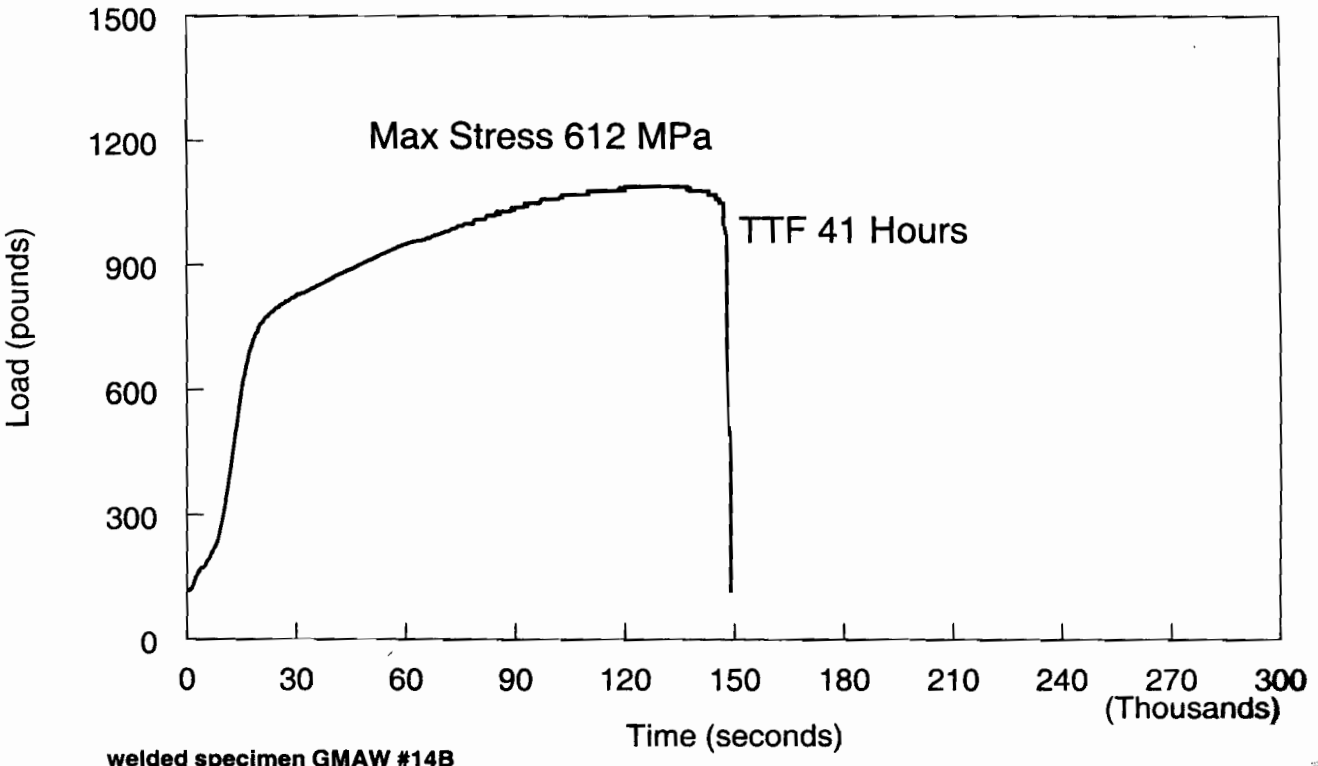
Walter J. Markowski

4/6/05

Slow Strain Rate Test

1.05M NaHCO3; 0.5M NaCl; 0.19 NaOH; 1.5M KCl

Test SSRMA22_SCW40



welded specimen GMAW #14B
aged at 1125°C for 20 minutes

Walter J. Mackerle
4/6/05

Test ID	Solution Composition	pH Initial	pH Adj'd	pH Final	Eapp(mV)	Max Stress (Mpa)	TTF(hrs)	RA(%)	% Elong	SCC?
SSRMA22_SCW28	0.5M NaCl; 7.1M KCl	7.87	not adj'd	9.36	400	560	39	55.9	44.4	Y
	0.38M NaNO3; NaCO3 as in SCW									
SSRMA22_SCW29	same as *28 except 3.3M KCl	7.41	not adj'd	9.44	400	590	50	50	55	Y
SSRMA22_SCW30	same as *26 except no HCO3		not adj'd		400*	787	79	76.9	87.6	N
SSRMA22_SCW31	SCW	7.73	8.31	9.03	200	730	74	77	85.2	N
SSRMA22_SCW32	SCW	7.73	8.31	8.85	400	674	38	65.9	41.6	N
SSRMA22_SCW33	1.05M NaHCO3; 0.5M NaCl 0.19M NaOH; 1.5M KCl	8.58	not adj'd	9.81	400	652	33	30	36.6	Y
SSRMA22_SCW34	AIR - GMAW #12A	N/A	N/A	N/A	N/A	725	36	56.9	38.8	N/A
SSRMA22_SCW35	AIR - GMAW #12B	N/A	N/A	N/A	N/A	753	45	48.2	50.4	N/A
SSRMA22_SCW36	AIR - GTAW #10A	N/A	N/A	N/A	N/A	753	37	51.6	40.8	N/A
SSRMA22_SCW37	AIR - GTAW #10B	N/A	N/A	N/A	N/A	809	52	49.3	59.8	N/A
SSRMA22_SCW38	AIR - GMAW #13A Thermally Aged 1125°C / 20 min	N/A	N/A	N/A	N/A	725	47	50.4	53.2	N/A
SSRMA22_SCW39	AIR - GMAW #13B Thermally Aged 1125°C / 20 min	N/A	N/A	N/A	N/A	770	56	54.8	62.4	N
SSRMA22_SCW40 #14B 1125°C/20 min	1.05M NaHCO3; 0.5M NaCl 0.19M NaOH; 1.5M KCl	8.58	not adj'd	9.73	400	612	41	53.7	45.2	Y
SSRMA22_SCW41 #14A 1125°C/20 min	SCW	7.79	8.69	10.5	400	669	50	58	57	N

Continued In NB # 695: pg 4/11/05

K.J. Chang 6/27/06