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#218

Kim Gruss / NRC

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Initial Scientific notebook entry for Alloy 625 and Alloy C-22 cyclic polarization tests.

Title: CPP and Potentiostatic Tests of Alloy 625 and Alloy C-22

Tests Performed by: Kimberly Ann Gruss (NRC)

Objectives: To determine the initiation and repassivation potentials for localized corrosion of Alloy 625 and Alloy C-22 as a function of chloride concentration and temperature

Equipment: EG&G Versastat Serial Number 20104. EG&G model 352 corrosion software. Keithley Electrometer model 614 Serial Number 555368, or equivalent. ASTM G-5 polarization cell, teflon/glass reaction vessels or vessel meeting the requirements of TOP-008. NEC Powermate V2133 computer.

Materials: Alloy 625 and Alloy C-22

Specimen specifications: 0.250" diameter x 1.915" long (+/- 0.005") specimens polished to a 600 grit finish. Specimens to be weighed before and after exposure.

Measurement Parameters: As described in TOP-008.

Required Level of Accuracy: Potentials +/- 5 mV.

Uncertainty and Sources of Error: Current density calculated as current divided by sample area. Actual current density of corroding areas is not determined.

Kimberly Ann Gruss 4/10/97

Kimberly Ann Gruss 4/10/97

TOP-022 TEST

Objective: verify the performance of the EG+G Versastat (S/N 20104) potentiostat and EG+G Model 352c Software, using TOP-022.

Equipment: EG+G Versastat ~~(S/N)~~ potentiostat (S/N 20104) kag 4/9/97
Calibrated resistor box (refer to TOP-022) ~~w/i~~
- Calibration due date: 17 JUN 97. kag 4/9/97
- R = 1.000439 kΩ

Data: saved as Top022.dat onto floppy disk

Kimberly Ann Gruss

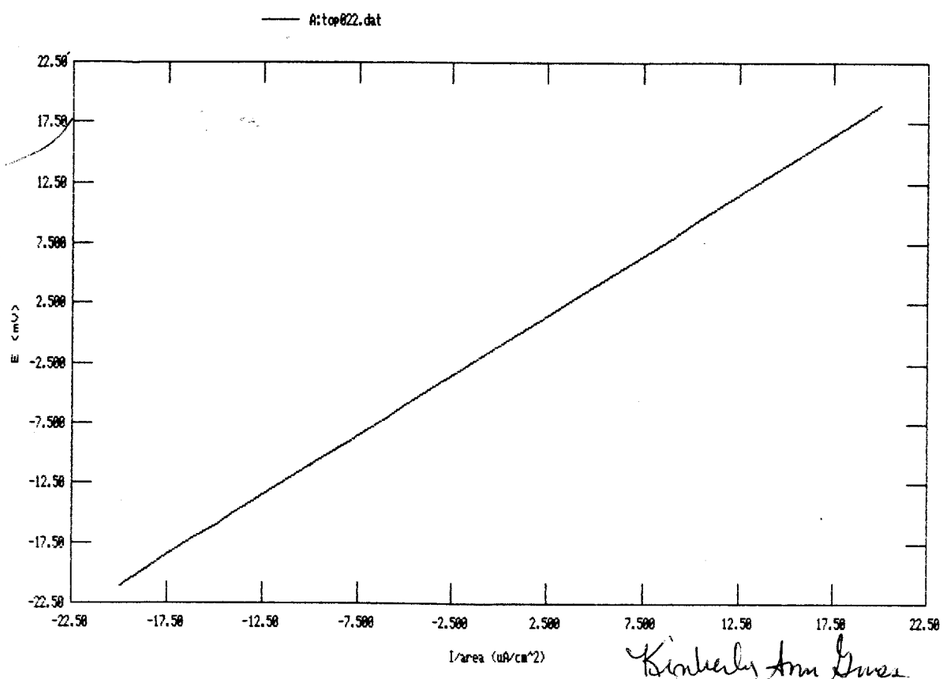
Model 352/252 Corrosion Analysis Software, v. 2.01
Filename: A:top022.dat
Pstat: VStat[] Ver 2
LP LINEAR POLARIZATION — File Status: NORMAL
Date Run: 04-06-97 — Time Run: 11:22:16

Cond. Time	CT	pass	s	Initial Pot.	IP	-20.00E-3	V oc
Cond. Pot.	CP	pass	V	Final Pot.	FP	20.00E-3	V oc
Initial Delay	ID	10	s				
Scan Rate	SR	1.000	mV/s	Curr. Range	CR	Auto	
Scan Incr.	SI	1.000	mV	Step Time	ST	1.000	s
No. of Points	NP	41					
				GI Time Const.	TC	Off	
Line Sync.	LS	yes		IR Mode	IR	none	
Rise Time	RT	high stability		Filter	FL	Off	
Working Elec.	WE	Solid		Ref. Elec.	RE	SCE 0.2415	V
Sample Area	AR	1.000	cm^2	Equiv. Wt.	EW	0.0000	g
Density	DE	1.000	g/ml	Open Circuit	OC	-1.000E-3	V

Comment: TOP-022 with 1000 ohm resistor

Kimberly Ann Gruss 4/10/97

Model 352/252 Corrosion Analysis Software, v. 2.81 Filename: A:top022.dat Pstat: VStat[] Ver 2
LP LINEAR POLARIZATION File Status: NORMAL Date Run: 04-06-97 Time Run: 11:22:16
CP PASS vs. R CT PASS IP -0.020 vs. OC ID 10 S FP 0.020 vs. OC SI 1.000E-03
SR 1.000E-03 ST 1.000E+00 CR AUTO NP 41 IR NONE FL NONE
RT HIGH STABILITY REF 0.24150 SCE WRK SOLID AR 1.000E+00 LS YES EN 0.000E+00
DEN 1.000E+00 OC -0.001
Comment: TOP-022 with 1000 ohm resistor



Kimberly Ann Gruver
4/10/97

Kimberly Ann Gruver 4/10/97

~~TOP~~ Kay 4/8/97

Cyclic Polarization test on 316L – 316cppl.dat

Objective: Measure E_p and E_{rp}; to ~~familiarize~~ gain understanding Kay 4/10/97 of the operation of electrochemical hardware + software.

Specimen: 316L Ht# T80746
0.250" Diam × 1.915" long
600 grit finish, exposed area 8.0 cm²
Start wt. 11.74149 gm
End wt. 11.71654 gm

Solution: 1000 ppm Cl^- as NaCl Lot # 960780 (3.297gm)
85 ppm HCO_3^- as ~~Na_2CO_3~~ $NaHCO_3$ KD 6/9/97 Lot #92 3337A (0.23640gm)
Kay 4/10/97 ~~100~~ 20ppm SO_4^-, Stock Solution, 40 ml
↳ SO_4 ~ 4/97/NB 157, p. 161
10ppm NO_3^-, 20ml Stock Solution NO_3^- – 4/97/NB 157, p.161
2ppm F^-, 2ml Stock Solution F^- – 4/97/NB 157, p.161
+DI water to 2000 ml, Dearated w/99.999% N_2
2000ml Solution

T = 95°C, Hg Thermometer 183301
Start pH = 8.278
End pH = 9.268

Potentiostat: EG+G Versastat S/N 20104 w/ Model 352c software

Reference: Fisher SCE 13-620-51 S/N 3106339

Counter Electrode: Pt. Flag

E_{corr} = −756 mV } Keithley 614 electrometer S/N
E_{pt} =

Test Started 4/9/97 Test Ended 4/9/97

E_p = +220 mV, E_{rp} = −40 mV ⇒ Pits were observed on specimen.

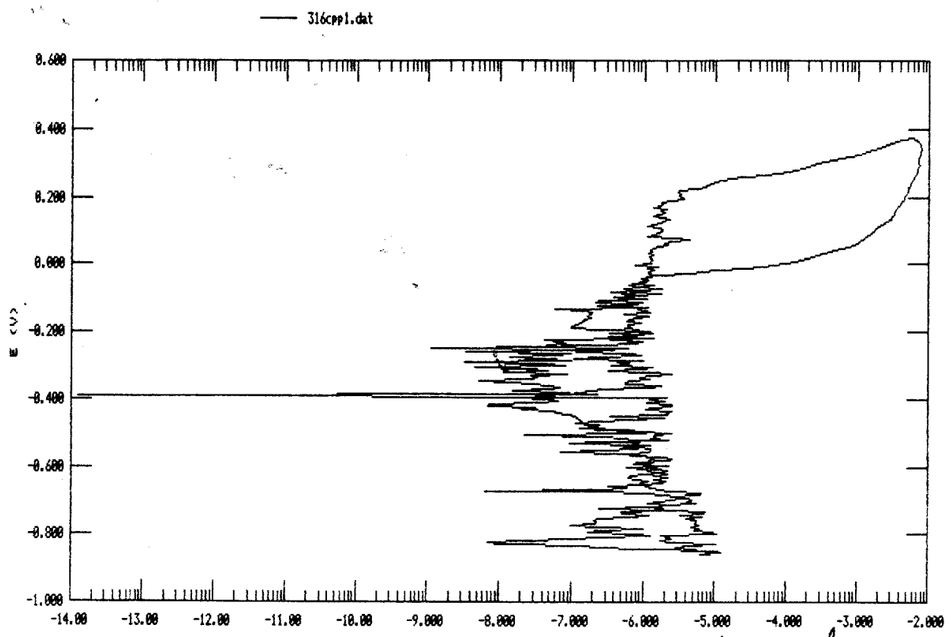
Kimberly Ann Gruver 4/10/97

Model 352/252 Corrosion Analysis Software, v. 2.01 Filename: A:\316cpp1.dat Pstat: VStat[] Ver 2
CP CYCLIC POLARIZATION File Status: NORMAL Date Run: 04-06-97 Time Run: 14:31:26

CP	PASS vs. R	CT	PASS	IP	-0.100 vs. OC	ID	20 S	V1	0.100 vs. OC
SI	5.000E-03	SR	1.670E-04	ST	2.993E+01	CR	AUTO	NP	494
FL	NONE	RT	HIGH STABILITY	REF	0.24150 SCE	WRK	SOLID	AR	8.000E+00
IT	4.000E-02	ITA	0.000E+00	EW	0.000E+00	DEN	7.900E+00	OC	-0.760

FP	-0.100 vs. OC		
IR	NONE		
LS	YES		

Comment: 316L P80746 1000 ppm Cl at 95 C



Kimberly Ann Gross
4/10/97

Kimberly Ann Gross 4/10/97

Kimberly Ann Gross
4/10/97

Model 352/252 Corrosion Analysis Software, v. 2.01
Filename: A:\316cpp1.dat
Pstat: VStat[] Ver 2
CP CYCLIC POLARIZATION File Status: NORMAL
Date Run: 04-06-97 Time Run: 14:31:26

Cond. Time	CT	pass	s	Initial Pot.	IP	-0.1000	V oc
Cond. Pot.	CP	pass	V	Vertex 1 Pot.	V1	0.1000	V oc
Initial Delay	ID	20	s	I Threshold	IT	5.000E-3	A/cm^2
				Final Pot.	FP	-0.1000	V oc
Scan Rate	SR	0.1670	mV/s	Curr. Range	CR	Auto	
Scan Incr.	SI	5.000	mV	Step Time	ST	29.93	s
No. of Points	NP	494					
				GI Time Const.	TC	Off	
Line Sync.	LS	yes		IR Mode	IR	none	
Rise Time	RT	high stability		Filter	FL	Off	
Working Elec.	WE	Solid		Ref. Elec.	RE	SCE 0.2415	V
Sample Area	AR	8.000	cm^2	Equiv. Wt.	EW	0.0000	g
Density	DE	7.900	g/ml	Open Circuit	OC	-0.7600	V

Comment: 316L P80746 1000 ppm Cl at 95 C

Kimberly Ann Gross

CPP of 825 - 825cppl.dat

Objective: Measure E_p and E_{rp}

Specimen: Alloy 825, Ht # HH4371FG
0.245" Diam x 1.913" long
600 grit finish. Exposed area 8.0 cm^2
Start Wt = 10.78052 gm
End Wt = 10.62283 gm

Solution: 1000 ppm Cl^-, 85 ppm HCO_3^-, 20 ppm SO_4^-, 10 ppm NO_3^-, 2 ppm F^-, 2000 ml solution from p. 5.
T = 95°C, Hg Thermometer 183301
Start pH = 8.278
End pH = 9.223

Potentiostat: EG+G Versastat S/N 20104 w/ Model 352C Software

Reference: Fisher SCE 13-620-51 S/N 3108339

Counter Electrode: Pt. Flag

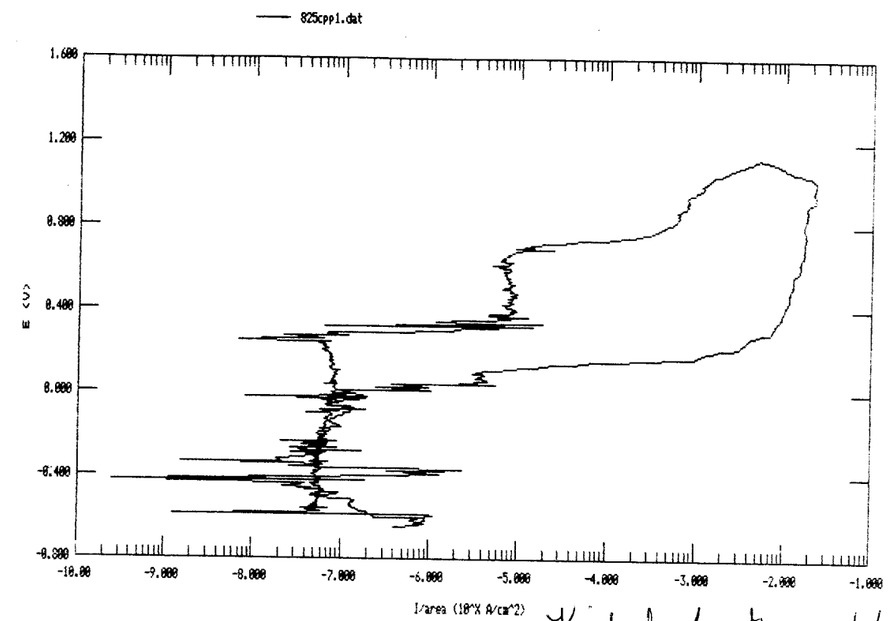
E_{corr} = -545 mV
E_{pt} = -400 mV
} Keithley 614 Electrometer S/N

Test Started 4/10/97 Test Ended 4/10/97

E_{pit} = 705 mV Specimen shows large pits
E_{rp} = 0 mV

Kimberly Ann Gruss 4/11/97

Model 352/252 Corrosion Analysis Software, v. 2.01 Filename: a:\825cppl.dat Pstat: VStat[] Ver 2
CP CYCLIC POLARIZATION File Status: NORMAL Date Run: 04-10-97 Time Run: 10:47:52
CP PASS vs. R CT PASS IP -0.100 vs. OC ID 20 S V1 0.100 vs. OC FP -0.100 vs. OC
SI 5.000E-03 SR 1.670E-04 ST 2.993E+01 CR AUTO NP 700 IR NONE
FL NONE RT HIGH STABILITY REF 0.24150 SCE WRK SOLID AR 8.000E+00 LS YES
IT 4.000E-02 ITA 8.000E+00 EW 0.000E+00 DEN 8.140E+00 OC -0.545
Comment: Alloy 825, Ht. HH4371FG, 1000 ppm Cl-, at 95 C



Kimberly Ann Gruss 4/11/97

Kimberly Ann Gruss 4/11/97

Model 352/252 Corrosion Analysis Software, v. 2.01
Filename: a:\825cpp1.dat
Pstat: VStat[] Ver 2
CP CYCLIC POLARIZATION — File Status: NORMAL
Date Run: 04-10-97 — Time Run: 10:47:52

Cond. Time	CT	pass	s	Initial Pot.	IP	-0.1000	V oc
Cond. Pot.	CP	pass	V	Vertex 1 Pot.	V1	0.1000	V oc
Initial Delay	ID	20	s	I Threshold	IT	5.000E-3	A/cm^2
				Final Pot.	FP	-0.1000	V oc
Scan Rate	SR	0.1670	mV/s	Curr. Range	CR	Auto	
Scan Incr.	SI	5.000	mV	Step Time	ST	29.93	s
No. of Points	NP	768					
				GI Time Const.	TC	Off	
Line Sync.	LS	yes		IR Mode	IR	none	
Rise Time	RT	high stability		Filter	FL	Off	
Working Elec.	WE	Solid		Ref. Elec.	RE	SCE 0.2415	V
Sample Area	AR	8.000	cm^2	Equiv. Wt.	EW	0.0000	g
Density	DE	8.140	g/ml	Open Circuit	OC	-0.5450	V

Comment: Alloy 825, Ht. HH4371FG, 1000 ppm Cl-, at 95 C

Kimberly Ann Gruwa
4/11/97

Kimberly Ann Gruwa 4/11/97

CPP of 625 – 625cpp1.dat

Objective: Measure E_p and E_{rp}

Specimen: Alloy 625, Ht #NX9936AG, $\rho = 8.44$ gm/ml
0.250"dx 1.913" long
600 grit finish, exposed area 8.0 cm^2
Start wt. = 12.23528 gm
End wt. = 12.22267 gm

Solution: 1000 ppm Cl^-, 85 ppm HCO_3^-, 20 ppm SO_4^-, 10 ppm NO_3^-, 2 ppm F^-, 2000 mL solution from p. 5.
T = 95°C, Hg thermometer 183301
Start pH = 8.278
End pH = 9.839

Potentiostat: EG+G Versastat S/N 20104 w/ Model 352C software

Reference: Fisher SCE 13-620-51 S/N 3106339

Counter Electrode: Pt. Flag

E_{corr} = 700 mV
E_{pt} = -126 mV
} Keithley 614 Electrometer S/N

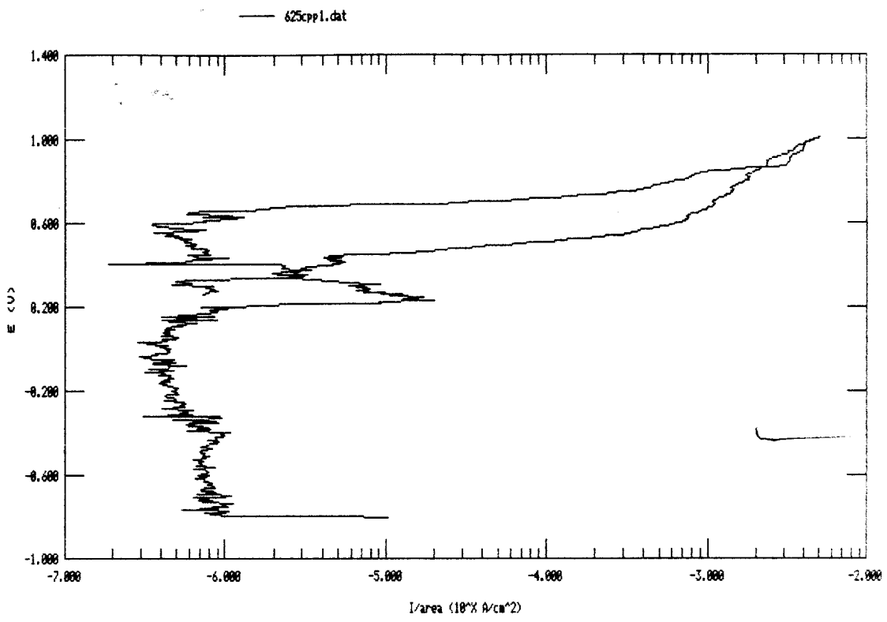
Test Started ~~705~~ 4/10/97 Test Ended
Kag 4/11/97

E_{pit} = +648 mV
E_{rp} = 358 mV

Results: No pits were present on specimen.
Surface was yellow in color up to water level after specimen was pulled from the sol'n.

Kimberly Ann Gruwa 4/14/97

Model 352/252 Corrosion Analysis Software, v. 2.01 Filename: a:\625cpp1.dat Pstat: VStat[] Ver 2
CP CYCLIC POLARIZATION File Status: NORMAL Date Run: 04-11-97 Time Run: 08:49:17
CP PASS vs. R CT PASS IP -0.100 vs. OC ID 20 S V1 0.100 vs. OC FP -0.100 vs. OC
SI 5.000E-03 SR 1.670E-04 ST 2.993E+01 CR AUTO NP 512 IR NONE
FL NONE RT HIGH STABILITY REF 0.24150 SCE WRK SOLID AR 8.000E+00 LS YES
IT 4.000E-02 ITA 8.000E+00 EW 0.000E+00 DEN 8.440E+00 OC -0.702
Comment: Alloy 625, Ht #NX9936A6, 1,000 ppm Cl-, 95 C



Kimberly Ann Gmez 4/14/97

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Model 352/252 Corrosion Analysis Software, v. 2.01
Filename: a:\625cpp1.dat
Pstat: VStat[] Ver 2
CP CYCLIC POLARIZATION File Status: NORMAL
Date Run: 04-11-97 Time Run: 08:49:17

Cond. Time	CT	pass	s	Initial Pot.	IP	-0.1000	V oc
Cond. Pot.	CP	pass	V	Vertex 1 Pot.	V1	0.1000	V oc
Initial Delay	ID	20	s	I Threshold	IT	5.000E-3	A/cm^2
				Final Pot.	FP	-0.1000	V oc
Scan Rate	SR	0.1670	mV/s	Curr. Range	CR	Auto	
Scan Incr.	SI	5.000	mV	Step Time	ST	29.93	s
No. of Points	NP	512					
				GI Time Const.	TC	Off	
Line Sync.	LS	yes		IR Mode	IR	none	
Rise Time	RT	high stability		Filter	FL	Off	
Working Elec.	WE	Solid		Ref. Elec.	RE	SCE 0.2415	V
Sample Area	AR	8.000	cm^2	Equiv. Wt.	EW	0.0000	g
Density	DE	8.440	g/ml	Open Circuit	OC	-0.7020	V

Comment: Alloy 625, Ht #NX9936A6, 1,000 ppm Cl-, 95 C

Kimberly Ann Gmez 4/14/97

Kimberly Ann Gmez 4/14/97

CPP of 625, 4M Cl^-, 95°C – 625cpp2.dat

Objective: measure E_{pit} + E_{rp}

Specimen: Alloy 625, Ht # NX9936AG, ρ = 8.44 gm/ml
0.250" Diameter x 1.913" long
600 grit finish, exposed area 8.0 cm²
Start Wt = 12.22578 gm
End wt = 12.22221 gm

Solution: 4M Cl^- as NaCl lot #960780 (233.76848 gm) DA 6/9/97
85 ppm HCO_3^- as ~~Na_2CO_3~~ lot #923337A (0.118080 gm)
20 ppm SO_4^-, 20 ml SO_4^- - 4/97 Stock Sol'n, NB 157, p. 161
10 ppm NO_3^-, 10 ml NO_3^- - 4/97 Stock Sol'n, NB 157, p. 161
2 ppm F^-, 2 ml F^- - 4/97 Stock Sol'n, NB 157, p. 161
} 1000 ml solution
+ DI water to 1000 ml, Deaerated w/ 99.999% N_2
85 ppm HCO_3^- added as $NaHCO_3$ DA 6/9/97
T = 95°C, Hg thermometer, #183301
Start pH = 7.655 Kag / 4/14/97
End pH = 8.705

Potentiostat: EG+G Versastat S/N 20104, w/ Model 352C software

Reference: Fisher SCE 13-620-51 S/N 3106339

Counter Electrode: Pt Flag

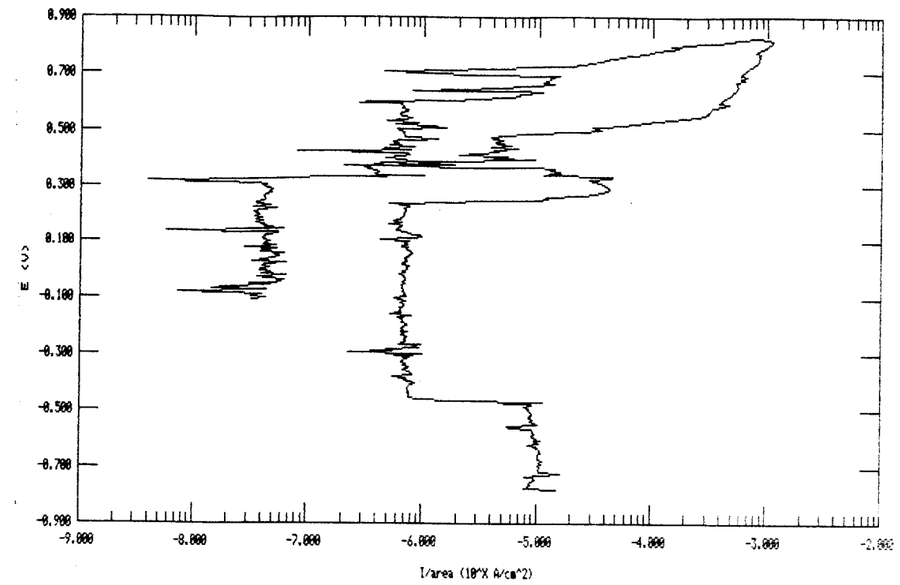
Ecor = ~~-668 mV~~ -676 mV Kag 4/14/97
Epit = -38 mV

Test Started 4/14/97, 11:05 am

Epit = 707 mV
Erp = 387 mV

Localized pitting at top of sample – pits appear to be shallow. Specimen surface had black corr. product ~~and~~ in localized areas + yellow film in other areas.

Kimberly Ann Gomez 4/14/97



4/14/97 Kimberly Ann Gomez

Model 352/252 Corrosion Analysis Software, v. 2.01
Filename: a:\625cpp2.dat
Pstat: VStat[] Ver 2
CP CYCLIC POLARIZATION — File Status: NORMAL
Date Run: 04-12-97 — Time Run: 08:21:45

Cond. Time	CT	pass	s	Initial Pot.	IP	-0.1000	V oc
Cond. Pot.	CP	pass	V	Vertex 1 Pot.	V1	0.1000	V oc
Initial Delay	ID	20	s	I Threshold	IT	5.000E-3	A/cm^2
				Final Pot.	FP	0.1000	V oc
Scan Rate	SR	0.1671	mV/s	Curr. Range	CR	Auto	
Scan Incr.	SI	5.000	mV	Step Time	ST	29.92	s
No. of Points	NP	510					
				Gl Time Const.	TC	Off	
Line Sync.	LS	yes		IR Mode	IR	none	
Rise Time	RT	high stability		Filter	FL	Off	
Working Elec.	WE	Solid		Ref. Elec.	RE	SCE 0.2415	V
Sample Area	AR	8.000	cm^2	Equiv. Wt.	EW	0.0000	g
Density	DE	8.440	g/ml	Open Circuit	OC	-0.6830	V

Kimberly Ann Gomez 4/14/97

Kimberly Ann Gomez 4/14/97

CPP of 625, ~~4 M Cl⁻, 2.5 pH~~ 1M Cl⁻, 95°C - ~~cpp~~ 625cpp3.dat
Kag 4/14/97

Objective: measure E_{pit} + E_{rp}

Specimen: Alloy 625, Ht# NX9936AG, ρ = 8.44 gm/mole
0.251" Diam x 1.915" long
600 grit finish, exposed area = 8.0 cm²
Start wt = 12.22173 gm
End wt = ~~12.23602 gm~~ 12.22216 Kag 4/18/97

Solution: 1M Cl⁻ as NaCl lot #960780 (58.44911 gm)
85 ppm HCO_3^- as ~~Na_2CO_3~~ NaHCO lot #923337A (0.12095 gm)
20 ppm SO_4^-, 20 ml SO_4^- - 4/97 Stock Sol'n, NB 157, p.161
10 ppm NO_3^-, 10 ml NO_3^- - 4/97 Stock Sol'n, NB 157, p.161
2 ppm F^-, 2 ml F^- - 4/97 Stock Sol'n, NB 157, p.161
+ DI water to 1000 ml, Deaerated w/ N_2 (99.999%)
85 ppm NCO_3^- added as $NaHCO_3$ DR 6/9/97
T = 95°C, Hg Thermometer #183304
Start pH = ~~7.899~~ 7.903 Kag 4/14/97
End pH = 8.893

Potentiostat: EG+G Versastat S/N 20104 w/ Model 352C Software

Reference Electrode: Fisher SCE #13-620-51 S/N 3106339

Counter Electrode: Pt. Flag

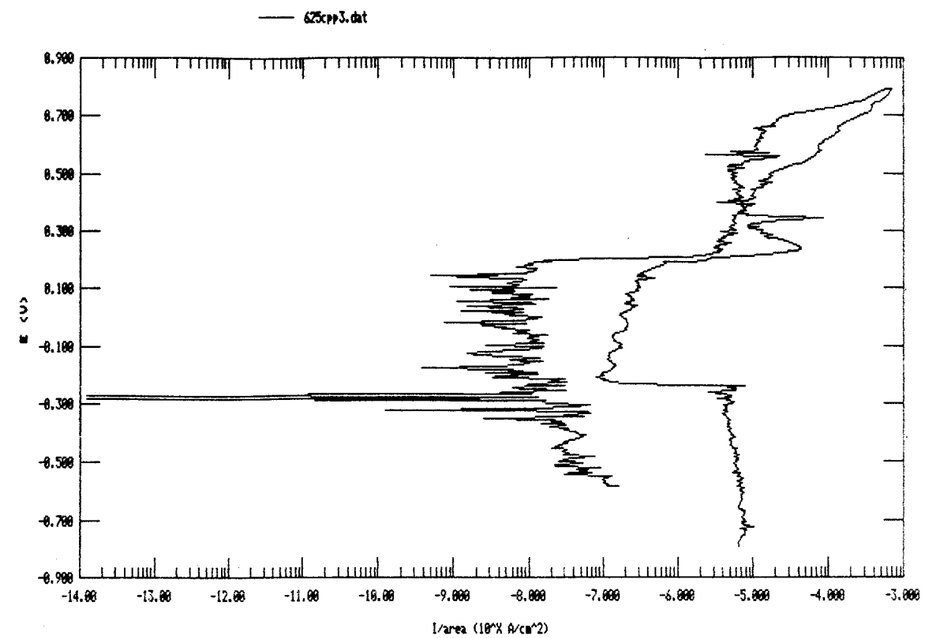
E_{corr} = 685 mV
E_{Pt} = ~~400 mV~~ -379 mV Kag 4/14/97

Test Started 4/14/97

E_{pit} = 655 mV
E_{rp} = 405 mV

No pitting - yellow surface layer after test.

Kimberly Ann Kennedy 4/14/97



Model 352/252 Corrosion Analysis Software, v. 2.01
Filename: a:\625cpp3.dat
Pstat: VStat[] Ver 2
CP CYCLIC POLARIZATION — File Status: NORMAL
Date Run: 04-12-97 — Time Run: 14:36:47

Cond. Time	CT	pass	s	Initial Pot.	IP	-0.1000	V oc
Cond. Pot.	CP	pass	V	Vertex 1 Pot.	V1	0.1000	V oc
Initial Delay	ID	20	s	I Threshold	IT	5.000E-3	A/cm^2
				Final Pot.	FP	0.1000	V oc
Scan Rate	SR	0.1671	mV/s	Curr. Range	CR	Auto	
Scan Incr.	SI	5.000	mV	Step Time	ST	29.92	s
No. of Points	NP	594					
				GI Time Const.	TC	Off	
Line Sync.	LS	yes		IR Mode	IR	none	
Rise Time	RT	high stability		Filter	FL	Off	
Working Elec.	WE	Solid		Ref. Elec.	RE	SCE 0.2415	V
Sample Area	AR	8.000	cm^2	Equiv. Wt.	EW	0.0000	g
Density	DE	8.440	g/ml	Open Circuit	OC	-0.6900	V

Kimberly Ann Kennedy 4/14/97

CPP of 625, 4M Cl^-, 95°C, 2.4pH ~ 625cpp4.dat

Objective: Measure E_{pit} + E_{rp}

Specimen: Alloy 625, Ht# NX9936AG, ρ = 8.44 gm/ml
0.250" x 1.915" long
600grit finish, exposed area 8.0 cm^2
Start wt = 12.17461 gm
End wt = 12.16980 gm

Solution: 4M Cl^- as NaCl Lot #960780 (233.75768 gm)
20ppm SO_4^-, 20ml SO_4^- - 4/97 Stock Sol'n, NB157, p.161
10ppm, NO_3^-, 10ml NO_3^- - 4/97 Stock Sol'n, NB157, p.161
2ppm F^-, 2ml F^- 4/97 Stock Sol'n, NB157, p.161
7.1 ml D.M HCl, Stock Sol'n LB 218, p.20 (prep. 4/15/97)
+ DI water to 1000 ml, Dearated w/ N_2 (99.999%)

Start pH = 2.572
End pH = 2.692
T=95°C, Hg Thermometer 183304

Potentiostat = EG&G Versastat S/N 20104 w/ Model 352C Software

Ref. Electrode = Fisher SCE # 13-620-51 S/N 3106339

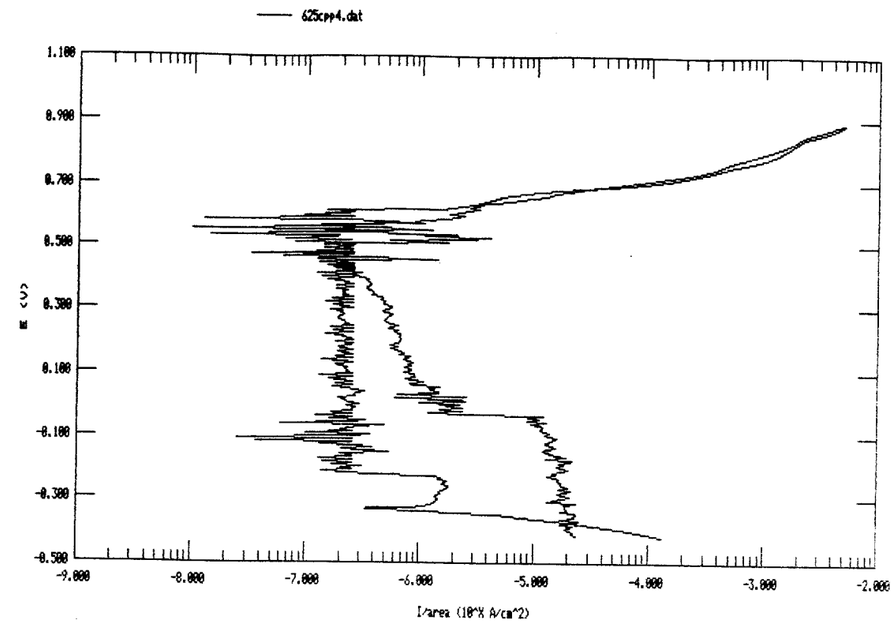
Counter Electrode = Pt. Flag

E_{cor} = -320 mV
E_{Pt} = +420 mV

No pits observed - yellow film on surface

E_{rp} = 579 mV
E_{pit} = 569 mV

Kimberly Ann Kimura 4/16/97



Model 352/252 Corrosion Analysis Software, v. 2.01
Filename: a:\625cpp4.dat
Pstat: VStat[] Ver 2
CP CYCLIC POLARIZATION — File Status: NORMAL
Date Run: 04-16-97 — Time Run: 10:34:41

Cond. Time	CT	pass	s	Initial Pot.	IP	-0.1000	V oc
Cond. Pot.	CP	pass	V	Vertex 1 Pot.	V1	0.1000	V oc
Initial Delay	ID	20	s	I Threshold	IT	5.000E-3	A/cm^2
				Final Pot.	FP	-0.1000	V oc
Scan Rate	SR	0.1670	mV/s	Curr. Range	CR	Auto	
Scan Incr.	SI	5.000	mV	Step Time	ST	29.93	s
No. of Points	NP	524					
				GI Time Const.	TC	Off	
Line Sync.	LS	yes		IR Mode	IR	none	
Rise Time	RT	high stability		Filter	FL	Off	
Working Elec.	WE	Solid		Ref. Elec.	RE	SCE 0.2415	V
Sample Area	AR	8.000	cm^2	Equiv. Wt.	EW	0.0000	g
Density	DE	8.440	g/ml	Open Circuit	OC	-0.3210	V

Comment: Alloy 625, 4M Cl-, pH=2.5, T=95 C

Kimberly Ann Kimura 4/16/97

Stock Solutions

~~0.1M~~ 1.0M NaOH, 8.02161 gm NaOH + DI water to 200 ml, NaOH lot #883164, prepared 4/15/97, expires 6/15/97
kag 4/15/97

1.0M HCl, 8.34 ml HCl lot # 95615B + DI water to 200 ml prepared 4/15/97, expires 6/15/97

(0.80216 gm)
0.1M NaOH, 20 ml 1.0M NaOH Stock sol'n as described above + DI water to 200 ml prep. 4/15/97, expires 6/15/97

0.1M HCl, 10 ml 1.0M HCl Stock Sol'n as described above + DI water to 100 ml prep. 4/15/97, expires 6/15/97

(0.08021 gm)
0.01M NaOH, 10 ml 0.1M NaOH Stock Sol'n as described above + DI water to 100 ml prep. 4/15/97, expires 6/15/97

0.01 HCl, 10 ml 0.1M HCl Stock Sol'n as described above + DI water to 100 ml prep 4/15/97, expires 6/15/97

Kimberly Ann Gross 4/16/97

CPP of 304

Objective: to measure E_{rp} + E_{pit} to check out the system

Specimen: 304, Ht # T0954, $\rho = 7.94$ gm/ml
0.251" × 1.912" long
220 grit finish, exposed area
Start wt = 11.32539 gm
End wt = 11.29975 gm

Solution: 1000 ppm Cl^-, 85 ppm HCO_3^-, 20 ppm SO_4^-, 10 ppm NO_3^-, 2 ppm F^-, 2000 ml solution from p.5
T = 95°C, Hg thermometer 18330,
Start pH = 8.278
End pH = 9.688

Potentiostat: EG+G Versastat S/N 20104 w/ Model 352C Software

Reference Electrode: Fisher SCE #13-620-51 S/N 3106339

Counter Electrode: Pt. Flag

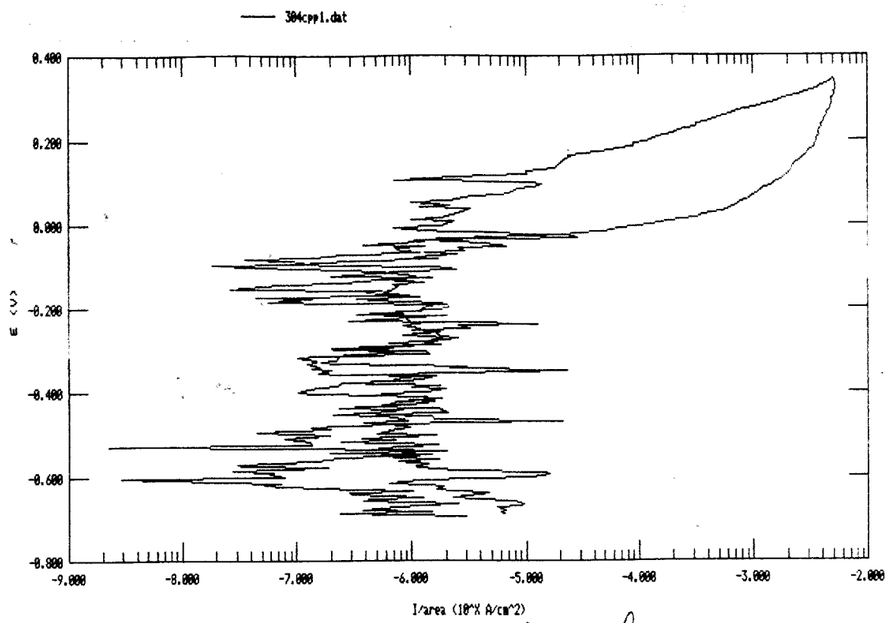
$E_{corr} = -591$ mV
$E_{Pt} = +80$ mV

Test Started 4/16/97

$E_{pit} = 107$ mV
$E_{rp} = -33$ mV

Many, many pits!

Kimberly Ann Gross 4/16/97



Kimberly Ann Omsa 4/16/97

Model 352/252 Corrosion Analysis Software, v. 2.01
Filename: a:\304cpp1.dat
Pstat: VStat1 Ver 2
CP CYCLIC POLARIZATION
Date Run: 04-16-97

File Status: NORMAL
Time Run: 05:11:35

Cond. Time	CT	pass	s	Initial Pot.	IP	-0.1000	V oc
Cond. Pot.	CP	pass	V	Vertex 1 Pot.	V1	0.1000	V oc
Initial Delay	ID	20	s	I Threshold	IT	5.000E-3	A/cm^2
				Final Pot.	FP	-0.1000	V oc
Scan Rate	SR	0.1670	mV/s	Curr. Range	CR	Auto	
Scan Incr.	SI	5.000	mV	Step Time	ST	29.93	s
No. of Points	NP	414					
				GI Time Const.	TC	Off	
Line Sync.	LS	yes		IR Mode	IR	none	
Rise Time	RT	high stability		Filter	FL	Off	
Working Elec.	WE	Solid		Ref. Elec.	RE	SCE 0.2415	V
Sample Area	AR	8.000	cm^2	Equiv. Wt.	EW	0.0000	g
Density	DE	7.940	g/ml	Open Circuit	OC	-0.5930	V

Comment: 304, 1000 ppm Cl-, 95 C

Kimberly Ann Omsa 4/16/97

Kimberly Ann Omsa 4/16/97

CPP of 625 w/ a crevice, 4 M Cl^-, 2.5 pH, 95°C

625cpp5.dat

Objective: Measure E_{pit} + E_{rp} with a crevice corrosion geometry

Specimen: Alloy 625, Ht # NX9936AG, ρ = 8.44 gm/ml
Specimen dimensions - See dwg. on page 24
600 grit finish, exposed area 20 cm^2
Start wt = 31.195386 gm
End wt = 31.091686

Solution: 4 M Cl^- as NaCl lot # 960780 (233.72479 gm)
20 ppm $SO_4^=$, 20 ml $SO_4^=$ - 4/97 Stock Sol'n, NB 157, p.161
10 ppm NO_3^-, 10 ml NO_3^- - 4/97 Stock Sol'n, NB 157, p.161
2 ppm F^-, 2 ml F^- - 4/97 Stock Sol'n, NB 157, p.161
5.5 ml 0.1 M HCl Stock Sol'n, NB 218, p.20
+ DI water to 1000 ml, Deaerated w/ N_2 (99.999%)

T = 95°C, Hg Thermometer, 183301
Start pH = 2.499
End pH = 7.463

Potentiostat: EG+G Versastat S/N 20104 w/ Model 352C Software

Ref. Electrode: Fisher SCE #13-620-51 S/N 3106339

Counter Electrode - Pt Flag

E_{cor} = -320 mV
E_{pt} = +462 mV

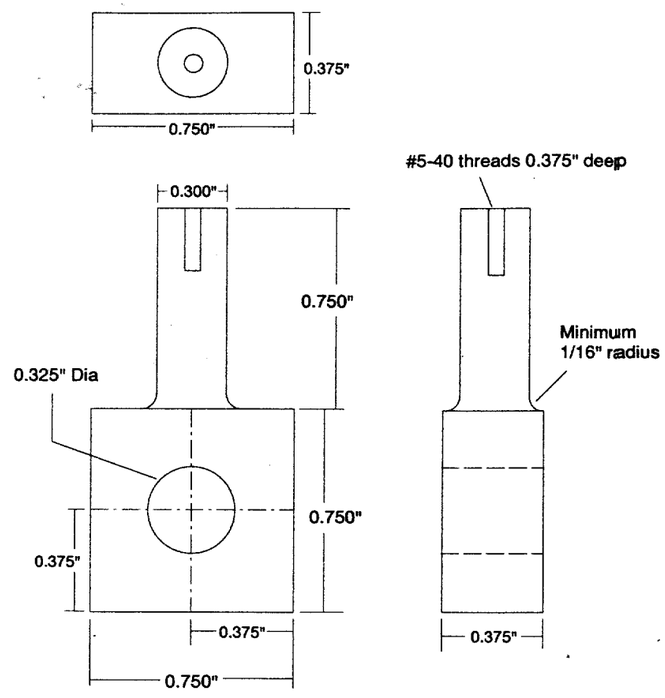
Test Started 4/16/97

E_{pit} = 177 mV
E_{rp} = -253 mV

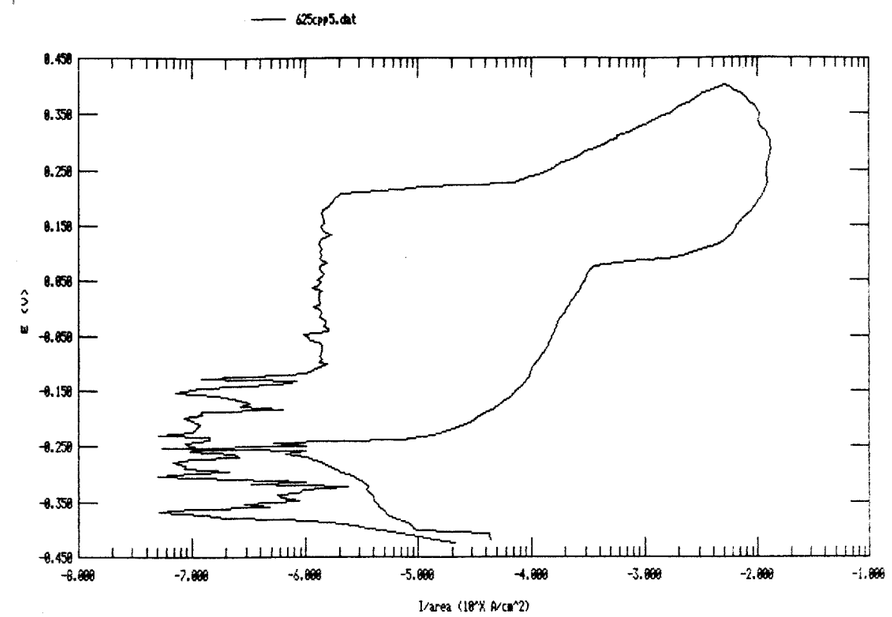
Large, fairly deep pits observed w/ black corr. product in + around pit.

Kimberly Ann Omsa 4/20/97

CREVICE REPASSIVATION SPECIMEN
All Dimensions +/- 0.003"



Kimberly Ann Bruce 4/20/97



Model 352/252 Corrosion Analysis Software, v. 2.01
Filename: a:\625cpp5.dat
Pstat: VStat[] Ver 2
CP CYCLIC POLARIZATION — File Status: NORMAL
Date Run: 04-17-97 — Time Run: 10:07:00

Cond. Time	CT	pass	s	Initial Pot.	IP	-0.1000	V oc
Cond. Pot.	CP	pass	V	Vertex 1 Pot.	V1	0.1000	V oc
Initial Delay	ID	20	s	I Threshold	IT	5.000E-3	A/cm^2
				Final Pot.	FP	-0.1000	V oc
Scan Rate	SR	0.1671	mV/s	Curr. Range	CR	Auto	
Scan Incr.	SI	5.000	mV	Step Time	ST	29.92	s
No. of Points	NP	330					
				GI Time Const.	TC	Off	
Line Sync.	LS	yes		IR Mode	IR	none	
Rise Time	RT	high stability		Filter	FL	Off	
Working Elec.	WE	Solid		Ref. Elec.	RE	SCE 0.2415	V
Sample Area	AR	20.00	cm^2	Equiv. Wt.	EW	0.0000	g
Density	DE	8.440	g/ml	Open Circuit	OC	-0.3230	V

Kimberly Ann Bruce 4/20/97

CPP of C-22 w/ a crevice, 4M Cl^-, pH=2.5, T=95°C

C22cpp1.dat

Objective: measure E_{rp} & E_{pit} with a crevice corrosion geometry

Specimen: Alloy C-22, Ht # 2277-8-3175
Specimen Dimensions - see page 24
600 grit finish, exposed area = 20 cm^2
Start wt: 31.59458 gm
End wt. ~~31.67581 gm~~ KCag 4/22/97
31.59100 gm

Solution: 4M Cl^- as NaCl Lot # 960780 (233.77446 gm)
20 ppm $SO_4^=$ - 20 ml $SO_4^=$ - 4/97 Stock Sol'n
10 ppm NO_3^-, 10 ml NO_3^- - 4/97 Stock Sol'n } NB157, p.161
2 ppm F^-, 2 ml F^- - 4/97 Stock Sol'n
5.4 ml 0.1M HCl Stock Sol'n, NB218, p20
+DI water to 1000 ml, Deaerated w/ N_2 (99.999%)

Start pH = 2.514
End pH = 3.555
T=95°C, Hg thermometer, 183304

Potentiostat: EG+G Versastat S/N 20104 w/ Model 352C Software

Ref. Electrode: Fisher SCE #13-620-51 S/N 3106339

Counter Electrode: Pt. Flag

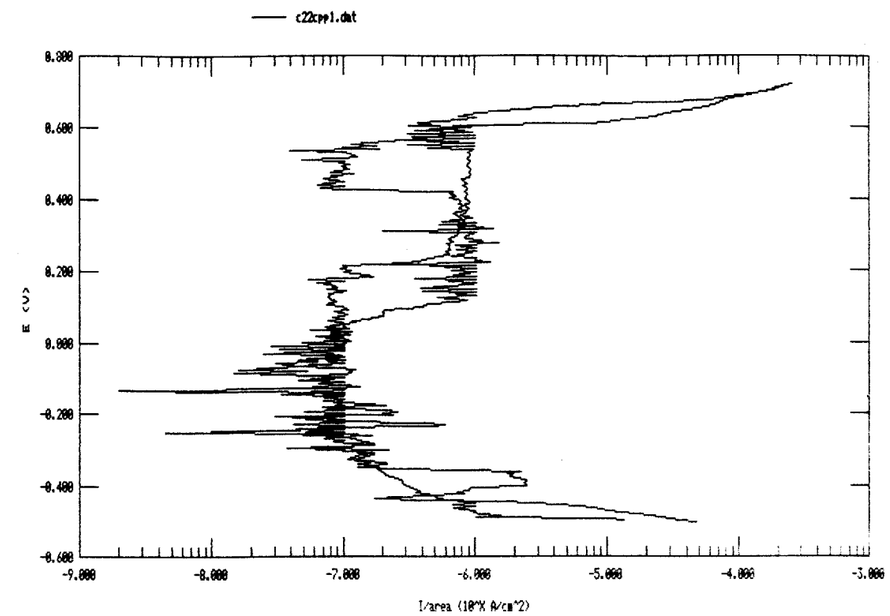
E_{corr} = -267 mV
E_{Pt} = 400 mV

Test started 4/19/97

E_{rp} = 595 mV
E_{pit} = 615 mV

No pits, Yellow-brown surface film.

Kimberly Ann Lynn 4/21/97



Model 352/252 Corrosion Analysis Software, v. 2.01
Filename: a:\c22cpp1.dat
Pstat: VStat[] Ver 2
CP CYCLIC POLARIZATION
Date Run: 04-17-97

File Status: NORMAL
Time Run: 18:11:32

Cond. Time	CT	pass	s	Initial Pot.	IP	-0.1000	V oc
Cond. Pot.	CP	pass	V	Vertex 1 Pot.	V1	0.1000	V oc
Initial Delay	ID	20	s	I Threshold	IT	5.000E-3	A/cm^2
				Final Pot.	FP	-0.1000	V oc
Scan Rate	SR	0.1671	mV/s	Curr. Range	CR	Auto	
Scan Incr.	SI	5.000	mV	Step Time	ST	29.92	s
No. of Points	NP	498					
				GI Time Const.	TC	Off	
Line Sync.	LS	yes		IR Mode	IR	none	
Rise Time	RT	high stability		Filter	FL	Off	
Working Elec.	WE	Solid		Ref. Elec.	RE	SCE 0.2415	V
Sample Area	AR	20.00	cm^2	Equiv. Wt.	EW	0.0000	g
Density	DE	8.690	g/ml	Open Circuit	OC	-0.4050	V

Kimberly Ann Lynn 4/21/97

CPP of Alloy 625, 1M Cl^-, pH=2.5, 95°C – w/ Crevice

625cpp6.dat

Objective: Measure E_{rp} + E_{pit} with a crevice corrosion geometry

Specimen: Alloy 625, Ht # NX9936AG, ρ = 8.44 gm/ml
Specimen Dimensions – See page 24
600 grit finish, exposed area 20 cm^2
Start wt = 31.31584 gm
End wt = 31.30621 gm

Solution: 1M ~~NaCl~~ Cl^- as NaCl lot #960700, ~~58.44221 gm~~ 58.44100 gm
20ppm $SO_4^=$, 20ml $SO_4^=$ 4/97 Stock Sol'n
10ppm NO_3^-, 10 ml NO_3^- 4/97 Stock Sol'n
2ppm F^-, 2ml F^- 4/97 Stock Sol'n
} NB157, p.161 kag 4/19/97
21.5 ml 0.1M HCl Stock Sol'n – NB218, p 20
+ DI water to 1000 mL, Deaerated 99.999% N_2

T=95°C, Hg thermometer, 183301
Start pH = 2.500
End pH = 2.586

Potentiostat = EG+G Versastat S/N 20101 w/ Model 352c Software

Ref. Electrode: Fisher SCE # 13-620-51 S/N 3106339

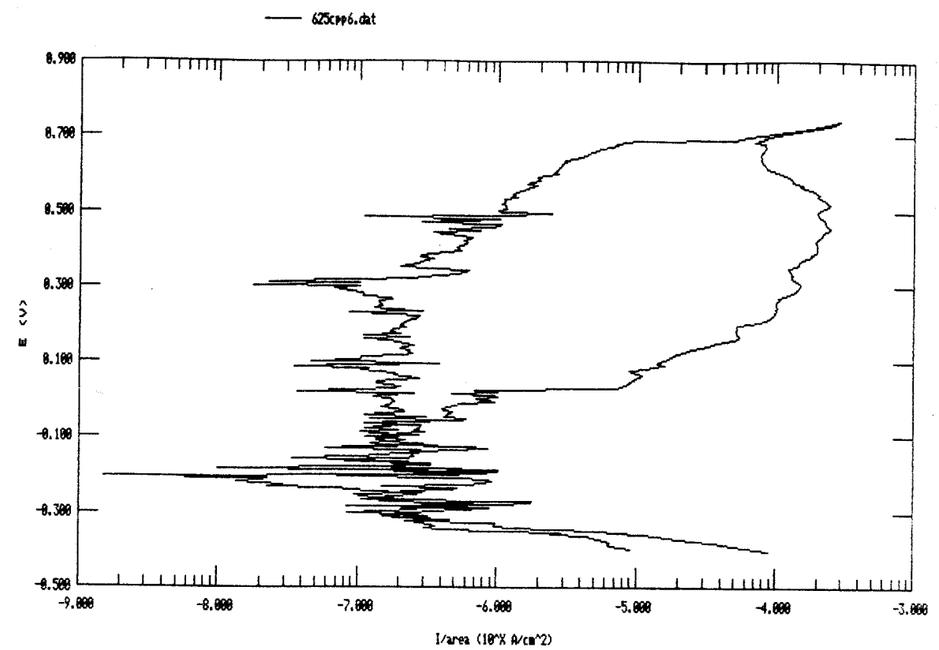
Counter Electrode: Pt. Flag

E_{corr} = -301 mV
E_{pt} = +526 mV

Test Started 4/18/97

E_{pit} = 515 mV
E_{rp} = -60 mV

Kimberly Ann Lyons 4/21/97



Model 352/252 Corrosion Analysis Software, v. 2.01
Filename: a:\625cpp6.dat
Pstat: VStat[] Ver 2
CP CYCLIC POLARIZATION — File Status: NORMAL
Date Run: 04-18-97 — Time Run: 09:47:40

Cond. Time	CT	pass	s	Initial Pot.	IP	-0.1000	V oc
Cond. Pot.	CP	pass	V	Vertex 1 Pot.	V1	0.1000	V oc
Initial Delay	ID	20	s	I Threshold	IT	5.000E-3	A/cm^2
				Final Pot.	FP	-0.1000	V oc
Scan Rate	SR	0.1671	mV/s	Curr. Range	CR	Auto	
Scan Incr.	SI	5.000	mV	Step Time	ST	29.92	s
No. of Points	NP	458					
				GI Time Const.	TC	Off	
Line Sync.	LS	yes		IR Mode	IR	none	
Rise Time	RT	high stability		Filter	FL	Off	
Working Elec.	WE	Solid		Ref. Elec.	RE	SCE 0.2415	V
Sample Area	AR	20.00	cm^2	Equiv. Wt.	EW	0.0000	g
Density	DE	8.440	g/ml	Open Circuit	OC	-0.3050	V

Kimberly Ann Lyons 4/21/97

CPP of Alloy 625, 4M Cl^-, pH ~8.5, 95°C - w/ Crevice

625cpp7.dat

Objectives: Measure E_{pit} + E_{rp} w/ a crevice corrosion geometry

Specimen: Alloy 625, Ht # NX9936AG, ρ = 8.44 gm/~~cm³~~ ml
Specimen Dimensions - see page 24
600 grit finish, exposed area 20 cm²
Start Wt = 31.24796 gm
End Wt = ~~31.25375 gm~~ 31.23832 gm kay 4/22/97

Solution: 4 M Cl^- as NaCl lot # 960780 (233.76329 gm)
20 ppm SO_4^- - SO_4^- - 4/97 Stock Sol'n
10 ppm NO_3^- - NO_3^- - 4/97 Stock Sol'n
2 ppm F^- - F^- - 4/97 Stock Sol'n
} NB157, p. 161
85 ppm HCO_3^- as ~~$NaHCO_3$~~ 20 6/9/97 lot # 923337A (0.11685 gm)
+ DI water to 1000 ml, Deaerated w/ 99.999% N_2
85 ppm HCO_3^- added as $NaHCO_3$ DD 6/9/97
T = 95°C, Hg Thermometer 183304
Start pH = 7.529
End pH = 8.728

Potentiostat = EG+G Versastat S/N 20104 w/ Model 352C Software

Ref. Electrode = Fisher SCE #13-601-51 S/N 3106339

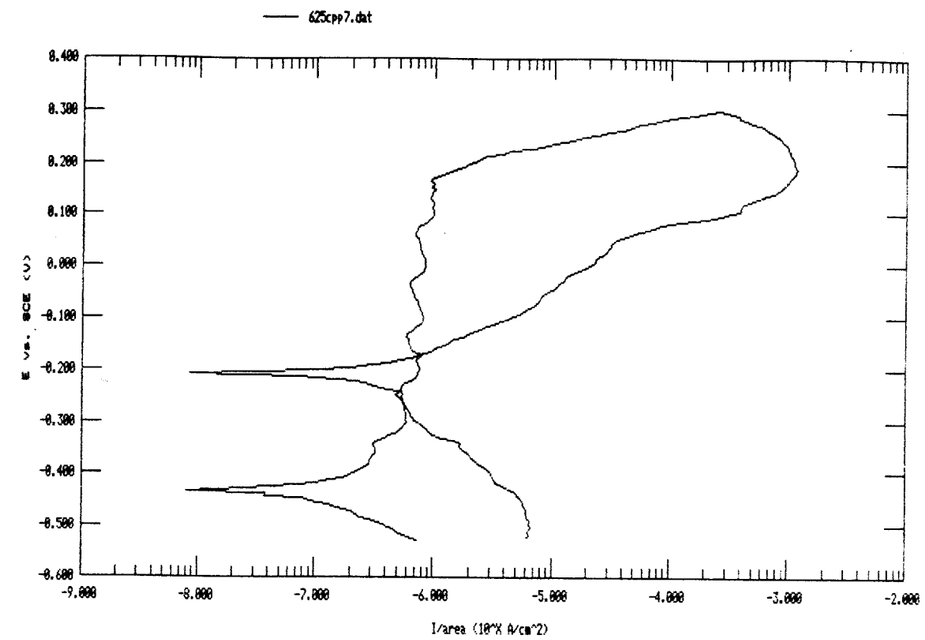
Counter Electrode = Pt. Flag

E_{corr} = -431 mV
E_{pt} = -371 mV

Test Date: 4/18/97

E_{pit} = 168 mV
E_{rp} = -177 mV

Kimberly Ann Bruner 4/21/97



Model 352/252 Corrosion Analysis Software, v. 2.01
Filename: A:\625cpp7.dat
Pstat: VStat[] Ver 2
CP CYCLIC POLARIZATION — File Status: NORMAL
Date Run: 04-18-97 — Time Run: 14:46:32

Cond. Time	CT	pass	s	Initial Pot.	IP	-0.1000	V oc
Cond. Pot.	CP	pass	V	Vertex 1 Pot.	V1	0.1000	V oc
Initial Delay	ID	20	s	I Threshold	IT	5.000E-3	A/cm^2
				Final Pot.	FP	-0.1000	V oc
Scan Rate	SR	0.1671	mV/s	Curr. Range	CR	Auto	
Scan Incr.	SI	5.000	mV	Step Time	ST	29.92	s
No. of Points	NP	332					
				GI Time Const.	TC	Off	
Line Sync.	LS	yes		IR Mode	IR	none	
Rise Time	RT	high stability		Filter	FL	I 5.3Hz	
Working Elec.	WE	Solid		Ref. Elec.	RE	SCE 0.2415	V
Sample Area	AR	20.00	cm^2	Equiv. Wt.	EW	0.0000	g
Density	DE	8.440	g/ml	Open Circuit	OC	-0.4270	V

Kimberly Ann Bruner 4/21/97

CPP of Alloy 625, 1000 ppm Cl^-, 95°C - w/Crevice

625cpp8.dat

Objectives: Measure E_{pit} + E_{rp} w/ a crevice corrosion geometry

Specimen: Alloy 625. Ht# NX9936AG, ρ = 8.44 gm/ml
Specimen Dimensions - see page 24
600 grit finish, exposed area 20 cm^2
Start wt = 30.79735 gm
End wt. = 31.16451 gm

Solution: 1000 ppm Cl^- as NaCl lot # 9160780 (1.64961 gm)
20 ppm SO_4^{2-} as SO_4^{2-} - 4/97 Stock Sol'n
10 ppm NO_3^- - NO_3^- - 4/97 Stock Sol'n } NB 157, p. 161
2 ppm F^- - F^- - 4/97 Stock Sol'n
85 ppm HCO_3^- as ~~Na_2CO_3~~ $NaHCO_3$ lot # 923337A (0.11866 gm)
+ DI water to 1000 ml, Dearated w/ 99.999% N_2
85 PPM HCO_3^- ADDED AS $NaHCO_3$ 6/9/97
T = 95°C, Hg thermometer, 183304
Start pH = 8.181
End pH = 9.410

Potentiostat: EG&G Versastat S/N 20104 w/ Model 352C Software

Ref. Electrode: Fisher SCE #13-601-51 S/N 3106339

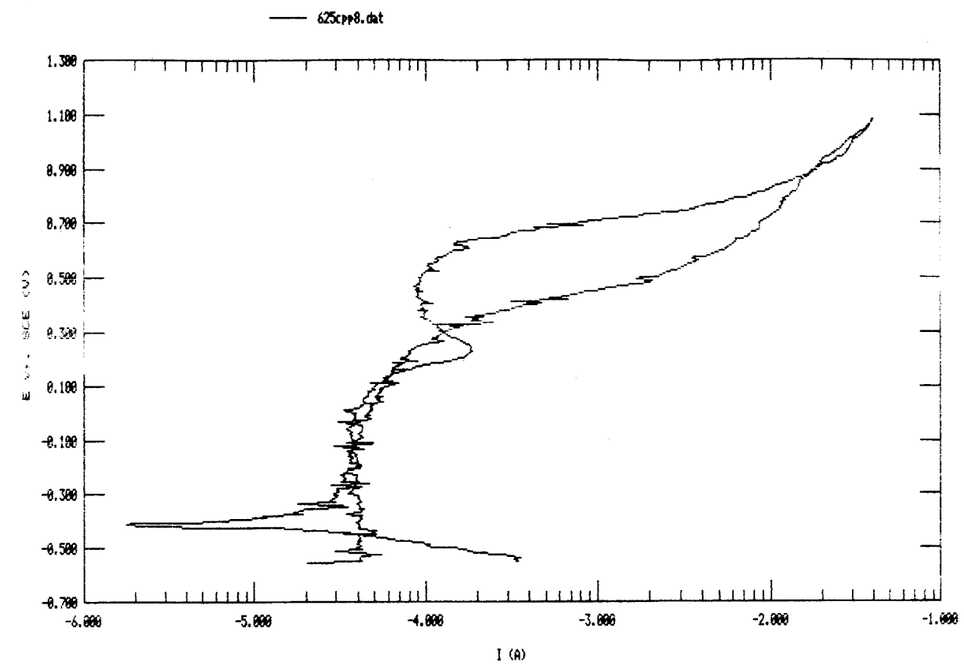
Counter Electrode: Pt flag

E_{corr} = -456 mV
E_{pt} = -390 mV

Test Date 4/22/97

E_{pit} = 509 mV
E_{rp} = 299 mV

Kimberly Ann Lynch 4/22/97



Model 352/252 Corrosion Analysis Software, v. 2.01
Filename: a:\625cpp8.dat
Pstat: VStat[] Ver 2
CP CYCLIC POLARIZATION
Date Run: 04-21-97

File Status: NORMAL
Time Run: 16:01:36

Cond. Time	CT	pass	s	Initial Pot.	IP	-0.1000	V oc
Cond. Pot.	CP	pass	V	Vertex 1 Pot.	V1	0.1000	V oc
Initial Delay	ID	10	s	I Threshold	IT	40.00E-3	A
				Final Pot.	FP	-0.1000	V oc
Scan Rate	SR	0.1670	mV/s	Curr. Range	CR	Auto	
Scan Incr.	SI	5.000	mV	Step Time	ST	29.93	s
No. of Points	NP	654					
				GI Time Const.	TC	Off	
Line Sync.	LS	yes		IR Mode	IR	none	
Rise Time	RT	high stability		Filter	FL	I 5.3Hz	
Working Elec.	WE	Solid		Ref. Elec.	RE	SCE 0.2415	V
Sample Area	AR	1.000	cm^2	Equiv. Wt.	EW	0.0000	g
Density	DE	8.440	g/ml	Open Circuit	OC	-0.4560	V

Should be 100E-3 A

Kimberly Ann Lynch 4/24/97

CPP of Alloy 625, 1000 ppm Cl^-, pH = 2.5, T = 95°C – w/crevice

625cpp9.dat

Objectives: Measure E_{pit} + E_{rp} w/ a crevice corrosion geometry

Specimen: Alloy 625, HT# NX9936AG, ρ = 8.44 gm/mL
Specimen Dimensions – see page 24
600 grit finish, exposed area 20.0 cm^2
Start wt = 31.19385 gm
End wt = 30.78469 gm

Solution = 1000 ppm Cl^- as NaCl lot #960780 (1.65614 gm)
20 ppm SO_4^- as SO_4^- 4/97 Stock Sol'n
10 ppm NO_3^- as NO_3^- 4/97 Stock Sol'n
2 ppm F^- as F^- 4/97 Stock Sol'n
85 ppm HCO_3^- as $NaHCO_3$ lot #923337A (0.11883 gm)
42.9 mL 0.1M HCl as Stock Sol'n – NB 218 p. 20
+ DI water to 1000 mL, Dearated w/ 99.999% N_2

T = 95°C, Hg thermometer, 1B304
Start pH = 2.500
End pH = 2.745

Potentiostat = EG&G Versastat S/N 20104 w/ Model 352C Software

Ref. Electrode = Fisher SCE # 13-601-51 S/N 3106339

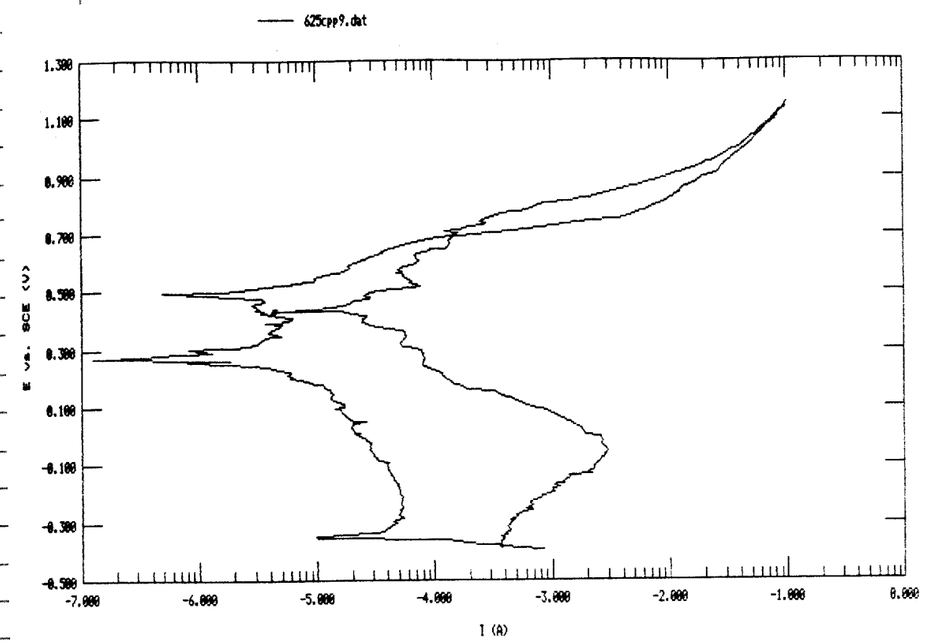
Counter Electrode: Pt. Flag

E_{corr} = -289 mV
E_{pt} = +480 mV

Test Date 4/22/97

E_{pit} = 497 mV
E_{rp} = 692 mV

Kimberly Ann Lunsford 4/24/97



Model 352/252 Corrosion Analysis Software, v. 2.01
Filename: a:\625cpp9.dat
Pstat: VStat[] Ver 2
CP CYCLIC POLARIZATION — File Status: NORMAL
Date Run: 04-22-97 — Time Run: 08:58:54

Cond. Time	CT	pass	s	Initial Pot.	IP	-0.1000	V oc
Cond. Pot.	CP	pass	V	Vertex 1 Pot.	V1	0.1000	V oc
Initial Delay	ID	20	s	I Threshold	IT	0.1000	A
				Final Pot.	FP	-0.1000	V oc
Scan Rate	SR	0.1671	mV/s	Curr. Range	CR	Auto	
Scan Incr.	SI	5.000	mV	Step Time	ST	29.92	s
No. of Points	NP	618					
				GI Time Const.	TC	Off	
Line Sync.	LS	yes		IR Mode	IR	none	
Rise Time	RT	high stability		Filter	FL	I 5.3Hz	
Working Elec.	WE	Solid		Ref. Elec.	RE	SCE 0.2415	V
Sample Area	AR	1.000	cm^2	Equiv. Wt.	EW	0.0000	g
Density	DE	8.440	g/ml	Open Circuit	OC	-0.2570	V

Kimberly Ann Lunsford 4/24/97

CPP of Alloy 625, 1M Cl^-, pH=8.5, T=95°C

625cpp10.dat

Objectives: Measure E_{pit} + E_{rp} w/ a Crevice Corrosion geometry

Specimen: Alloy 625, Ht# NX9936AG, ρ=8.44 gm/ml
Specimen Dimensions - see page 24
600 grit finish, exposed area 20.0 cm^2
Start wt: 31.26404 gm
End wt: 31.19856 gm

Solution: 1M Cl^- as NaCl Lot #960780 (58.4422 gm)
20ppm $SO_4^=$ as $SO_4^=$ - 4/97 Stock Sol'n
10ppm NO_3^- as NO_3^- - 4/97 Stock Sol'n
2ppm F^- as F^- - 4/97 Stock Sol'n
} N.157, p.161
85 ppm HCO_3^- as ~~$NaHCO_3$~~ $NaHCO_3$ Lot #923337A (0.117485 gm)
+ DI water to 1000 ml, Deaerated w/ 99.999% N_2
85 PPM HCO_3^- ADDED AS $NaHCO_3$ 6/9/97
T=95°C, Hg thermometer 183301
Start pH = 7.829
End pH = ~~8.739~~
8.763 tag 4/24/97

Potentiostat: EG+G Versastat S/N 20104 w/ Model 352c Software

Ref. Electrode: Fisher SCE #13-601-51 S/N 3106339

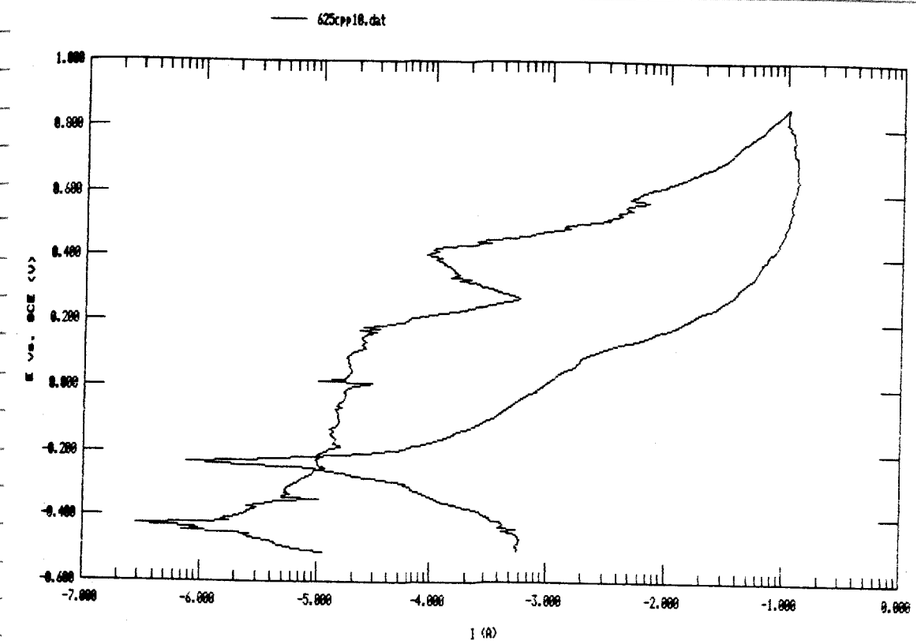
Counter Electrode: Pt. Flag

E_{corr} = -409 mV
E_{pit} = -107 mV

Test Date 4/22/97

E_{pit} = 424 mV
E_{rp} = -216 mV

Kimberly Ann Brown 4/24/97



Model 352/252 Corrosion Analysis Software, v. 2.01
Filename: a:\625cpp10.dat
Pstat: VStat[] Ver 2
CP CYCLIC POLARIZATION
Date Run: 04-22-97

File Status: NORMAL
Time Run: 14:39:28

Cond. Time	CT	pass	s	Initial Pot.	IP	-0.1000	V oc
Cond. Pot.	CP	pass	V	Vertex 1 Pot.	V1	0.1000	V oc
Initial Delay	ID	20	s	I Threshold	IT	0.1000	A
				Final Pot.	FP	-0.1000	V oc
Scan Rate	SR	0.1671	mV/s	Curr. Range	CR	Auto	
Scan Incr.	SI	5.000	mV	Step Time	ST	29.92	s
No. of Points	NP	548					
				GI Time Const.	TC	Off	
Line Sync.	LS	yes		IR Mode	IR	none	
Rise Time	RT	high stability		Filter	FL	I 5.3Hz	
Working Elec.	WE	Solid		Ref. Elec.	RE	SCE 0.2415	V
Sample Area	AR	1.000	cm^2	Equiv. Wt.	EW	0.0000	g
Density	DE	8.440	g/ml	Open Circuit	OC	-0.4110	V

Kimberly Ann Brown 4/24/97

CPP of Alloy 625, 4M Cl^-, pH=7.5, T=95°C

625cpp12.dat

Objective: to measure E_{rp} + E_{pit} w/ a crevice corrosion geometry

Specimen: Alloy 625, Ht# NX9936AG, ρ = 8.44 gm/cm³
Specimen Dimensions - see p. 24
600 grit finish, exposed area 20.0 cm²
Start wt: 31.17334 gm
End wt: 31.11881 gm

Solution: 4M Cl^- as NaCl Lot #960780 (233.76 ~~191~~ 144 gm) kag 4/28/97
20ppm $SO_4^=$ - $SO_4^=$ - 4/97 Stock Sol'n (20 ml)
10ppm NO_3^- as NO_3^- - 4/97 Stock Sol'n (10 ml)
2ppm F^- as F^- - 4/97 Stock Sol'n (2 ml)
} NB157, ~~p.161~~ p.172 kag 4/28/97
+ DI water to 1000 ml, Dearated w/ 99.999% N_2
DD 6/9/97 85 ppm HCO_3^- as ~~$NaCO_3$~~ Lot #923337A (0.~~11840~~ 11797 gm)
T=95°C, Hg thermom 183301
Start pH = ~~8.395~~ 7.592
End pH = ~~9.144~~ 8.543 kag 4/28/97
85 PPM HCO_3 ADDED AS $NaHCO_3$ DD 6/9/97

Potentiostat: EG&G Versastat w/ Model 352C Software

Ref. Electrode: Fisher SCE # 13-601-51 S/N ~~2010~~ 3106339 kag 4/24/97

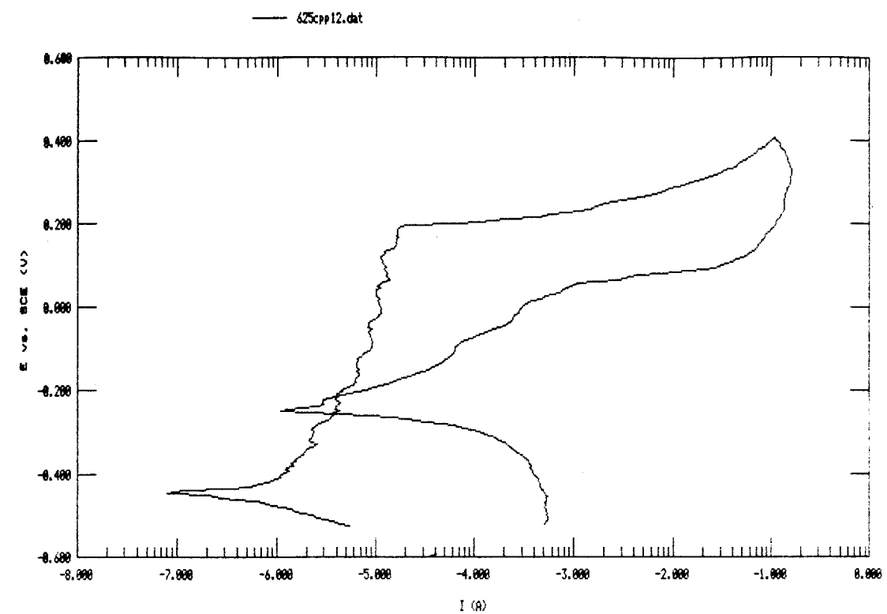
Counter Electrode: Pt. Flag

E_{corr} = ~~-292 mV~~ kag 4/28/97 -427 mV
E_{pt} = ~~-545 mV~~ kag 4/28/97 -219 mV

Test Date = 4/28/97

E_{pit} = 191 mV
E_{rp} = -214 mV

Kimberly Ann Lemon 4/28/97



Model 352/252 Corrosion Analysis Software, v. 2.01
Filename: a:\625cpp12.dat
Pstat: VStat[] Ver 2
CP CYCLIC POLARIZATION — File Status: NORMAL
Date Run: 04-24-97 — Time Run: 14:10:41

Cond. Time	CT	pass	s	Initial Pot.	IP	-0.1000	V oc
Cond. Pot.	CP	pass	V	Vertex 1 Pot.	V1	0.1000	V oc
Initial Delay	ID	20	s	I Threshold	IT	0.1000	A
				Final Pot.	FP	-0.1000	V oc
Scan Rate	SR	0.1671	mV/s	Curr. Range	CR	Auto	
Scan Incr.	SI	5.000	mV	Step Time	ST	29.92	s
No. of Points	NP	372					
				GI Time Const.	TC	Off	
Line Sync.	LS	yes		IR Mode	IR	none	
Rise Time	RT	high stability		Filter	FL	I 5.3Hz	
Working Elec.	WE	Solid		Ref. Elec.	RE	SCE 0.2415	V
Sample Area	AR	1.000	cm^2	Equiv. Wt.	EW	0.0000	g
Density	DE	8.440	g/ml	Open Circuit	OC	-0.4240	V

Comment: Alloy 625, 4 M Cl-, pH=7.5, 95 C

Kimberly Ann Lemon 4/29/97

CPP of Alloy 625, 1M Cl^-, pH=2.5, T=95°C

625cpp11.dat

Objective: to measure E_{pit} + E_{rp} w/ a crevice corrosion geometry

Specimen: Alloy 625, HT# NX9936AG, ρ=8.44 gm/ml
Specimen Dimensions - See p. 24
600 grit finish, exposed area ~~22.0~~ 30.0 cm² kag 4/24/97
Start wt: 31.21035 gm
End wt:

Solution: 1 M Cl^- as NaCl lot #960780 (58.44315 gm)
20 ppm $SO_4^=$ as $SO_4^=$ - 4/97 Stock Sol'n
10 ppm NO_3^- as NO_3^- - 4/97 Stock Sol'n
2 ppm F^- as F^- - 4/97 Stock Sol'n
} NB157, p. 161
+ DI water to 1000 ml, Dearated w/ 99.999% N_2
18.4 ml 0.1 M HCl as Stock Sol'n - NB218 p. 42

T=95°C, Hg thermometer 183304
Start pH = 2.500
End pH = 5.278

Potentiostat: EG+G Versastat w/ Model 352C Software

Ref. Electrode: Fisher SCE # 13-601-51 S/N 3106339

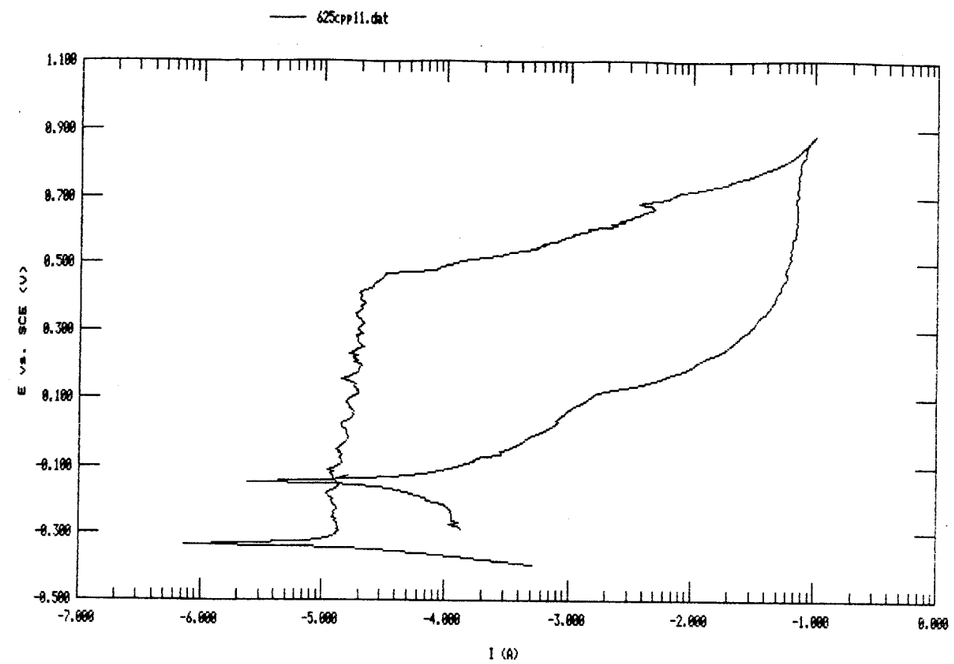
Counter Electrode: Pt. Flag

E_{corr} = -292 mV
E_{pit} = +545 mV

Test Date = 4/29/97

E_{pit} = 413 mV
E_{rp} = -142 mV

Kimberly Ann Gruver 4/29/97



Model 352/252 Corrosion Analysis Software, v. 2.01
Filename: a:\625cpp11.dat
Pstat: VStat[] Ver 2
CP CYCLIC POLARIZATION — File Status: NORMAL
Date Run: 04-24-97 — Time Run: 07:12:04

Cond. Time	CT	pass	s	Initial Pot.	IP	-0.1000	V oc
Cond. Pot.	CP	pass	V	Vertex 1 Pot.	V1	0.1000	V oc
Initial Delay	ID	20	s	I Threshold	IT	0.1000	A
				Final Pot.	FP	0.0000	V oc
Scan Rate	SR	0.1671	mV/s	Curr. Range	CR	Auto	
Scan Incr.	SI	5.000	mV	Step Time	ST	29.92	s
No. of Points	NP	488					
				GI Time Const.	TC	Off	
Line Sync.	LS	yes		IR Mode	IR	none	
Rise Time	RT	high stability		Filter	FL	I 5.3Hz	
Working Elec.	WE	Solid		Ref. Elec.	RE	SCE 0.2415	V
Sample Area	AR	1.000	cm^2	Equiv. Wt.	EW	0.0000	g
Density	DE	8.440	g/ml	Open Circuit	OC	-0.2920	V

Kimberly Ann Gruver 4/29/97

Stock Solutions

0.1 M HCl, 10 mL 1.0 M HCl Stock Sol'n as described on p.20 (NB218) + DI water to 100 mL
prepared 4/24/97, expires 6/24/97

Kimberly Ann Dunn 4/29/97

Lead-in-Pencil of Alloy 625, 4 M Cl^-, pH = 8.5, T = 95°C

625LIP1.dat

Objectives: To measure E_{rp} of a single pit

Specimen: Alloy 625, Ht# NX9936AG, ρ = 8.44 gm/mL
Specimen Dimensions – see p. 46
~~600 grit finish~~ kag 4/29/97
Start wt: 6.29789 gm
End wt: 6.29276 gm

Solution: 4 M Cl^- as NaCl Lot # 960780 (467.51438 gm)
20 ppm SO_4^- as SO_4^- Stock Sol'n
10 ppm NO_3^- as NO_3^- Stock Sol'n } NB157, p. 161
2 ppm F^- as F^- Stock Sol'n
Start pH = 8.637 → + DI water to 2000 mL

4 M Cl^- as NaCl Lot # 960780 (233.76866 gm)
20 ppm SO_4^- as SO_4^- Stock Sol'n
10 ppm NO_3^- as NO_3^- Stock Sol'n } NB157, p.172
2 ppm F^- as F^- Stock Sol'n
+ DI water to 1000 mL
Start pH = 8.271

3 L of sol'n needed for experiment – mixed both solutions
pH = 8.738 for mixed solution

T = 95°C, ~~Hg thermometer~~ Hg Thermometer # 0323008
Deaerated sol'n w/ 99.999% N_2

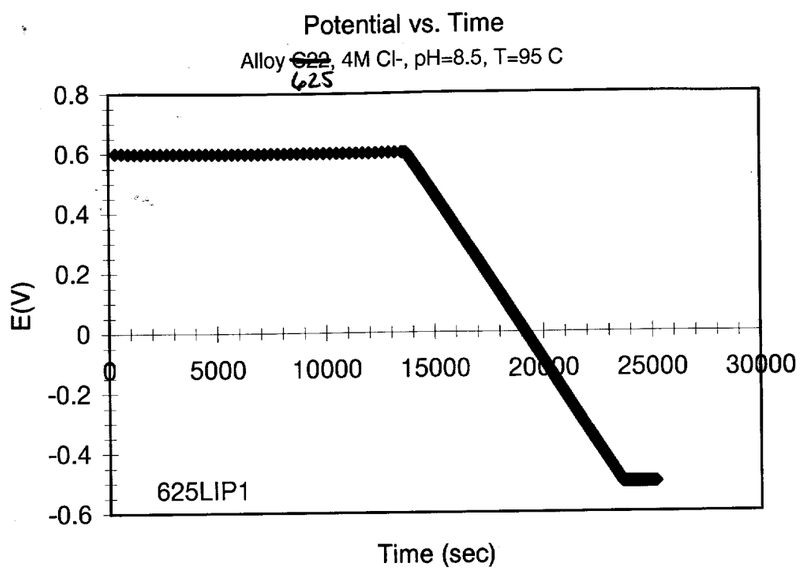
Potentiostat: Pine Model AFRDE5 Bi-Potentiostat S/N 6091
w/ Workbench Software
Ref. Electrode: Fisher SCE # 13-620-51 S/N 5129169

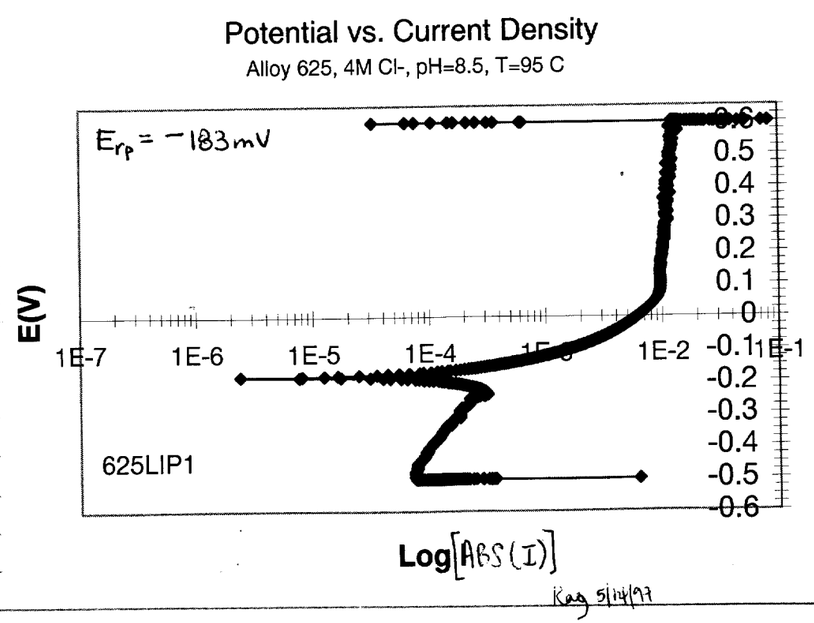
Counter Electrode: Pt. Flag

Kimberly Ann Dunn 4/29/97

E_{corr} = −558 mV
E_{pt} = −322 mV

Specimen appears to be corroded around the sides + at the top of the specimen.





Kimberly Ann Gruss 5/9/97

Reg 5/14/97

Initial Scientific Notebook Entry for Alloy 625 and Alloy C-22 Lead-In-Pencil Tests

Title: Lead-in-pencil tests of Alloy 625 and Alloy C-22

Tests Performed by: Kimberly Ann Gruss (NRC)

Objective: To measure the repassivation potential of a single corroding pit.

Equipment: Pine Model AFRDE5 Bi-Potentiostat S/N 6091 with Workbench Software; Keithley Electrometer model 617 S/N 0579628, or equivalent; right cylindrical polarization cell meeting the requirements of TOP-008; and, Austin 386-SX computer.

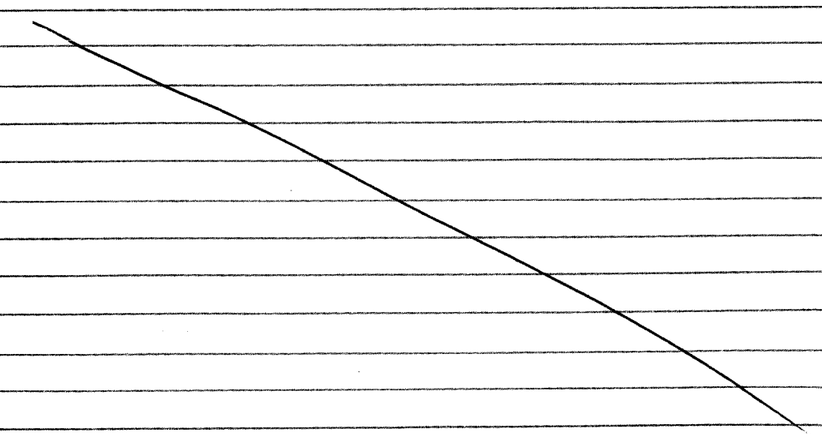
Materials: Alloy 625 and Alloy C-22

Specimen Specifications: Dimensions and geometry of specimens are illustrated on p. 46. Specimens to be weighed before and after exposure.

Measurement Parameters: As described in TOP-008.

Required Level of Accuracy: Potentials +/- 5 mV.

Uncertainty and Sources of Error: Measurement of the pit depth. Level of accuracy in depth is estimated to be +/- 0.5 mm.

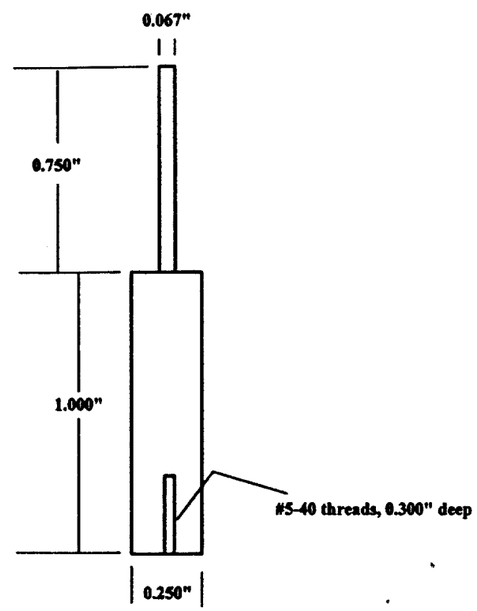


Kimberly Ann Gruss 5/5/97

Darrell S. Dunn
SwRI-CNWRA
BLDG 57
Ext 6090

Lead in pencil specimen

All dimensions +/- 0.001"



Machine perpendicular to rolling direction

Kimberly Ann Gmez 5/7/97

Lead-in-Pencil of Alloy 625, 4 MCl⁻, pH=8.5, T=95°C

625lip1b.dat

Objectives: to measure E_{rp} of a single pit + reproduce E_{rp} from experiment on p. 43

Specimen: Alloy 625, Ht# NX9936AG, ρ = 8.44 gm/ml
Specimen Dimensions – see p. 46 (Same specimen used as in experiment on p. 43)
Start wt / End wt – see p. 43

Solution: Same mixture of Solutions as on p. 43

Start pH = 7.819
End pH = 7.683
T=95°C, Hg Thermometer # 0323008
Deaerated sol'n w/ 99.999% N_2

Potentiostat: Pine Model AFRDE5 Bi-Potentiostat S/N 6091 w/ Workbench Software

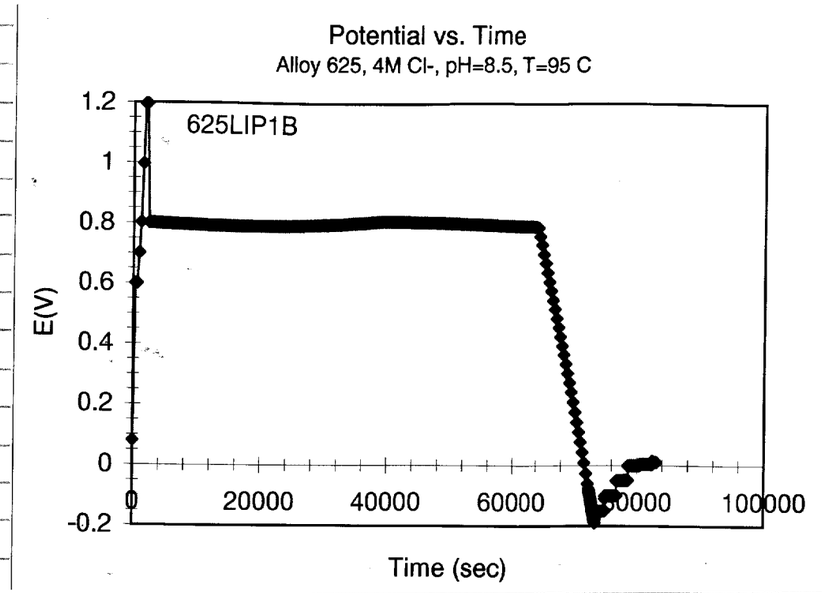
Ref. Electrode: Fisher SCE # 13-620-51 S/N 5129169

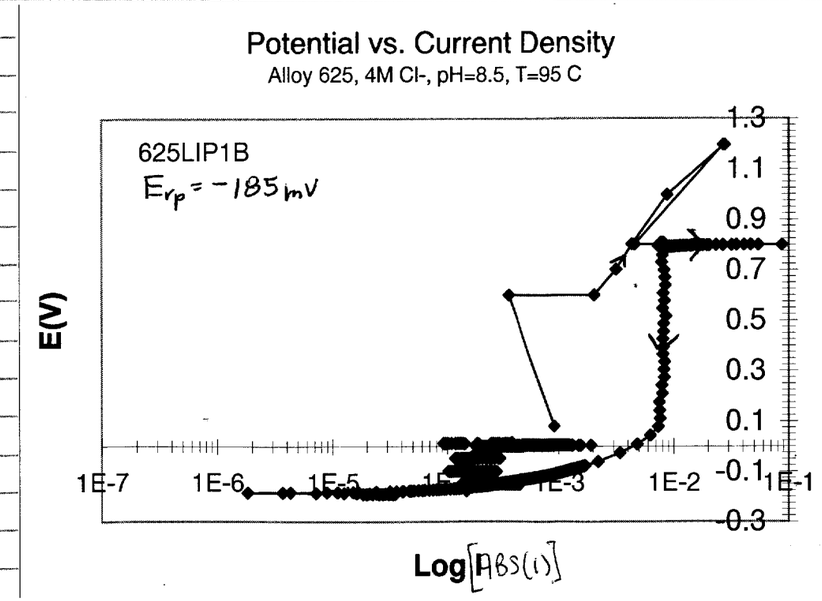
Counter Electrode: Pt. Flag

E_{cor} = −297 mV
E_{pt} = −60 mV

Specimen appears to be corroded around the sides + at the top of thinnest part.

Kimberly Ann Gmez 5/9/97





Kay 5/14/97

Kimberly Ann Gruss 5/9/97

CPP of Alloy 625, 1M Cl^-, pH=8.5, T=95 °C

625cpp13.dat

Objective: to measure E_{pit} + E_{rp} w/ a crevice corrosion geometry

Specimen: Alloy 625, Ht# NX9936AG, ρ = 8.44 gm/ml
Specimen Dimensions - See p. 24
600 grit finish, exposed area 20.0 cm²
Start wt: 31.05119 gm
End wt: 30.93291 gm

Solution: 1 M Cl^- as NaCl Lot # 960780 (116.87894 gm)
40 ml SO_4^+ Stock Sol'n (20 ppm)
20 ml NO_3^- Stock Sol'n (10 ppm) } NB157 p. 172
4 ml F^- Stock Sol'n (2 ppm)
85 ppm HCO_3^- as $NaCO_3$ Lot # (0.11763) gm
+ DI water to 2000 ml, Dearated w/ 99.999% N_2

T=95°C Hg thermometer #, 183301
Start pH = 8.135
End pH = 8.784

Potentiostat: EG+G Versastat w/ Model 352C software

Ref. Electrode: Fisher SCE #13-601-51 S/N 3106339

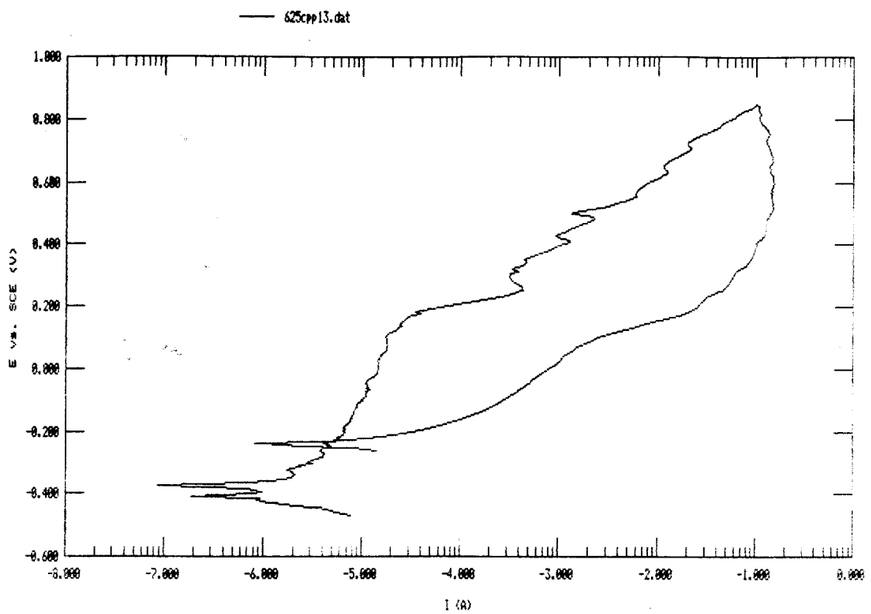
Counter Electrode: Pt Flag

E_{corr} = -359 mV
E_{pt} = -345 mV

Test Date: 4/30/97

E_{pit} = 303 mV
E_{rp} = -232 mV

Kimberly Ann Gruss 5/9/97



Model 352/252 Corrosion Analysis Software, v. 2.01
Filename: a:\625cpp13.dat
Pstat: VStat[] Ver 2
CP CYCLIC POLARIZATION — File Status: NORMAL
Date Run: 04-26-97 — Time Run: 13:44:33

Cond. Time	CT	pass	s	Initial Pot.	IP	-0.1000	V oc
Cond. Pot.	CP	pass	V	Vertex 1 Pot.	V1	0.1000	V oc
Initial Delay	ID	20	s	I Threshold	IT	0.1000	A
				Final Pot.	FP	0.1000	V oc
Scan Rate	SR	0.1671	mV/s	Curr. Range	CR	Auto	
Scan Incr.	SI	5.000	mV	Step Time	ST	29.92	s
No. of Points	NP	486					
				GI Time Const.	TC	Off	
Line Sync.	LS	yes		IR Mode	IR	none	
Rise Time	RT	high stability		Filter	FL	I 5.3Hz	
Working Elec.	WE	Solid		Ref. Elec.	RE	SCE 0.2415	V
Sample Area	AR	1.000	cm^2	Equiv. Wt.	EW	0.0000	g
Density	DE	8.440	g/ml	Open Circuit	OC	-0.3670	V

Kimberly Ann Bruce 5/7/97

CPP of Alloy 625, 1 M Cl^-, pH = 8.5, T = 95°C

625cpp14.dat

Objective: to measure E_{pit} + E_{rp} w/ a crevice corrosion geometry

Specimen: Alloy 625, Ht# NX9936AG, ρ = 8.44 gm/ml
Specimen Dimensions – see p. 24
600 grit finish, exposed area 20.0 cm^2
Start wt: 31.15711 gm
End wt: 31.05026 gm

Solution: 1 M Cl^-, 85 ppm HCO_3^-, 20 ppm SO_4^-, 10 ppm NO_3^-
2 ppm F^-; 2000 ml solution from p. 49
T = 95°C, Hg thermometer 183304
Start pH = 8.214
End pH = 9.091

Potentiostat: EG&G Versastat w/ Model 352C Software

Ref. Electrode: Fisher SCE #13-601-51 S/N 3106339

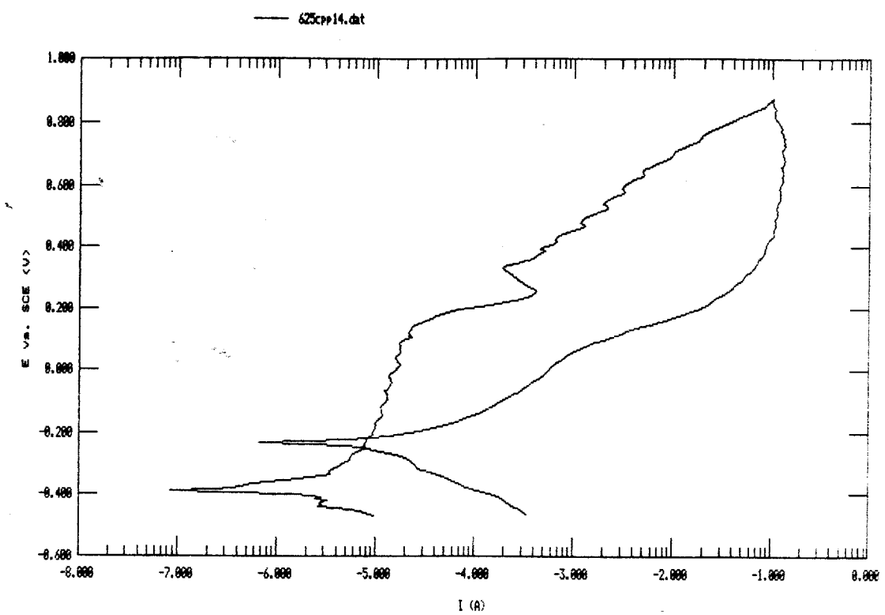
Counter Electrode: Pt. Flag

E_{corr} = −377 mV
E_{pt} = +330 mV

Test Date: 5/1/97

E_{pit} = 331 mV
E_{rp} = −219 mV

Kimberly Ann Bruce 5/9/97



Model 352/252 Corrosion Analysis Software, v. 2.01
Filename: a:\625cpp14.dat
Pstat: VStat[] Ver 2
CP CYCLIC POLARIZATION — File Status: NORMAL
Date Run: 04-27-97 — Time Run: 07:31:49

Cond. Time	CT	pass	s	Initial Pot.	IP	-0.1000	V oc
Cond. Pot.	CP	pass	V	Vertex 1 Pot.	V1	0.1000	V oc
Initial Delay	ID	20	s	I Threshold	IT	0.1000	A
				Final Pot.	FP	-0.1000	V oc
Scan Rate	SR	0.1671	mV/s	Curr. Range	CR	Auto	
Scan Incr.	SI	5.000	mV	Step Time	ST	29.92	s
No. of Points	NP	538					
				GI Time Const.	TC	Off	
Line Sync.	LS	yes		IR Mode	IR	none	
Rise Time	RT	high stability		Filter	FL	I 5.3Hz	
Working Elec.	WE	Solid		Ref. Elec.	RE	SCE 0.2415	V
Sample Area	AR	1.000	cm^2	Equiv. Wt.	EW	0.0000	g
Density	DE	8.440	g/ml	Open Circuit	OC	-0.3698	V

Kimberly Ann Bruno 5/9/97

Lead-in-Pencil of Alloy ~~625~~ C22, 4MCl⁻, pH = 8.5, T = 95°C
Kag 5/6/97

~~625lip~~ C22lip1a.dat
Kag 5/6/97

Objective: to measure E_{rp} of a single pit

Specimen: Alloy C22, ~~Ht# NX9936AG~~ Ht # 2278-8-3175 Kag 5/6/97 ρ = 8.69 gm/ml
Specimen Dimensions – See p. 48
Start wt: 6.32633 gm
End wt: 6.27108 gm

Solution: Same mixture of Solutions as on p. 43

Start pH = 7.683
End pH = 7.595
T = 95°C, Hg Thermometer # 0323008
Dearated Sol'n w/ 99.999% N_2

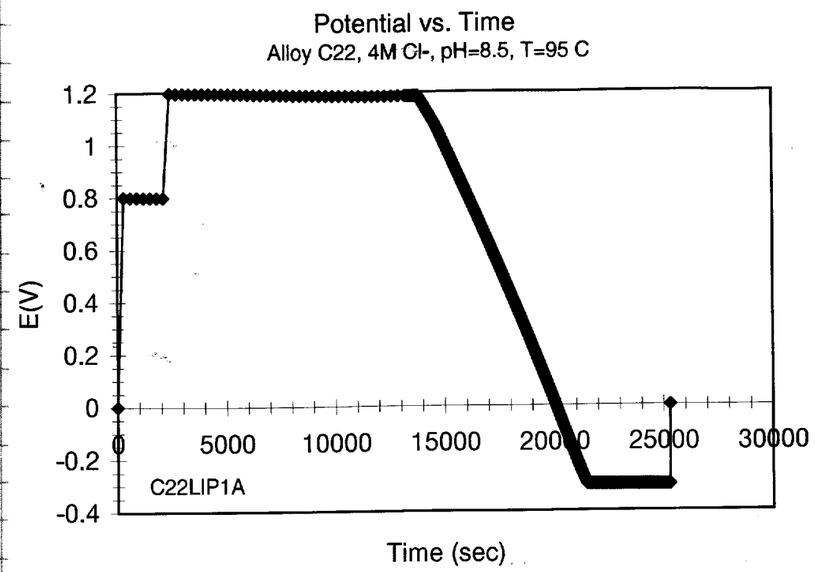
Potentiostat: Pine Model AFRDES Bi-Potentiostat S/N 6091
w/ Workbench Software

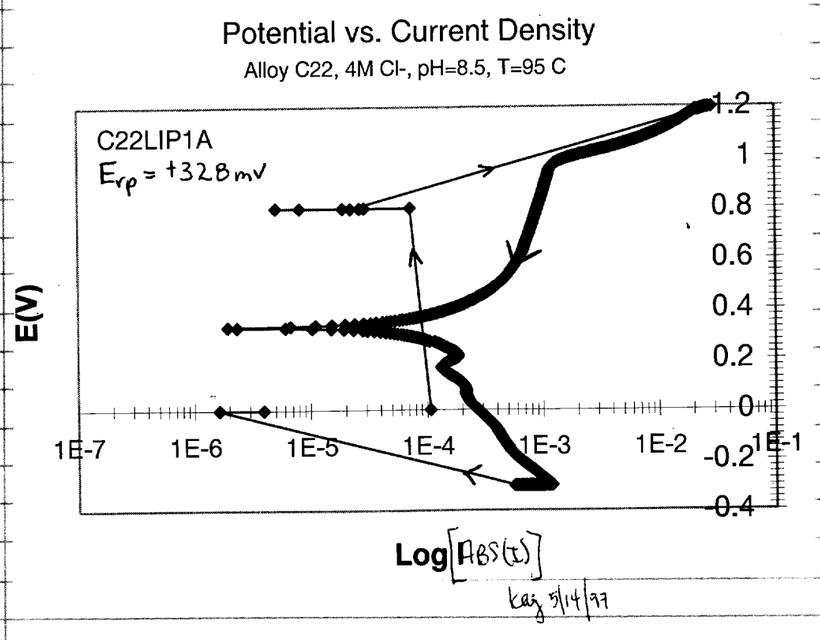
Ref. Electrode: Fisher SCE # 13-620-51 S/N 5129169

Counter Electrode: Pt. Flag

E_{corr} = −497 mV
E_{pt} = −125 mV

Kimberly Ann Bruno 5/9/97





kaz 5/14/97

Kimberly Ann Brown 5/9/97

Lead-in-Pencil of Alloy C22, 4M Cl^-, pH=8.5, T=95°C

C22lip1b.dat

Objective: to measure E_{rp} of a single pit + reproduce E_{rp} from experiment on p. 53

Specimen: Alloy C22, Ht# 2278-8-3175, ρ=8.69 gm/mL
Specimen Dimensions - see p. 53 (same specimen as used for experiment on p. 53)
Start/End wt: see p. 53.

Solution: Same mixture of Solutions as on p. 43

Start pH = 7.595
End pH =
T=95°C, Hg thermometer # 0323008
Dearated Solution w/ 99.999% N_2

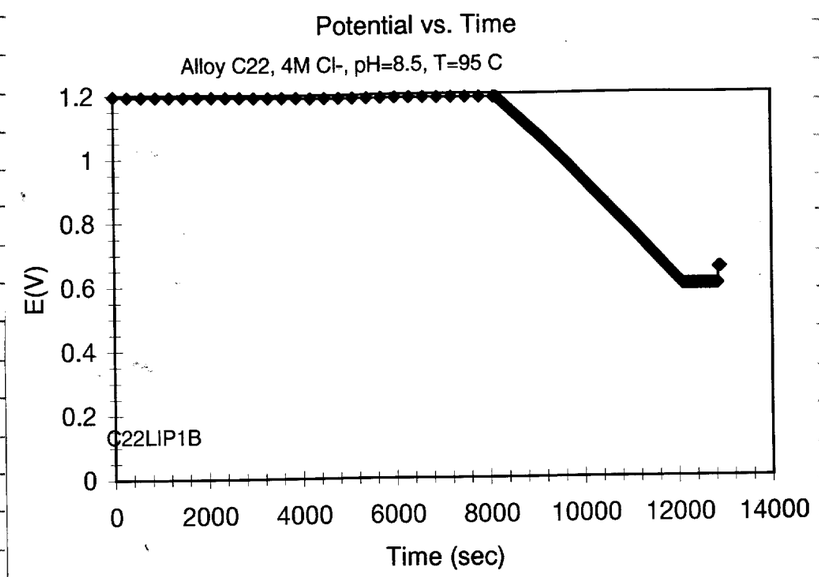
Potentiostat: Pine Model AFRDE5 Bi-Potentiostat S/N 6091 w/ Workbench Software

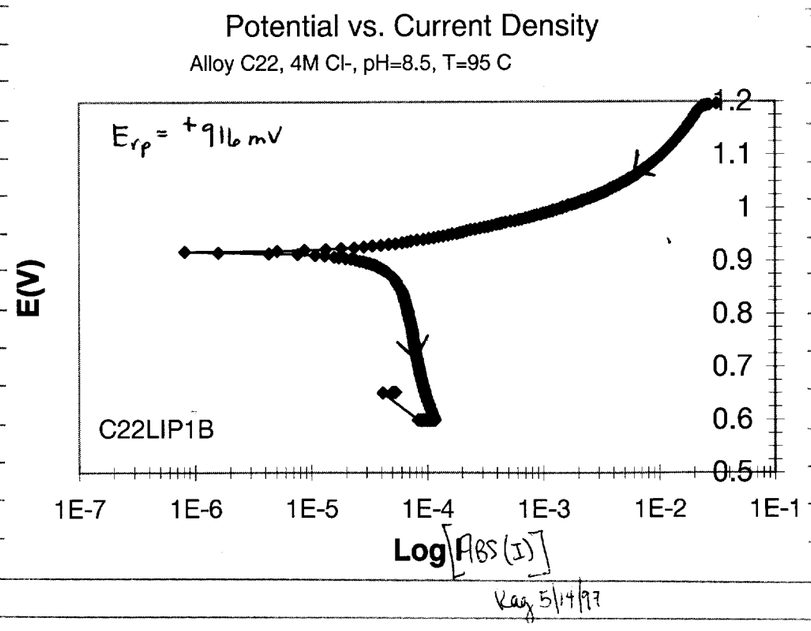
Ref. Electrode: Fisher SCE# 13-620-51 S/N ~~6091~~ 3106339 kaz 5/14/97

Counter Electrode: Pt. Flag

E_{corr} = −292.50 mV
E_{pt} = −118 mV

Kimberly Ann Brown 5/15/97





Kag 5/14/97

Kimberly Ann Gruver 5/15/97

Lead-in-Pencil of Alloy C22, 4MCl⁻, pH=8.5, T=95°C

C22lip1c.dat

Objective: to measure E_{rp} of a single pit + reproduce E_{rp} from experiments on p. 53 + 55

Specimen: Alloy C22, Ht# 2278-8-3175, ρ = 8.69 g/ml
Specimen Dimensions - see p. 53 - same specimen as used for experiments on pg. 53 + 55
Start/End wt: see p. 53

Solution: Same mixture of Solutions as on p. 43

Start pH = Did not record pH at start of test
End pH = 7.413
T=95°C, Hg thermometer # 0323008
Deaerated Sol'n w/ 99.999% N_2

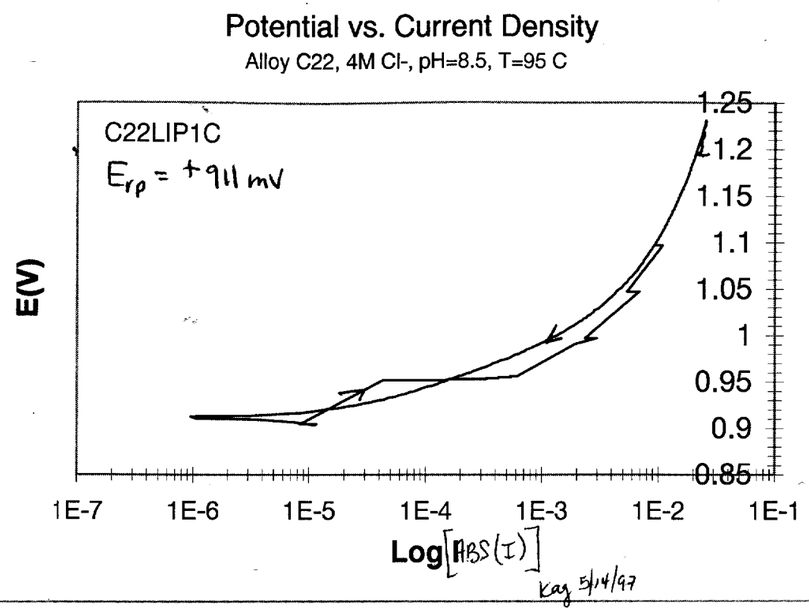
Potentiostat: Pine Model AFRDE5 Bi-Potentiostat S/N 6091 w/ Workbench Software

Ref. Electrode: Fisher SCE # 13-620-51 S/N ~~6091~~ Kag 5/14/97

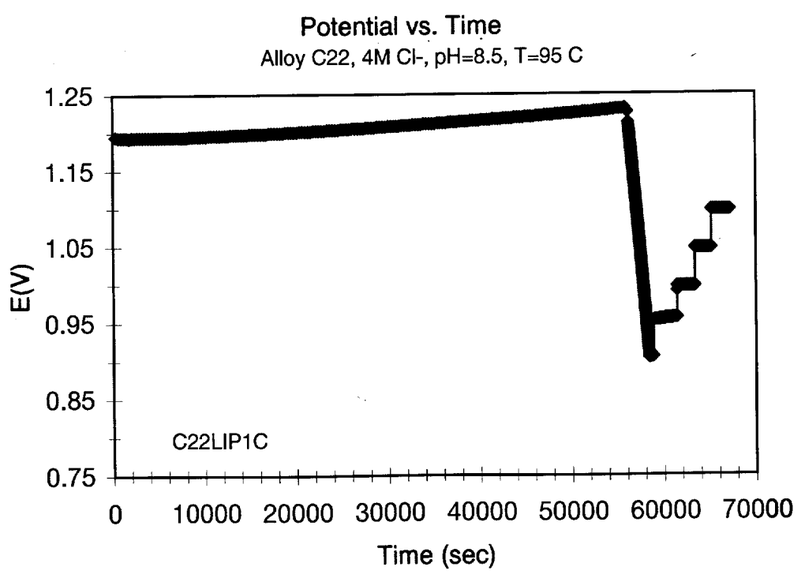
Counter Electrode: Pt. Flag

E_{corr} = +754.6 mV
E_{Pt} = −149.98 mV

Kimberly Ann Gruver 5/15/97



Kag 5/14/97



Kimberly Ann Gruss 5/15/97

Lead-in-Pencil of Alloy 625, 1 M Cl^-, pH = 8.5, T = 95°C

625 ~~Lip~~ 2a.dat
Kag 5/11/97

Objective: to measure E_{rp} of a single pit

Specimen: Alloy 625, Ht# NX9936AG, ρ = 8.44 gm/mℓ
Specimen Dimensions - see p. 46
Start wt: ~~tip~~ 6.32~~633~~713 gm Kag 5/6/97
End wt: 6.30319 gm
Pit depth - Start: 9.0mm End:

Solution: 1 M Cl^- as NaCl Lot # 960780 (116.88371 gm)
40mℓ SO_4^{2-} Stock Sol'n
20mℓ NO_3^- Stock Sol'n
4mℓ F^- Stock Sol'n
} NB 157, p. 172
+ DI water to 2000mℓ
Start pH = 6.194

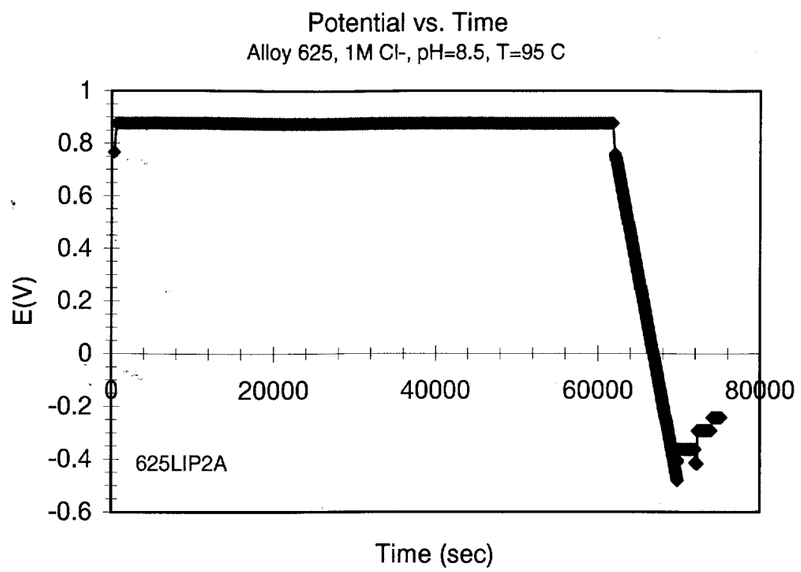
1 M Cl^- as NaCl Lot # 960780 (58.44355 gm)
20mℓ SO_4^- Stock Sol'n
10mℓ NO_3^- Stock Sol'n
2mℓ F^- Stock Sol'n
} NB 157, p. 172
+ DI water to 1000 mℓ
Start pH = 6.313

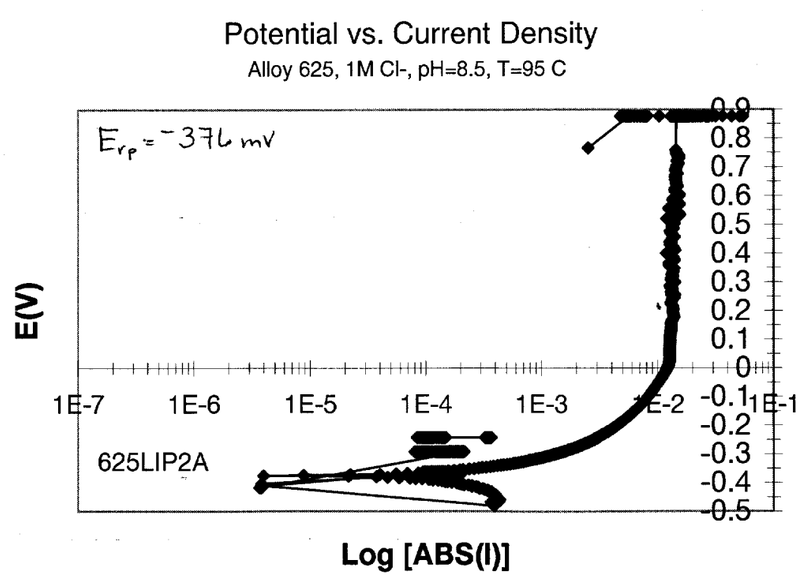
3 L of sol'n needed for experiment - mixed both solutions
Start pH = 6.167 for mixed solutions
End pH = 8.034
T = 95°C, Hg thermometer # 0323008
Dearated sol'n w/ 99.999% N_2

Potentiostat: EG&G Potentiostat Model 273 S/N 41108 w/ Workbench Software
Ref. Electrode: Fisher SCE # 13-601-51 S/N 3106339

Counter Electrode: Pt Flag.

Kimberly Ann Gruss 5/15/97





Kimberly Ann Kruse 5/15/97

Lead-in-Pencil of Alloy C22, 4M Cl⁻, pH=8.5, T=60°C

~~C22lip2b.dat~~ C22lip1d.dat
kag 4/11/97

Objective: to measure E_{rp} of a single pit

Specimen: Alloy C22, Ht# 2278-8-3175, ρ=8.69 gm/ml
Specimen Dimensions - See p. 53 (Same specimen as used for experiment on p. 53
Start wt/End wt: See p. 53

Solution: Same mixture of Solutions as on p. 43

Start pH = 7.413
End pH = 7.263 kag 5/11/97
T=60°C, Hg thermometer #0323008
Dearated Sol'n w/ 99.999% N_2

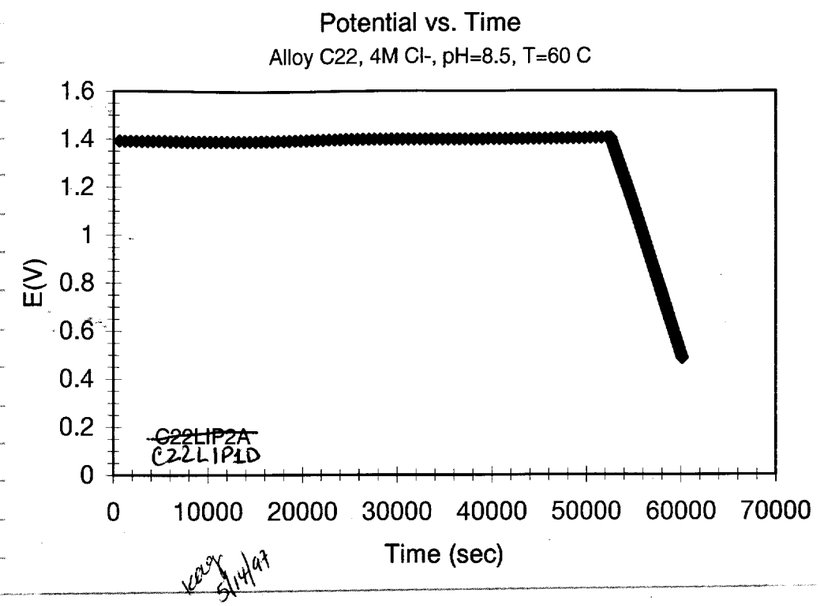
Potentiostat: Pine model AFRDE5 Bi-Potentiostat S/N 6091
w/ Workbench Software

Ref. Electrode: Fisher SCE #13-620-51 S/N ~~6091~~ 3106339
kag 5/11/97

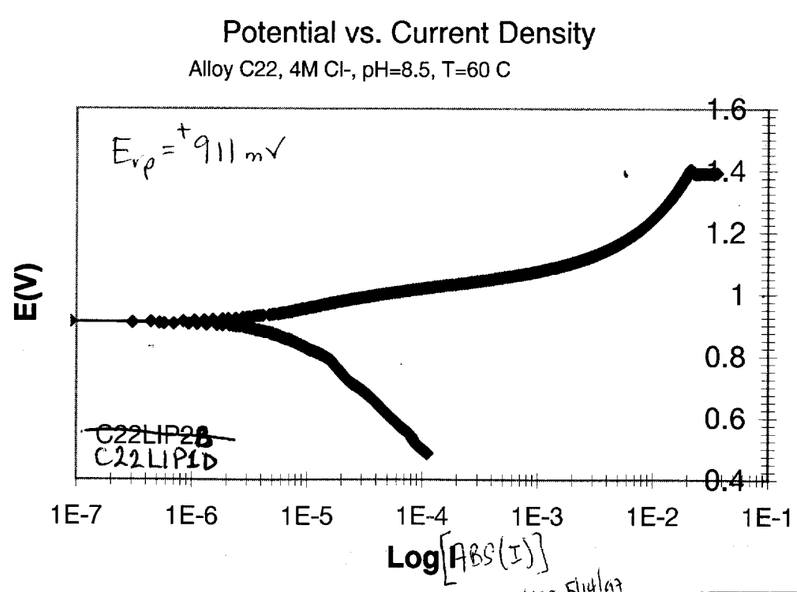
Counter Electrode: Pt. Flag

E_{corr} = +650 mV
E_{pt} = +31 mV

Kimberly Ann Kruse 5/15/97



kag 5/14/97



kag 5/14/97

Kimberly Ann Bruna 5/15/97

CPP of Alloy 625, 0.1 M Cl^-, pH=8.5, T=95°C w/ Crevice geometry

625cpp15.dat

Objective: to measure E_{pit} + E_{rp} w/ a crevice corrosion geometry

Specimen: Alloy 625, Ht.# NX9936AG, ρ = 8.44 g/ml
Specimen Dimensions – see p. 24
600 grit finish – exposed area 20.0 cm^2
Start wt: 31.10867 gm
End wt: 31.06558 gm

Solution: 0.1 M Cl^- as NaCl ~~85 ppm~~ Lot # 960780 (5.84325 gm)
85 ppm HCO_3^- as $NaCO_3$ Lot # 923337A (0.11803 gm)
20 ml $SO_4^=$ Stock Sol'n
10 ml NO_3^- Stock Sol'n } NB157, p. 172
2 ml F^- Stock Sol'n
+ DI water to 1000 ml (kag 5/14/97)
T=95°C, Hg thermometer, 183301
Start pH = 8.207
End pH = 9.246

Potentiostat: EG+G Versastat w/ Model 352C Software

Ref. Electrode: Fisher SCE # 13-601-51 S/N ~~3104339~~ 5144349 kag 5/9/97

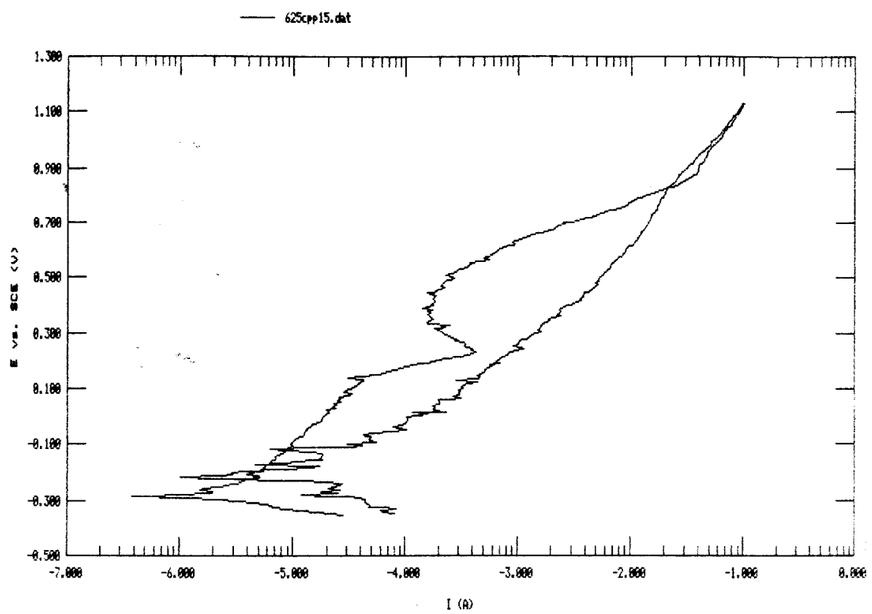
Counter Electrode: Pt Flag

E_{cor} = −247 mV
E_{pt} = +320 mV

Test Date = 5/9/97

$E_{p.t}$ = 403
E_{rp} = −117

Kimberly Ann Bruna 5/15/97



Model 352/252 Corrosion Analysis Software, v. 2.01
Filename: a:\625cpp15.dat
Pstat: VStat[] Ver 2
CP CYCLIC POLARIZATION — File Status: NORMAL
Date Run: 04-30-97 — Time Run: 08:01:21

Cond. Time	CT	pass	s	Initial Pot.	IP	-0.1000	V oc
Cond. Pot.	CP	pass	V	Vertex 1 Pot.	V1	0.1000	V oc
Initial Delay	ID	20	s	I Threshold	IT	0.1000	A
				Final Pot.	FP	-0.1000	V oc
Scan Rate	SR	0.1671	mV/s	Curr. Range	CR	Auto	
Scan Incr.	SI	5.000	mV	Step Time	ST	29.92	s
No. of Points	NP	594					
				GI Time Const.	TC	Off	
Line Sync.	LS	yes		IR Mode	IR	none	
Rise Time	RT	high stability		Filter	FL	I 5.3Hz	
Working Elec.	WE	Solid		Ref. Elec.	RE	SCE 0.2415	V
Sample Area	AR	1.000	cm^2	Equiv. Wt.	EW	0.0000	g
Density	DE	8.440	g/ml	Open Circuit	OC	-0.2520	V

Kimberly Ann Kruse 5/15/97

CPP of Alloy 625 - 0.3 M Cl^-, pH=8.5, T=95°C w/ crevice geometry

625cpp16.dat

Objective: to measure E_{rp} + E_{pit} w/ a crevice corrosion geometry

Specimen: Alloy 625, Ht.# NX9936AG, ρ = 8.44 g/ml
Specimen Dimensions - See p.24
600 grit finish - exposed area 20.0 cm^2
Start wt: 31.11130 gm
End wt: 31.08924 gm

Solution: 0.3 M Cl^- as NaCl lot# 960780 (17.53439 gm)
85 ppm HCO_3^- as $NaCO_3$ lot# 923337A (0.11750 gm)
20 ml SO_4^- Stock Sol'n
10 ml NO_3^- Stock Sol'n } NB 157, p.172
2 ml F^- Stock Sol'n
+ DI water to 1000 ml (kag 5/11/97)
T=95°C, Hg thermometer, 183304
Start pH = 8.187
End pH = 8.956

Potentiostat: EG+G Versastat w/ Model 352C Software

Ref. Electrode: Fisher SCE # 13-601-51 S/N ~~60 3106337~~ 5087374 kag 5/9/97

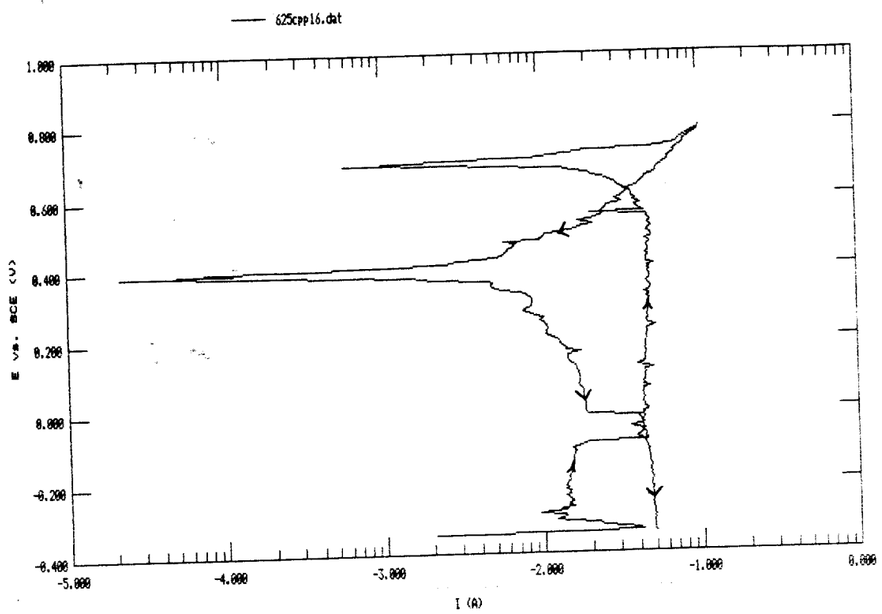
Counter Electrode: Pt. Flag

E_{cor} = -253 mV
E_{pt} = -385 mV

Test Date: 5/9/97

E_{pit} = ?
E_{cor} = ?

Kimberly Ann Kruse 5/15/97



Model 352/252 Corrosion Analysis Software, v. 2.01
Filename: a:\625cpp16.dat
Pstat: VStat[] Ver 2
CP CYCLIC POLARIZATION
Date Run: 04-30-97

File Status: NORMAL
Time Run: 13:30:40

Cond. Time	CT	pass	s	Initial Pot.	IP	-0.1000	V oc
Cond. Pot.	CP	pass	V	Vertex 1 Pot.	V1	0.1000	V oc
Initial Delay	ID	20	s	I Threshold	IT	0.1000	A
				Final Pot.	FP	-0.1000	V oc
Scan Rate	SR	0.1671	mV/s	Curr. Range	CR	Auto	
Scan Incr.	SI	5.000	mV	Step Time	ST	29.92	s
No. of Points	NP	454					
				GI Time Const.	TC	Off	
				IR Mode	IR	none	
Line Sync.	LS	yes		Filter	FL	I 5.3Hz	
Rise Time	RT	high stability		Ref. Elec.	RE	SCE 0.2415	V
Working Elec.	WE	Solid		Equiv. Wt.	EW	0.0000	g
Sample Area	AR	1.000	cm^2	Open Circuit	OC	-0.2480	V
Density	DE	8.440	g/ml				

Kimberly Ann Gruber 5/15/97

Lead-in-Pencil of Alloy C22, 4M Cl⁻, pH=8.5, T=60°

C22lip1e.dat

Objective: Measure E_{rp} of a single pit

Specimen: Alloy C22, Ht# 2278-8-3175, ρ=8.69 gm/mL
Specimen Dimensions - See p. 53 (same specimen as used for experiment on p. 53)
Start / End Wt: See p. 53

Solution: Same Mixture of Solutions as on p. 43

Start pH = 7.263
End pH = 6.697
T=60°C, Hg thermometer # 0323008
Dearated Soln w/ 99.999% N_2

Potentiostat: Pine Model AFRDE5 Bi-Potentiostat S/N 6091 w/ WorkBench Software

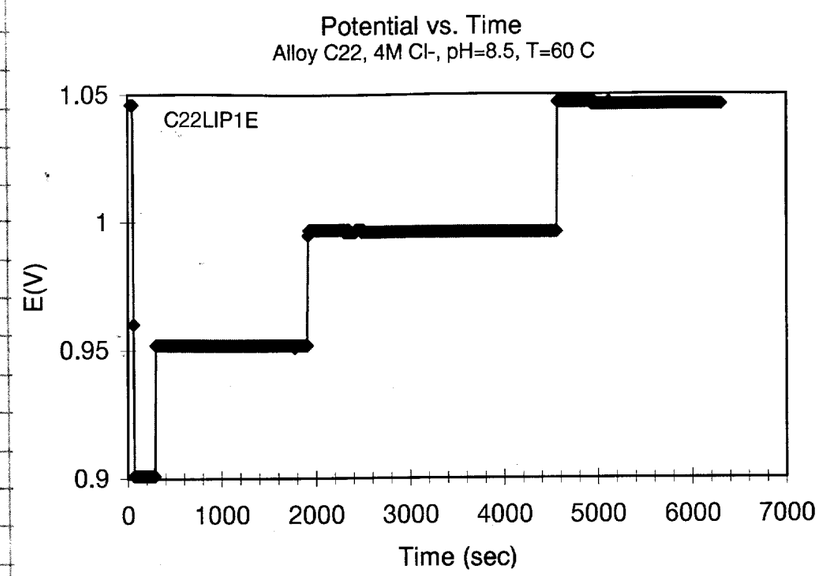
Ref. Electrode: Fisher SCE # 13-620-51 S/N 3106339

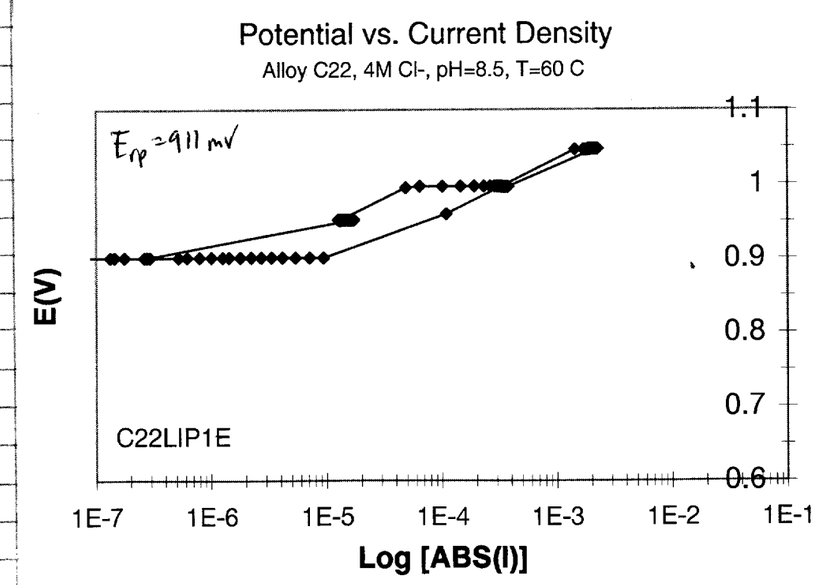
Counter Electrode: Pt Flag

E_{cor} = +6.1 mV
E_{Pt} = +3.1 mV

Note: Data obtained from this experiment is a continuation of the experiment for specimen C22lip1d (on p. 61).

Kimberly Ann Gruber 5/15/97





Kimberly Ann Gunas 5/15/97

Lead-in-Pencil of Alloy 625, 4M Cl^-, pH= 8.5, T= 60 °C

625lip3a.dat

Objective: Measure E_{rp} of a single pit

Specimen: Alloy 625, Ht# Nx 9936AG, ρ = 8.44 gm/ml
Specimen Dimensions - See p. 46
Start wt: 6.39862 gm
End wt: 6.39642 gm

Solution: 4M Cl^-, 60ml SO_4^- Stock Sol'n, 30ml NO_3^- Stock Soln, 6ml F^- Stock Sol'n + DI water to 3000 ml as described on p. ~~59.~~ 43
Key 5/11/97

Start pH = 6.697
End pH = 7.214
T= 60°C, Hg Thermometer #183305
Dearated Sol'n w/ 99.997% N_2

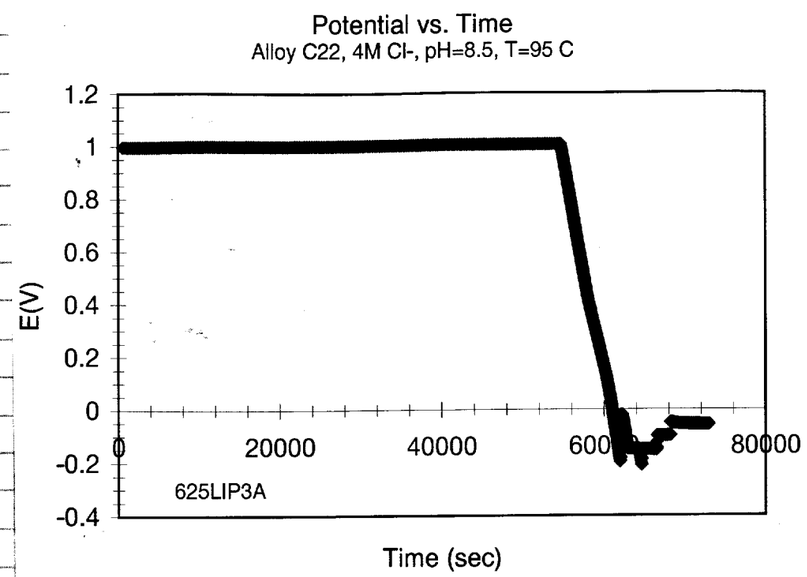
Potentiostat: Pine Model AFRDE5 Bi-Potentiostat S/N 6091 w/ Work Bench Software

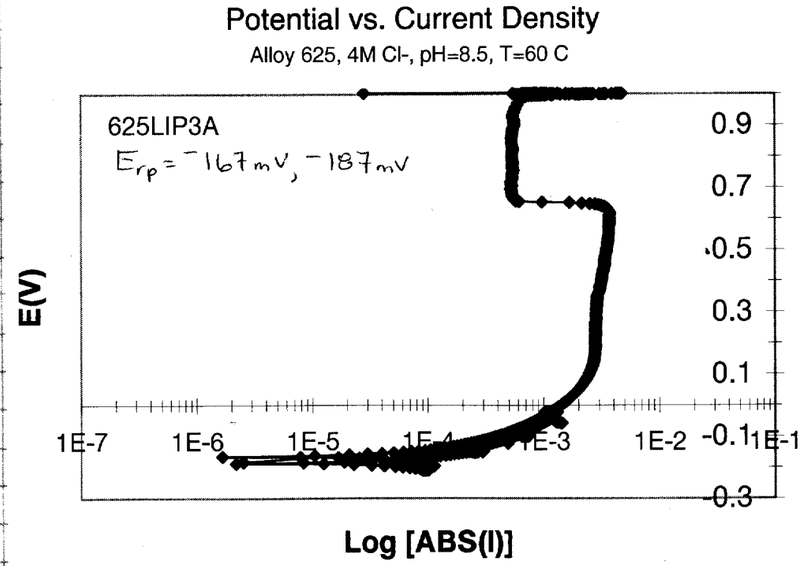
Ref. Electrode: Fisher SCE # 13-620-51 S/N 3106345

Counter Electrode: Pt. Flag

E_{corr} = -195 mV
E_{pt} = ~~+137 mV~~ -35 mV

Kimberly Ann Gunas 5/15/97





Kimberly Ann Dunn 5/15/97

Lead-in-Pencil of Alloy 625, 1M Cl⁻, pH=8.5, T=60°C

625lip4.dat

Objective: Measure Erp of a single pit

Specimen: Alloy 625, Ht# NX9936AG, ρ = 8.44 gm/ml
Specimen Dimensions - See p. 46
Start wt: 6.36158 gm
End wt: 6.36005 gm

Solution: 4M Cl⁻, 20ppm $SO_4^{=}$, 10ppm NO_3^-, 2ppm F^-, 3000 ml
Solution from p. 59

Start pH = 8.034
End pH = 7.703
T = 60°C, Hg thermometer # 183305
Dearated Sol'n w/ 99.999% N_2

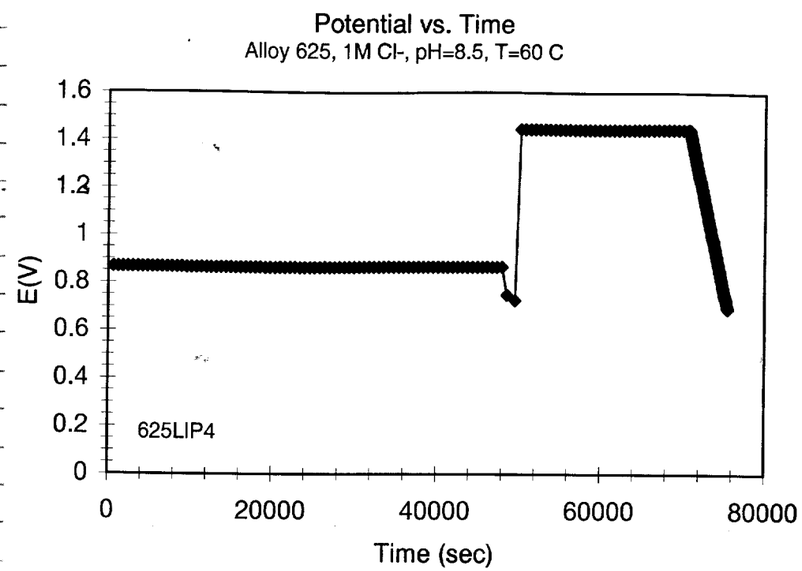
Potentiostat: EG+G Potentiostat Model 273 S/N 4110B w/ Workbench Software

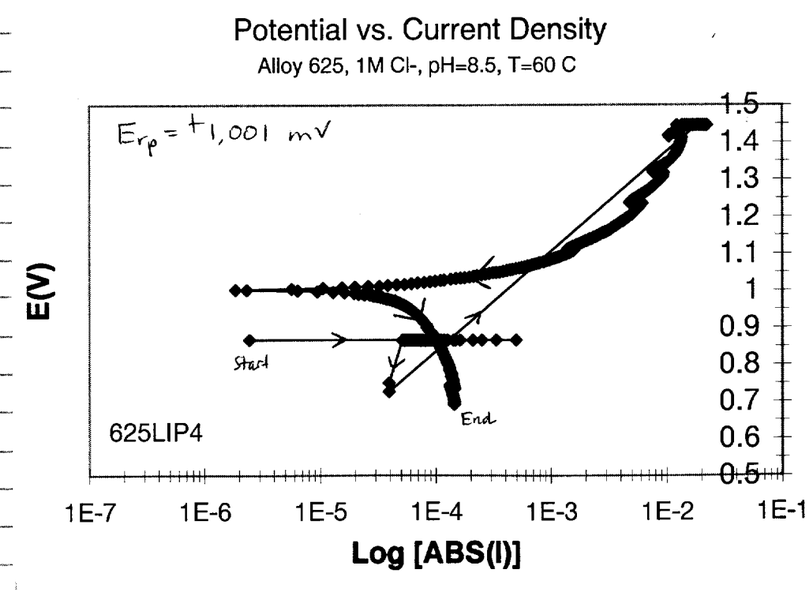
Ref. Electrode: Fisher SCE #13-620-51 S/N 3106345

Counter Electrode: Pt. Flag

E_{cor} = -322 mV
E_{pt} = -280 mV

Kimberly Ann Dunn 5/15/97





Kimberly Ann Gruver 5/15/97

Lead-in-Pencil of Alloy 625, 1000ppm Cl^-, pH=8.5, T=60°C

625lip5.dat

Objective: Measure E_{rp} of a single pit

Specimen: Alloy 625, Ht # NX9936AG, ρ = 8.448 gm/ml
Specimen Dimensions – see p. 46
Start wt: 6.35634 gm
End wt: 6.34948 gm

Solution: 1000ppm Cl^- as NaCl Lot # 960780 (4.94719 gm)
60ml $SO_4^=$ Stock Sol'n (20ppm)
30ml NO_3^- Stock Sol'n (10ppm)
6ml F^- Stock Sol'n (2ppm)
} NB157, p.172
+ DI water to 3000 ml, Deaerated w/ 99.999% N_2

T = 60°C, Hg thermometer # 0323008
Start pH = 5.703
End pH = 6.540

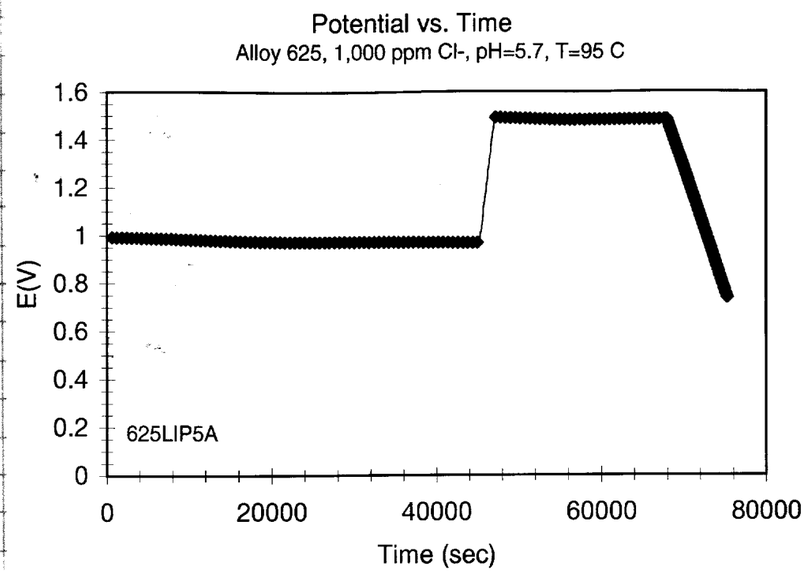
Potentiostat: Pine Model AFRDE5 Bi-Potentiostat S/N 6091
w/ Workbench Software

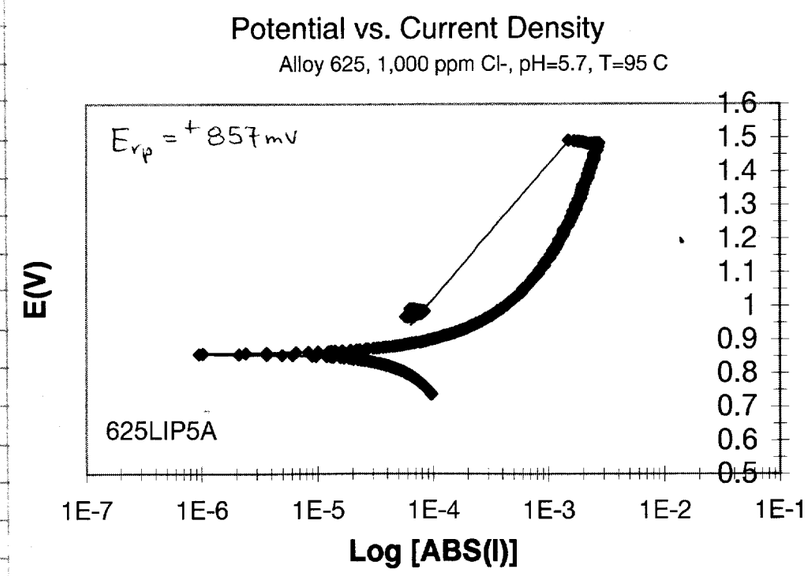
Ref. Electrode: Fisher SCE #13-620-51 S/N 3106339

Counter Electrode: Pt. Flag

E_{corr} = −220 mV
E_{pt} = −56 mV

Kimberly Ann Gruver 5/15/97





Kimberly Ann Lyons 5/15/97

lead-in-Pencil of Alloy C22-4MCl⁻, pH=8.5, T=25°C

C221.p1f.dat

Objective: To measure E_{rp} of a single pit

Specimen: Alloy C22, Ht# 2278-8-3175, ρ=8.69 gm/mL
Specimen Dimensions - See p.53 (Same specimen as used for experiment on p.53)
Start/End wt: See p.53

Solution: Same Mixture of Solutions as on p.43

Start pH = Did not record pH at start of test.
End pH = 6.697
T=25°C, Hg thermometer #0323008
Dearated Sol'n w/ 99.999% N_2

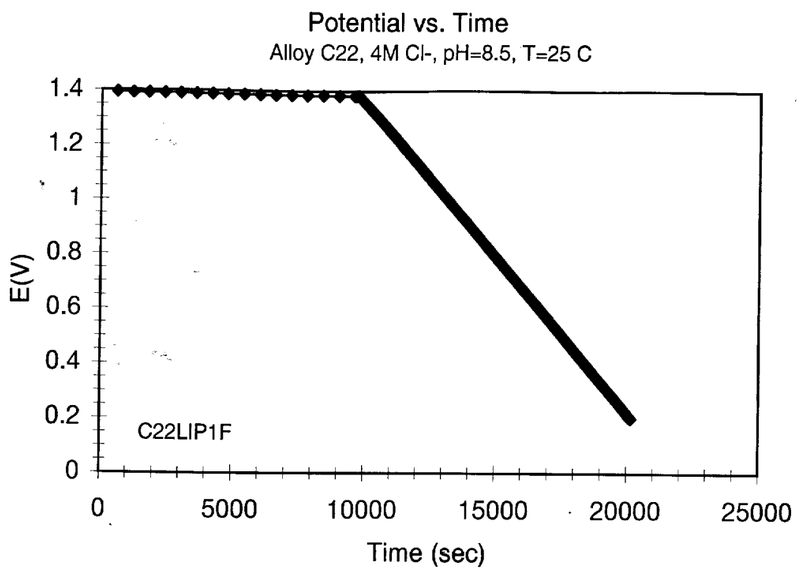
Potentiostat: Pine Model AFRDE5 Bi-Potentiostat S/N 6091 w/ Workbench Software

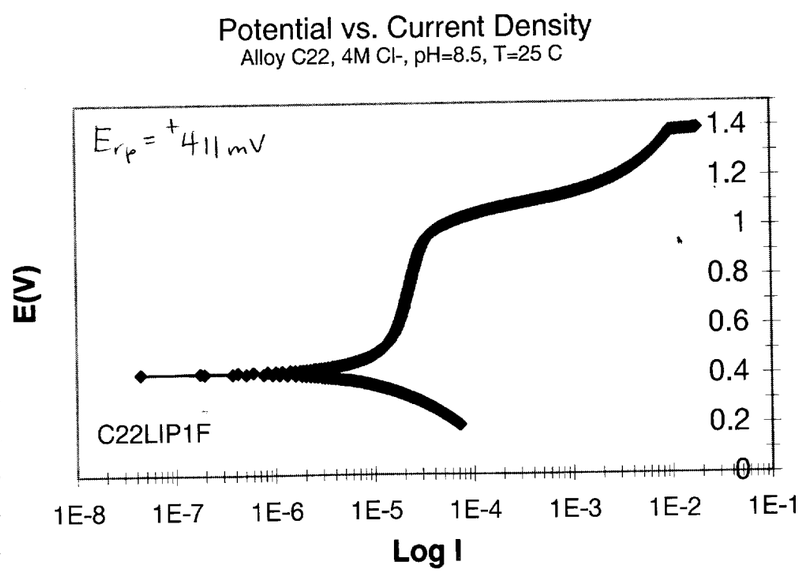
Ref. Electrode: Fisher SCE # 13-620-51 S/N 3106339

Counter Electrode: Pt. Flag

E_{corr} = +250.4 mV
E_{pt} = + 10.3 mV

Kimberly Ann Lyons 5/15/97





Kimberly Ann Gruss 5/15/97

Lead-in-Pencil of Alloy C22 - 1M Cl^-, pH=8.5, T=95°C

C22lip3.dat

Objective: to measure E_{rp} of a single pit

Specimen: Alloy C22, Ht #2278-8-3175 ρ = 8.69 g/mL
Specimen Dimensions - see p. 46
Start wt: 6.31756 gm
End wt: 6.29555 gm

Solution: Same Mixture of Solutions as on p. 59
1M Cl^-, 20 ppm SO_4^-, 10 ppm NO_3^-, 2 ppm F + DI water

Start pH = 7.703
End pH = 7.953
T = 95°C, Hg thermometer #0323008
Deaerated Sol'n w/ 99.999% N_2
EG&G Potentiostat Model 273 S/N 41108

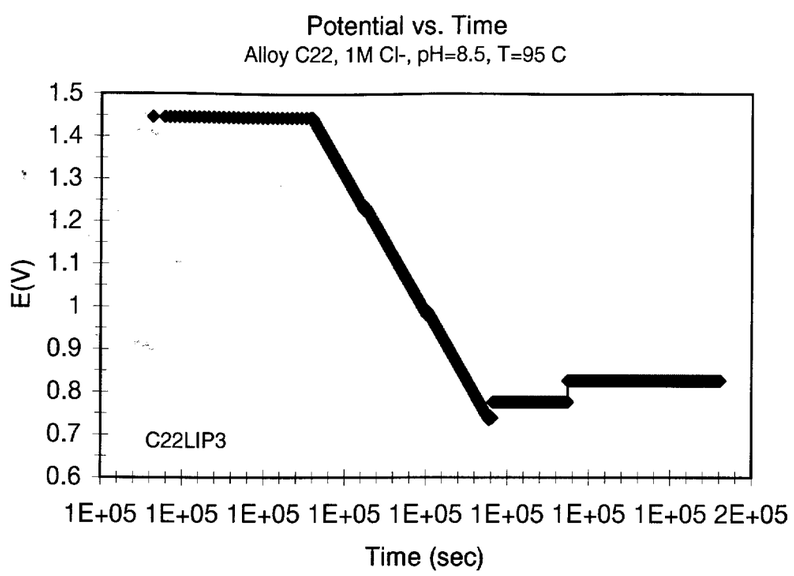
Potentiostat: ~~Pine Model AFRDE5 Bi-Potentiostat S/N 6091~~
w/ Workbench Software
kag 5/15/97

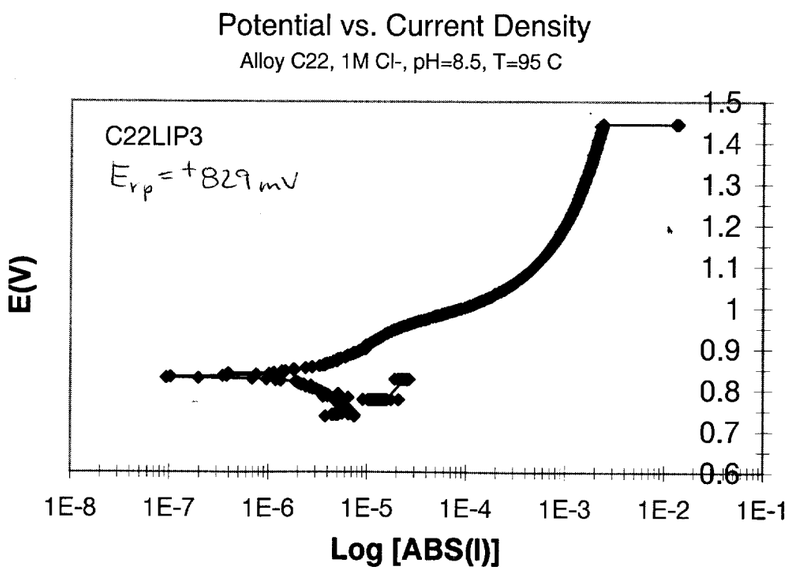
Ref. Electrode: Fisher SCE # 13-620-51, S/N ~~3106339~~ 3106345
kag 5/15/97

Counter Electrode: Pt. Flag

E_{cor} = -498 mV
E_{pt} = -547 mV

Kimberly Ann Gruss 5/15/97





Kimberly Ann Lindsay 5/15/97

Lead-in-Pencil & Alloy C22 - 1000 ppm Cl^-, pH = 8.5, T = 95°C

C22lip5.dat

Objective: measure E_{rp} of a single pit

Specimen: Alloy C22, Ht # 2278-8-3175, ρ = 8.69 gm/cc
Specimen Dimensions - see p. 46
Start wt: 6.17638 gm
End wt: 6.17324 gm

Solution: Same Mixture of Solutions as on p. 73
1000 ppm Cl^-, 20 ppm SO_4^-, 10 ppm NO_3^-, 2 ppm F^- + DI water

Start pH = 6.540
End pH = 7.422
T = 95°C, Hg thermometer # 1B3305
Deaerated Solution w/ 99.995% N_2

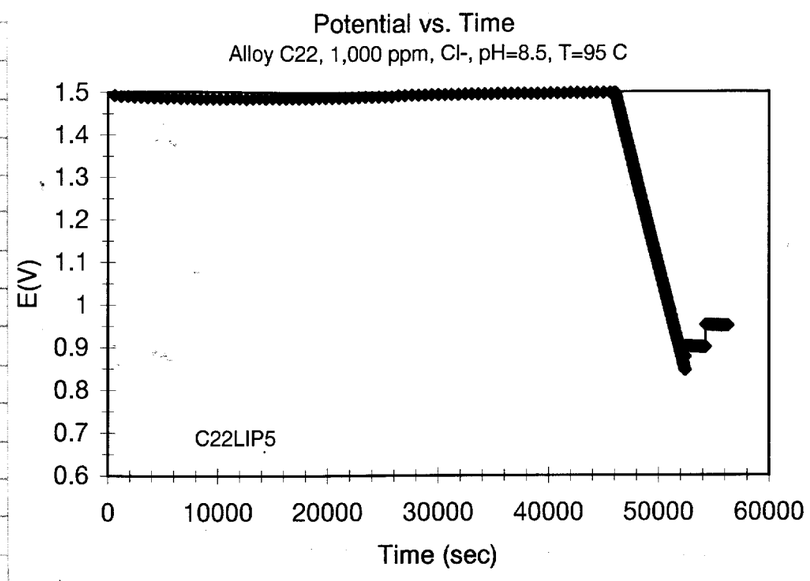
Potentiostat: Pine Model AFRDE5 Bi-Potentiostat S/N 6091
w/ Workbench Software

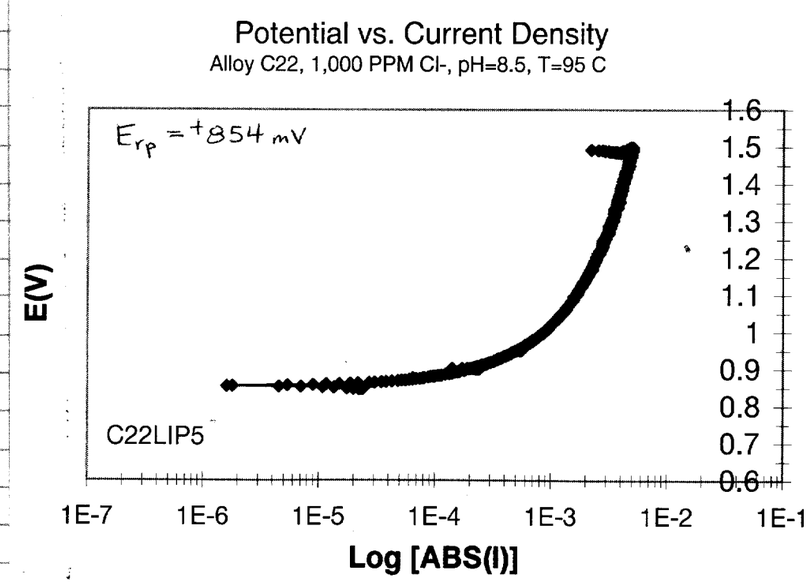
Ref. Electrode: Fisher SCE # 13-620-51, S/N ~~3106345~~ 3106339
Kay 5/15/97

Counter Electrode: Pt. Flag

E_{corr} = -518 mV
E_{pt} = -498 mV

Kimberly Ann Lindsay 5/15/97





Kimberly Ann Bruce 5/15/97

Lead-in-Pencil of Alloy 625 - 1M Cl⁻, pH=8.5, T=95°C

625lip7.dat

Objective: Measure E_{rp} of a single pit

Specimen: Alloy 625, Ht # NX9936AG, ρ = 8.449 g/cm³
Specimen Dimensions – See p. 46
Start wt: 6.31756 gm
End wt: 6.29318 gm → Note: a few filings fell out while cleaning

Solution: Same Mixture of Solutions as on p. ~~73~~ 59 Kay 5/15/97
1M Cl⁻, 20 ppm SO_4^-, 10 ppm NO_3^-, 2 ppm F^-

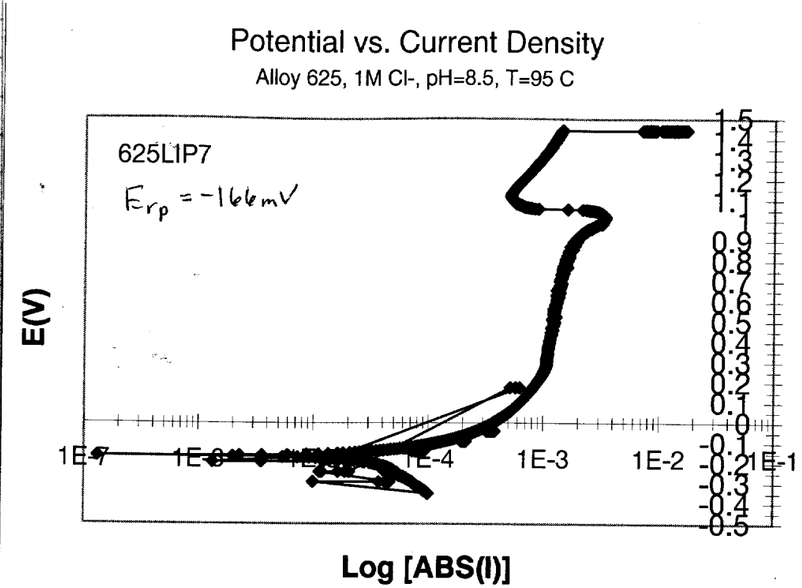
Start pH = 7.953
End pH = 7.904
T = 95°C, Hg thermometer ~~#103305~~ 0323008 Kay 5/19/97
Deaerated Solution w/ 99.999% N_2
EG&G Potentiostat Model 273 S/N 41108
Potentiostat: ~~Pine Model AFRDE5 Bi-Potentiostat S/N 6094~~
w/ Workbench Software Kay 5/15/97

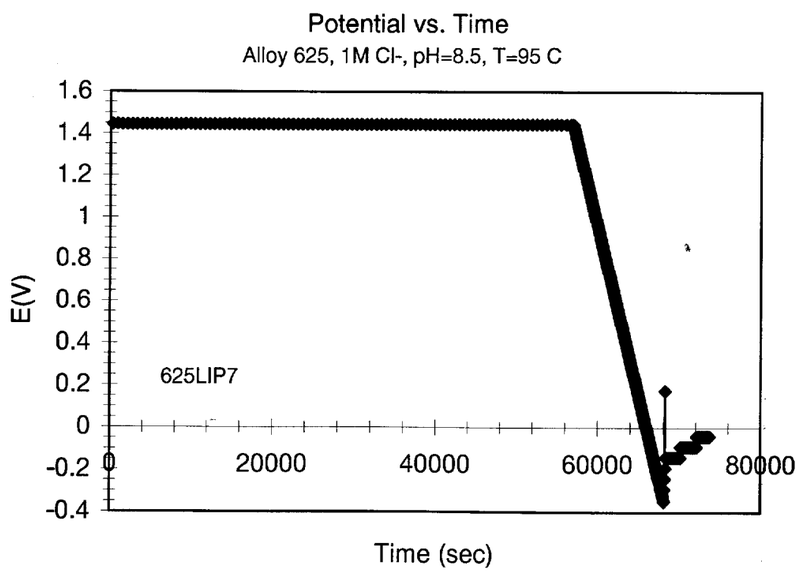
Ref. Electrode: Fisher SCE #13-620-51, S/N 3106345

Counter Electrode: Pt. Flag

E_{corr} = −690 mV
E_{pt} = −675 mV

Kimberly Ann Bruce 5/15/97





Kimberly Ann Gunter 5/15/97

Lead-in-Pencil of alloy 625 - 1000ppm, pH = 8.5, 60°C

625lip6.dat

Objective: to measure E_{rp} of a single pit

Specimen: Alloy 625, Ht# Nx9936AG, ρ = 8.44 gm/cc
Specimen Dimensions - See p. 46
Start wt: 6.31996 gm
End wt: ~~6.31484~~ gm ⇒ few filings came out of sample while cleaning in acetone.
6.31531 gm w/ 2 small filings added to specimen

Solution: Same Mixture of Solutions as on p. 73
1000 ppm Cl^-, 20 ppm SO_4^-, 10 ppm NO_3^-, 2 ppm F^-
+ DI water

Start pH = 7.422
End pH = 6.739
T = 60°C, Hg thermometer # 183305
Deaerated Sol'n w/ 99.999% N_2

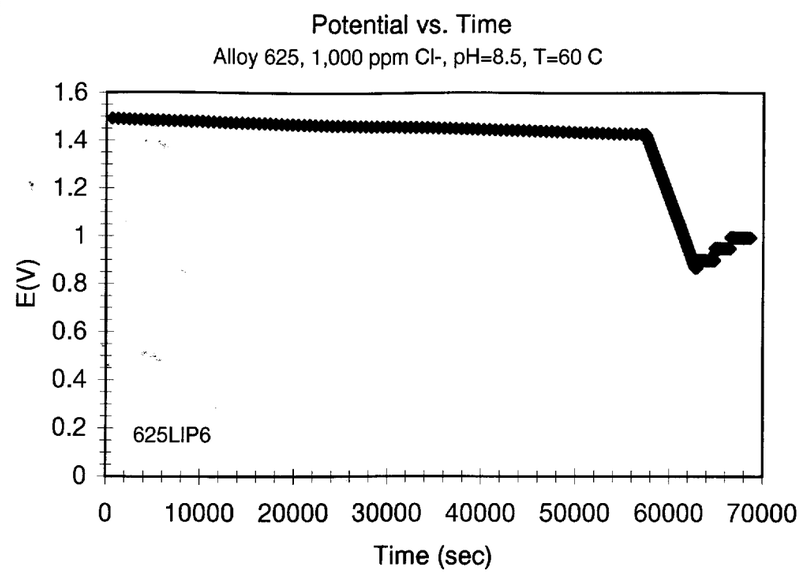
Potentiostat: Pine Model AFRDE5 Bi-Potentiostat S/N 6091
w/ Workbench Software

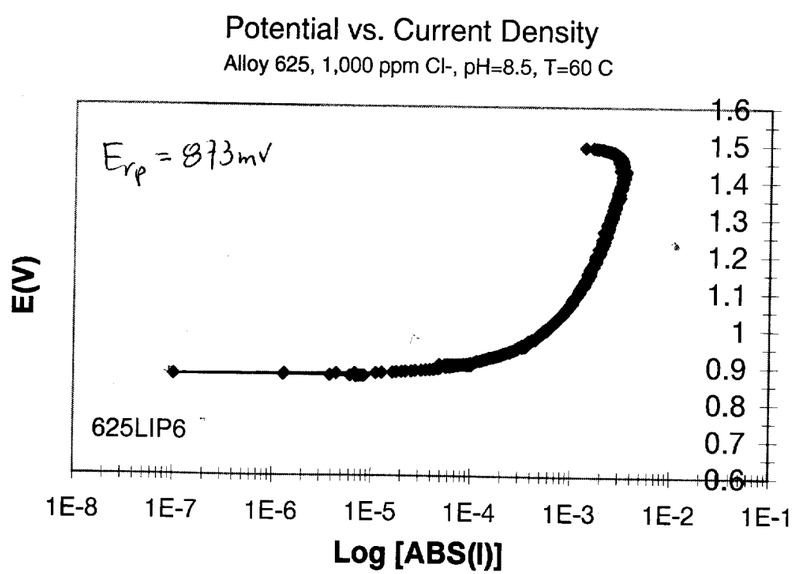
Ref. Electrode: Fisher SCE #13-620-51, S/N ~~3106345~~ 3106339
Kag 5/15/97

Counter Electrode: Pt. Flag

E_{corr} = -443 mV
E_{pt} = -485 mV

Kimberly Ann Gunter 5/15/97





Kimberly Ann Gruss 5/15/97

Lead-in-Pencil of Alloy C22 - 1M Cl⁻, pH=8.5, T=60°C

C22lip4.dat

Objective: Measure E_{rp} of a single pit

Specimen: Alloy C22, Ht.# 2278-8-3175, ρ = 8.69 gm/cm³
Specimen Dimensions - see p 46
Start wt: 6.15265
End wt: 6.13319 gm

Solution: 1M Cl^-, 20ppm SO_4^-, 10ppm NO_3^-, 2 ppm F^-
Same Solutions as on p. 59.

Start pH = 7.904
End pH = 7.662 0323008
T = 60°C, Hg thermometer ~~#183305~~ Kag 5/17/97
Dearated Solution, w/ 99.999% N_2

Potentiostat: EG+G Potentiostat Model 273 S/N 4108
w/ Workbench Software

Ref. Electrode: Fisher SCE # 13-620-51, S/N 3106345

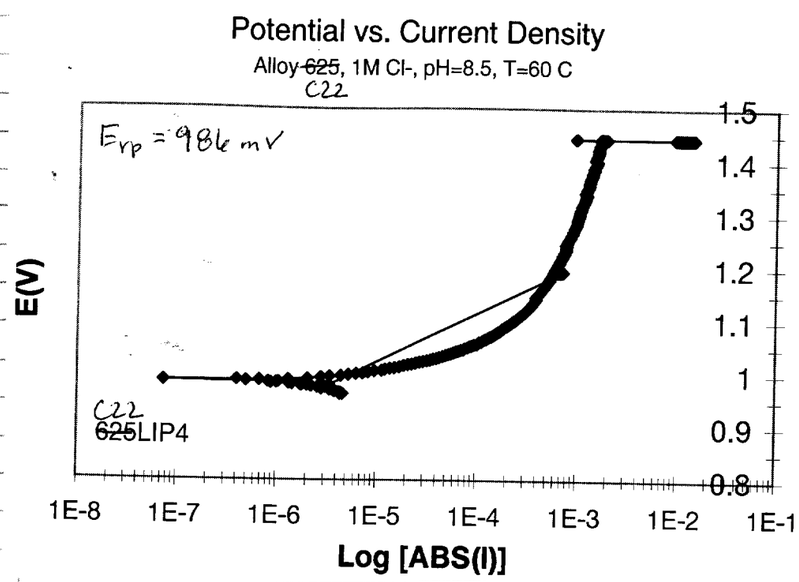
Counter Electrode: Pt. Flag

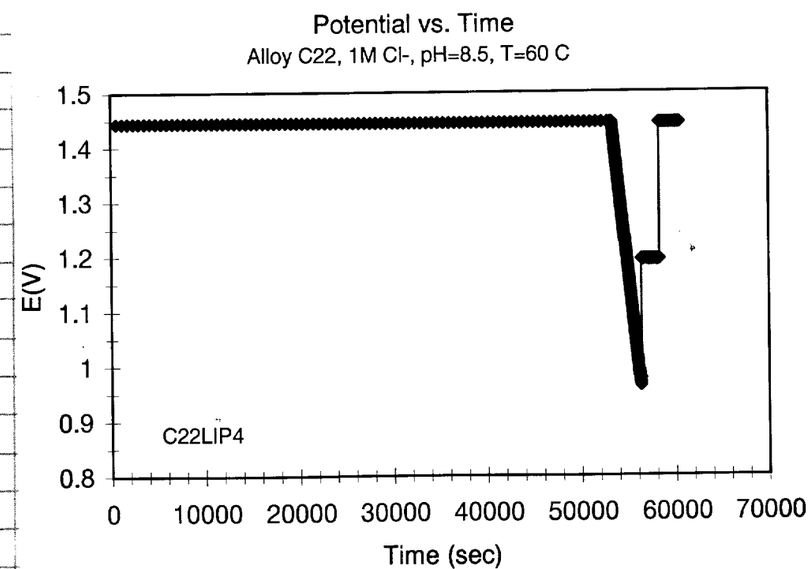
E_{corr} = -249 mV
E_{pt} = -83 mV

During the test, the solution in the pit was brownish-yellow in color.

After test, observed a bright yellow corrosion product. After the specimen was string out (the ~~water~~ solution in the pit removed), the erosion product appeared to be a yellow-brown color.

Kimberly Ann Gruss 5/27/97





Kimberly Ann Linser 5/27/97

Lead-in-Pencil of Alloy C22 - 4M Cl^-, pH=8.5, T=95°C

C22lip8.dat

Objective: Measure E_{rp} of a single pit

Specimen: Alloy C22, Ht # 2278-8-3175, ρ = 8.69 gm/ml
Specimen Dimensions - see p. 46
Start wt: 6.19348 gm
End wt: 6.16849 gm

Solution: 4M Cl^- as NaCl lot # 960780 (701.024550 gm)
20 ppm $SO_4^=$ Stock Solution (60 ml)
10 ppm NO_3^- Stock Solution (30 ml)
2 ppm F^- Stock Solution (6 ml)
} NB157, p.172
+ DI water to 3,000 ml, Dearated w/ 99.999% N_2

T = 95°C, Hg thermometer # 183305 Start pH = 8.003
~~Dearated Solution wt~~ kag 5/19/97 End pH = 4.046

Potentiostat: ~~EG&G Potentiostat Model 273 S/N~~ kag 5/19/97
Pine Model AFRDE5 Bi-Potentiostat S/N 6091
w/ Workbench Software

Ref. Electrode: Fisher SCE #13-620-51, S/N 3106339

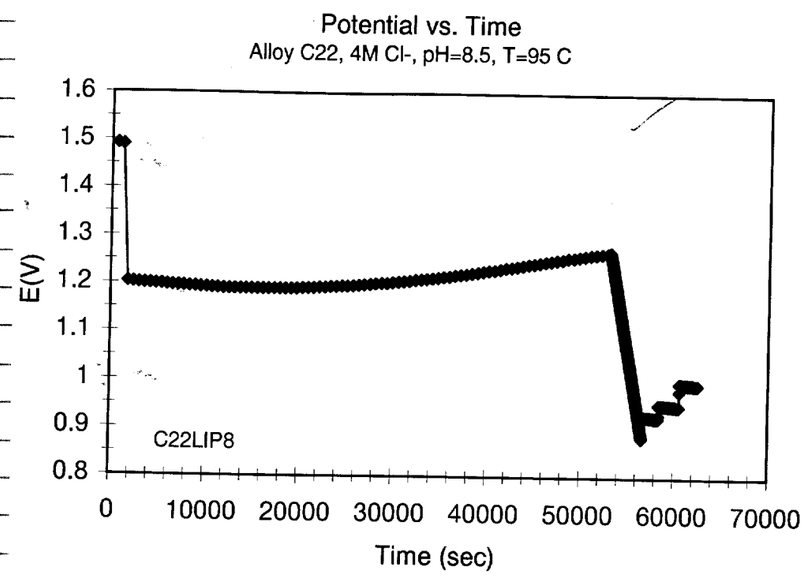
Counter Electrode: Pt. Flag

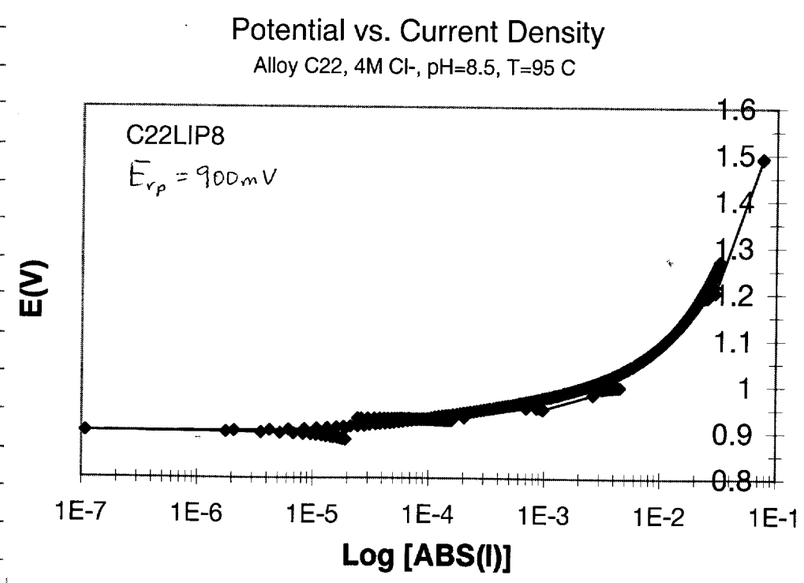
E_{cor} = -1 mV
E_{pt} = -278 mV

During the experiment, the solution in the pit was brownish-yellow in color.

After the test, the corrosion product appeared to be a bright yellow. The flat + sides (between specimen + glass) were covered w/ this material

Kimberly Ann Linser 5/27/97





Kimberly Ann Lindsay 5/27/97

Lead-in-Pencil of Alloy 625 – 1M Cl^-, pH=8.5, T=95°C

625Lip9.dat

Objective: measure E_{rp} of a single pit

Specimen: Alloy 625, Ht# NX9936AG, ρ = 8.44 gm/cm²
Specimen Dimensions - See p. 46
Start wt: 6.24467 gm
End wt: 6.22262 gm

Solution: 1M Cl^-, 20 ppm SO_4^-, 10 ppm NO_3^-, 2 ppm F^- + DI water
Same solution as on p. 59

Start pH = 7.662
End pH = 7.868

T = 95°C, Hg thermometer # 0323008
Deaerated Solution w/ 99.999 % N_2

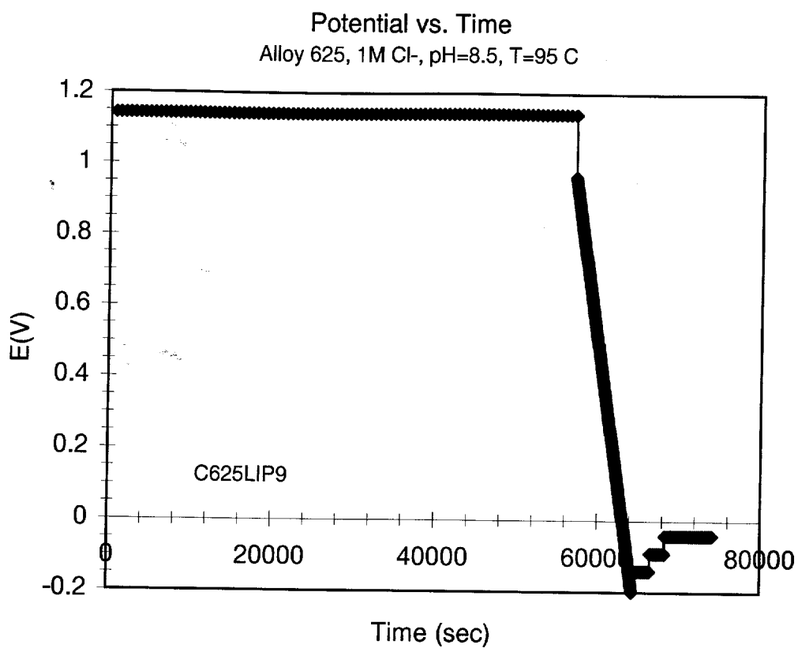
Potentiostat: EG+G Potentiostat Model 273 S/N 41108
w/ Workbench Software

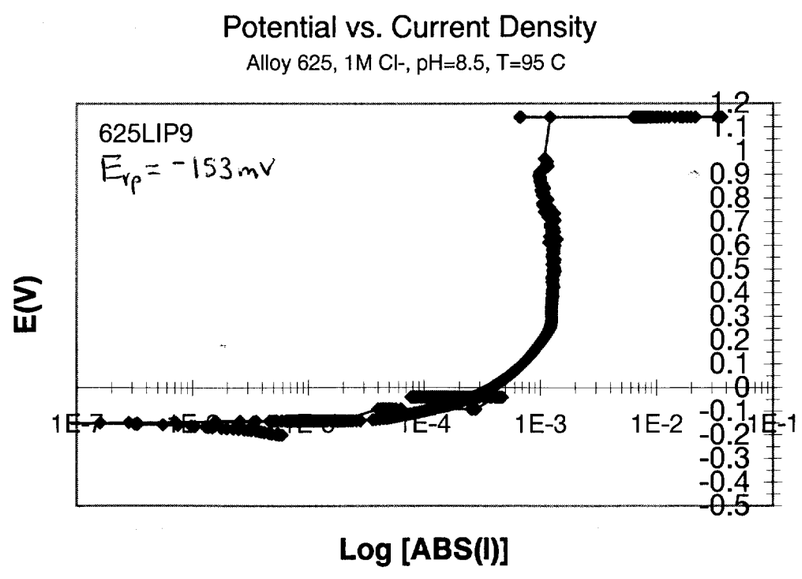
Ref. Electrode: Fisher SCE # B-620-51, S/N 3106345

Counter Electrode: Pt. Flag

E_{corr} = −501 mV
E_{pit} = −353 mV

Kimberly Ann Lindsay 5/27/97





Kimberly Ann Gruver 5/27/97

the Degredation of

Summary of Lead-in-Pencil Specimens

(Measured w/ uncalibrated caliper (green one))

Final length	Appearance
1.79 cm 625 lip1/1b	looks like some kind of dark gray oxide (adherent surface film), located between top + bottom 1/3's of specimen, forming a band around the lead. The top 1/3 + flat appear to be a dull bright gray (not the same gray oxide). Sharp corners at top. Not a significant amt. of crevice corrosion.
1.90cm 625lip2a	top 2/3 of specimen + the flat (area covered w/ glass) appears to be dull ~~bright~~ light gray. the corner is not ~~they~~ rounded, it is sharp. The top 1/3 looks like there was more significant crevice corrosion than the middle 1/3. There does not appear to be any dark gray surface film. w/ microscope at 50x, there appears to be many (high density) of small pits from top + middle 2/3. Small pits ~ 10μm deep.
1.78 cm 625lip3a	top 1/3 of specimen + flat are dull light gray. middle 1/3 appears to have a gray/green scale on it. Crevice corr. appears at crevice where glass + teflon tube meet (~ 70μm deep). Looks like general corrosion elsewhere - not a lot of large distinct pits. Corner is somewhat rounded.
1.90cm 625lip4	Surface is covered w/ adherent scale that is rainbow colored. It does not appear to have been corroded (in that there appears to be no dull light gray metal exposed). The top flat has cylindrical depression in it (may be from machining process). At the tip, the scale is yellowish and there are depressed striations running longitudinally. Corner is sharp.

Kimberly Ann Gruver 5/27/97

Summary of the Degradation of Lead-in-Pencil Specimens (Cont)

1.88 cm
625 lip 5a

Surface is covered w/ a very light yellow adherent scale. Except at the end where it is light gray (dull). The flat is also covered w/ a light yellow film. The corner is rounded slightly, and longitudinal depressed striations are visible. At the tip, a very high density of very small pits was observed.

1.67 cm
C22 lip 1a-f

No discoloration in the surface – shiney metal. Except at tip where it appears to have pits. The corner is very well rounded, so the tip is almost spherical. There is crevice corr. where the glass + teflon tube met at about 2/3 from the tip. The crevice is 45 μm deep. Also, some gib. appear to be etched, and there are small nearly spherical pits at the tip.

1.82 cm
C22 lip 3

Brownish adherent surface scale. Crevice corr. where glass + teflon met (30 μm). Tip is slightly rounded + ~~has pits~~ is pitted. Pit density is much less than for 625. Also, spherically shaped + seem to coalesce.

1.82 cm
C22 lip 4

No discoloration in the surface – shiney metal. Tip appears to be fairly flat, but w/ rounded corners. There appears to be no crevice corrosion. There are some pits at the tip of the specimen, though the density of pits is much less than for C22 lip 8. These pits are also somewhat spherical.

1.82 cm
C22 lip 8

No discoloration in the surface – shiney metal. Tip is rounded + almost spherical. There was no crevice corrosion. The tip is heavily pitted w/ nearly spherical pits. The pit density seems large, and the pits seemed to coalesce.

Kimberly Ann Gruss 5/27/97

(Cont'd)

Note: Uncorroded specimen length
C22 = 1.91 cm, 1.91 cm
625 = 1.90 cm, 1.90 cm

Final Length

1.90 cm
C22 lip 5

Brownish adherent surface scale. Tip is rounded. ~~Not~~ No crevice corr.

1.81 cm
625 lip 7

yellow → gray adherent surface scale. Significant crevice (10 μm) corrosion at glass/teflon joint + crevice-like longitudinal corrosion that originates at the tip + goes down to glass/teflon joint. The corners are gone; i.e. the tip is rounded and not flat any more. Looks like a type of general corrosion, in that there doesn't seem to be noticeable pits, OR there are so many pits they coalesced?

1.90 cm
625 lip 6

Rainbow colored surface film. At tip, there are ~~vert~~ longitudinal ridges. The corners are sharp, but pits are found on the tip + sides. The tip looks heavily pitted with small pits – almost like swiss cheese.

Kimberly Ann Gruss 5/27/97

Results from XRD Scans of Specimens 625cpp9 + 625cpp11

FORM FOR REQUESTING WORK FROM OTHER DIVISIONS

A. TO BE COMPLETED BY DIVISION 20 PERSONNEL

Requester: D. Dunn **Request Date:** 4/29/97
Project No.: 20-5708-561 **Phone No.:** 6090
Description of Work Requested: XRD OF SELECTED SPECIMENS
625CPP9 (GOLD FILM) 625 CPP11 (CORROSION PRODUCTS)
OPTICAL PHOTO OF SPECIMENS 1 PHOTO OF ENTIRE SPECIMEN
2 CLOSEUP OF CORRODED AREAS.
EDS OF 625CPP9 & 625CPP11

☐ Optical Microscopy ☐ SEM ☐ Hardness ☐ Profilometer ☐ Auger ☐ Other

***QUALITY REQUIREMENTS:** The work requested is governed by the CNWRA Quality Assurance Program which addresses requirements of 10CFR50, Appendix B. Personnel performing this work shall be qualified under the CNWRA QA program or equivalently under the SwRI Nuclear QA program. Test and analysis methods shall be documented by approved procedures or recognized, standard methods. Measuring and test equipment shall be calibrated and controlled according to CNWRA and SwRI Nuclear QA program requirements.*

Sample Identification	Description
825CPP1	ALLOY 825 CYL SPECIMEN w/ PITS
C22 CPP1	C22 w/ CREVICE CORROSION
625 CPP5	ALLOY 625 w/ CREVICE CORROSION
625 CPP10	ALLOY 625 w/ CREVICE CORROSION
625 CPP9	ALLOY 625 w/ CREVICE CORROSION
625 CPP11	ALLOY 625 w/ CREVICE CORROSION

B. TO BE COMPLETED BY DIVISION PERFORMING WORK[1]

☐ Optical Microscopy ☐ SEM ☐ Hardness ☐ Profilometer ☐ Auger ☐ Other

Person Assigned: JIM SPENCER **Signature:** J. Spencer
Division: 06 **Date:** 5/12/97
EMPLOYEE # 3889
Make, Model & Serial No. of Equipment Used (*attach list if necessary*):

Software Used (If any):

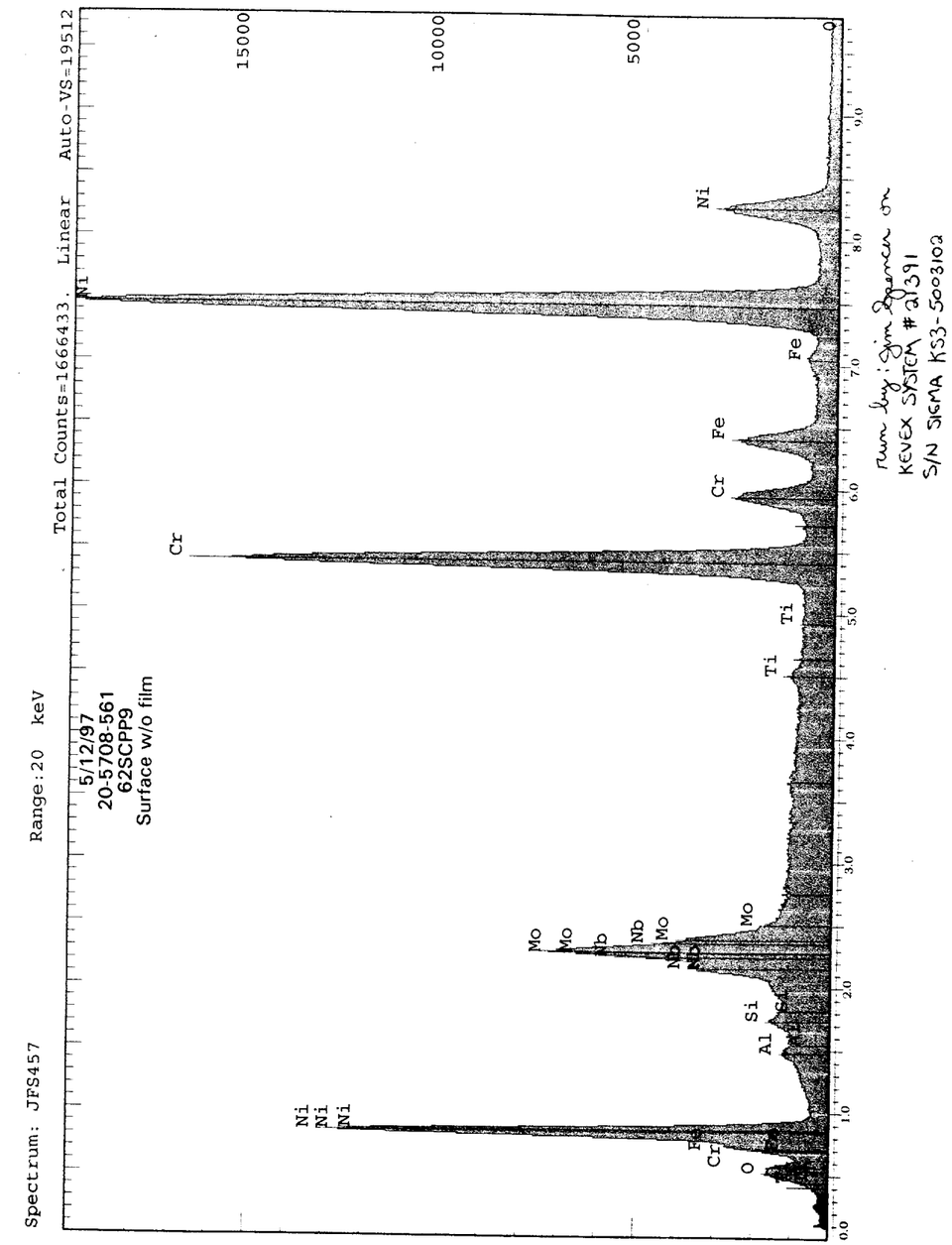
Standards Used (If any):

Photographic Negative Numbers (If Applicable):

[1] Please sign and date any hardcopy of analysis or list of photographs (The photographs themselves need not be signed). If error occurred during entry, do not erase or overwrite, but strikeout with single line, initial and date, and then reenter correct information.

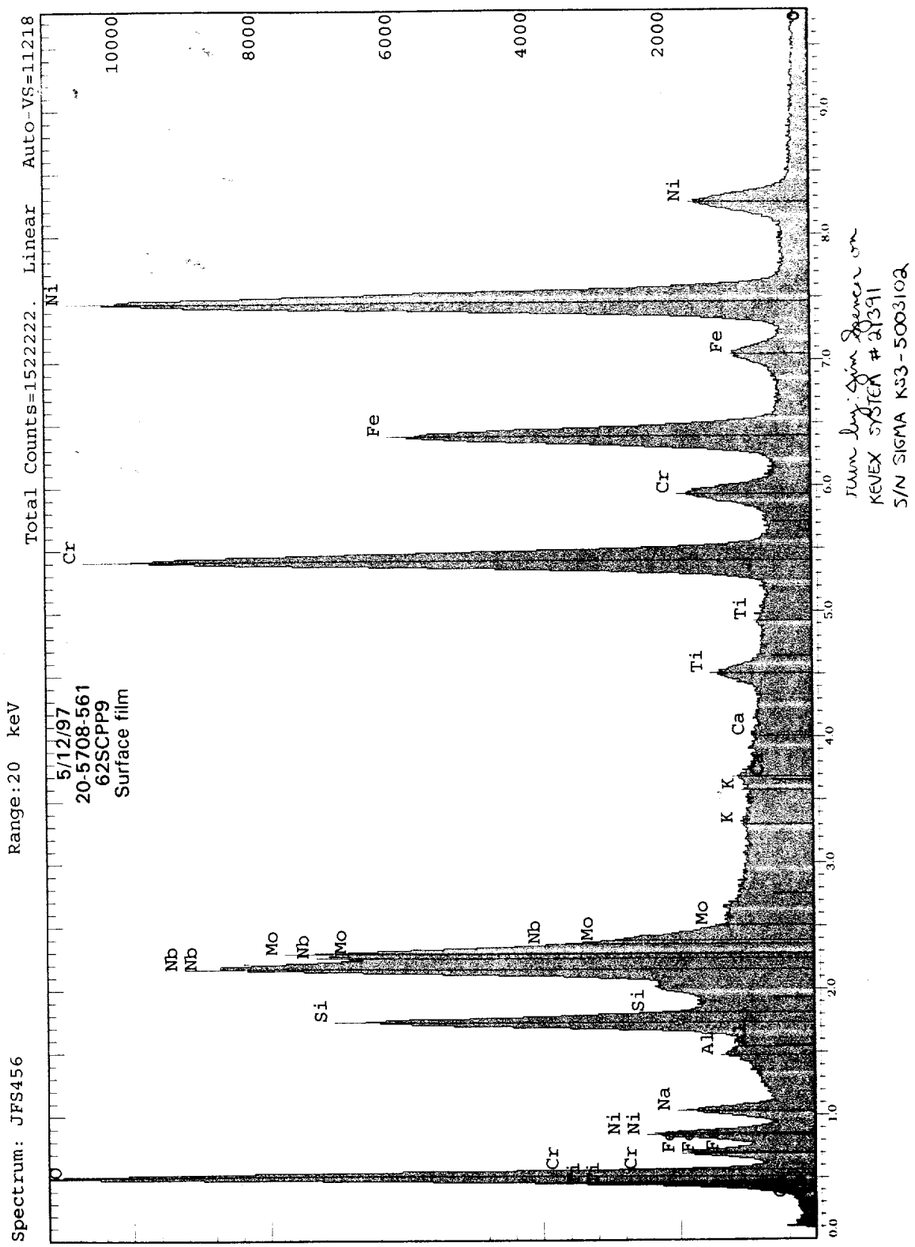
Kimberly Ann Smith 5/27/97

EDS Spectrum of untarnish area on 625cpp9



Kimberly Ann Smith 5/27/97

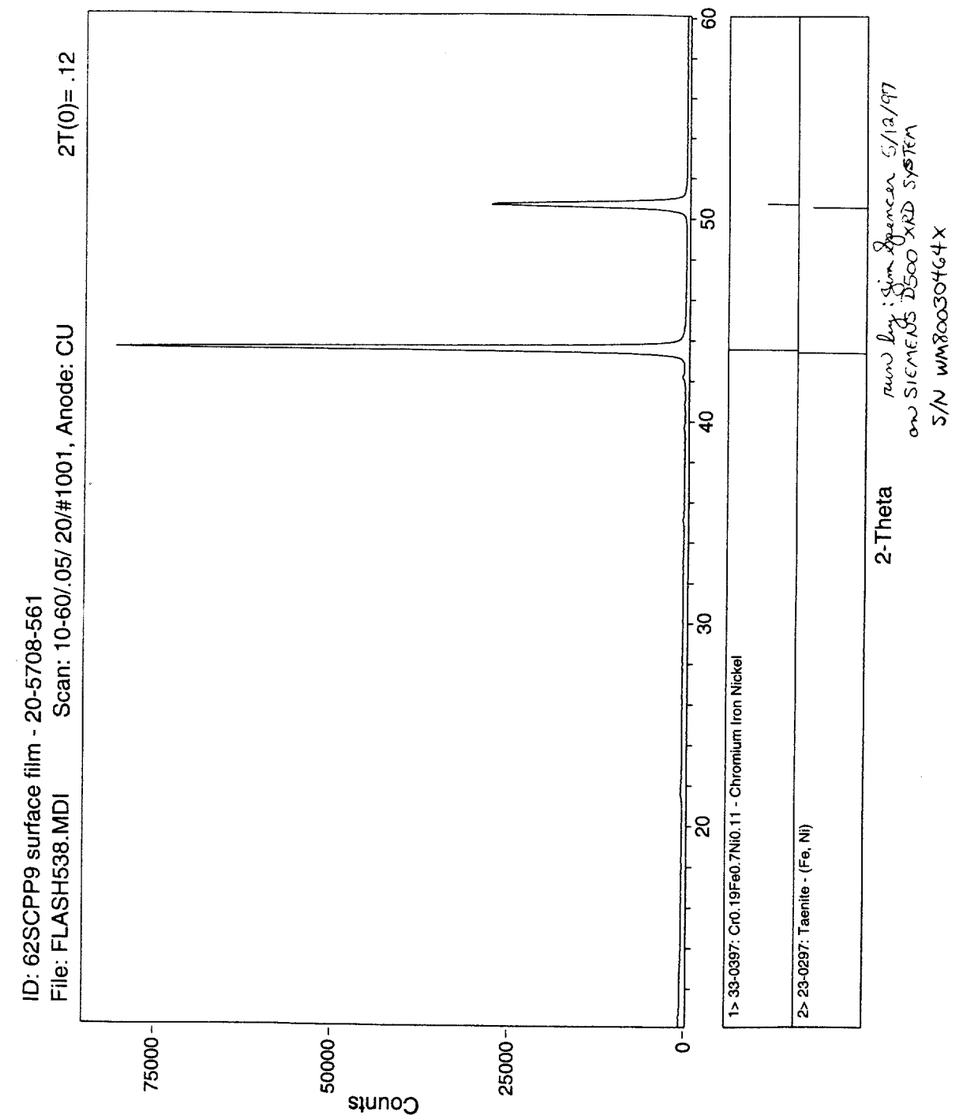
EDS Spectrum of Tarnished Surface on 625cpp9



run by: Jim Spencer on
KEVEX SYSTEM #21391
S/N SIGMA KS3-5003102

Kimberly Ann Gross 5/27/97

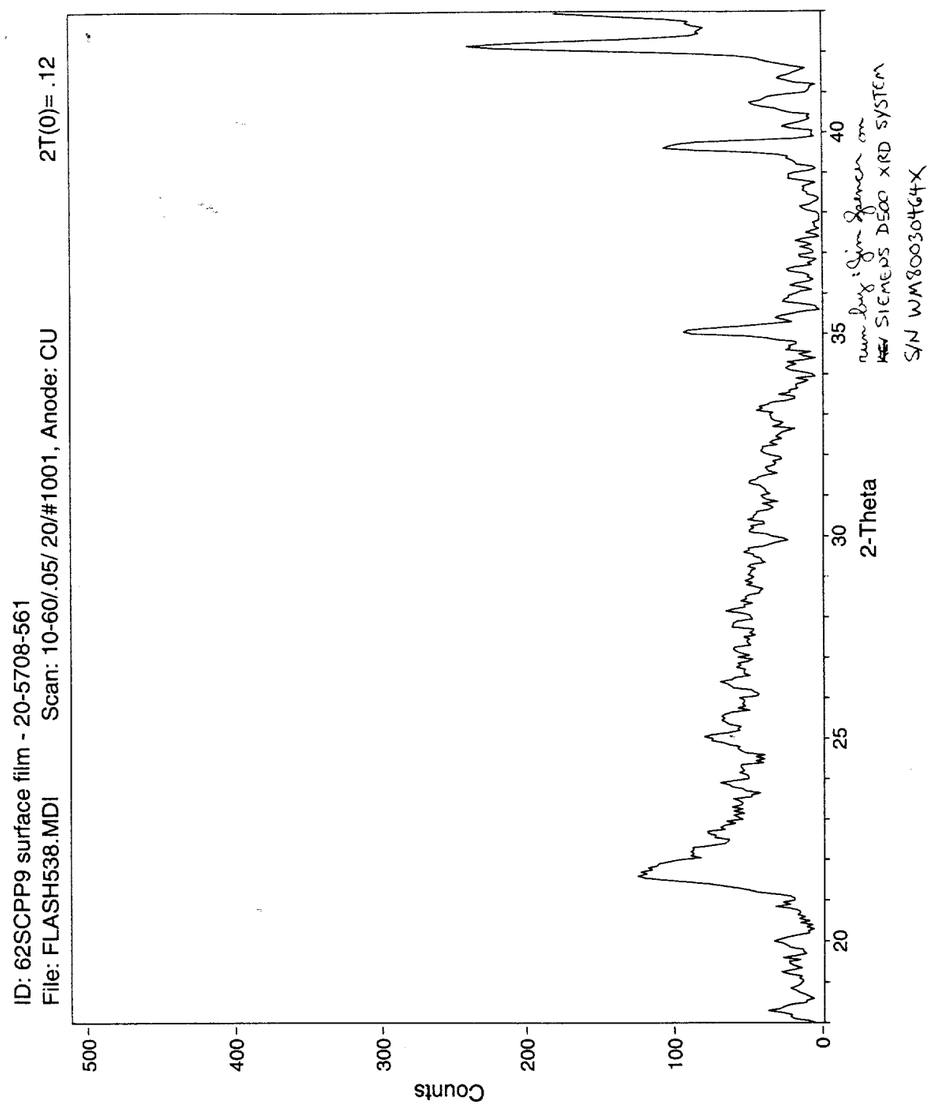
XRD Spectrum of Specimen 625cpp9 - High intensity peaks are those of the 625 specimen.



run by: Jim Spencer 5/12/97
on SIEMENS D500 XRD SYSTEM
S/N WM80030464X

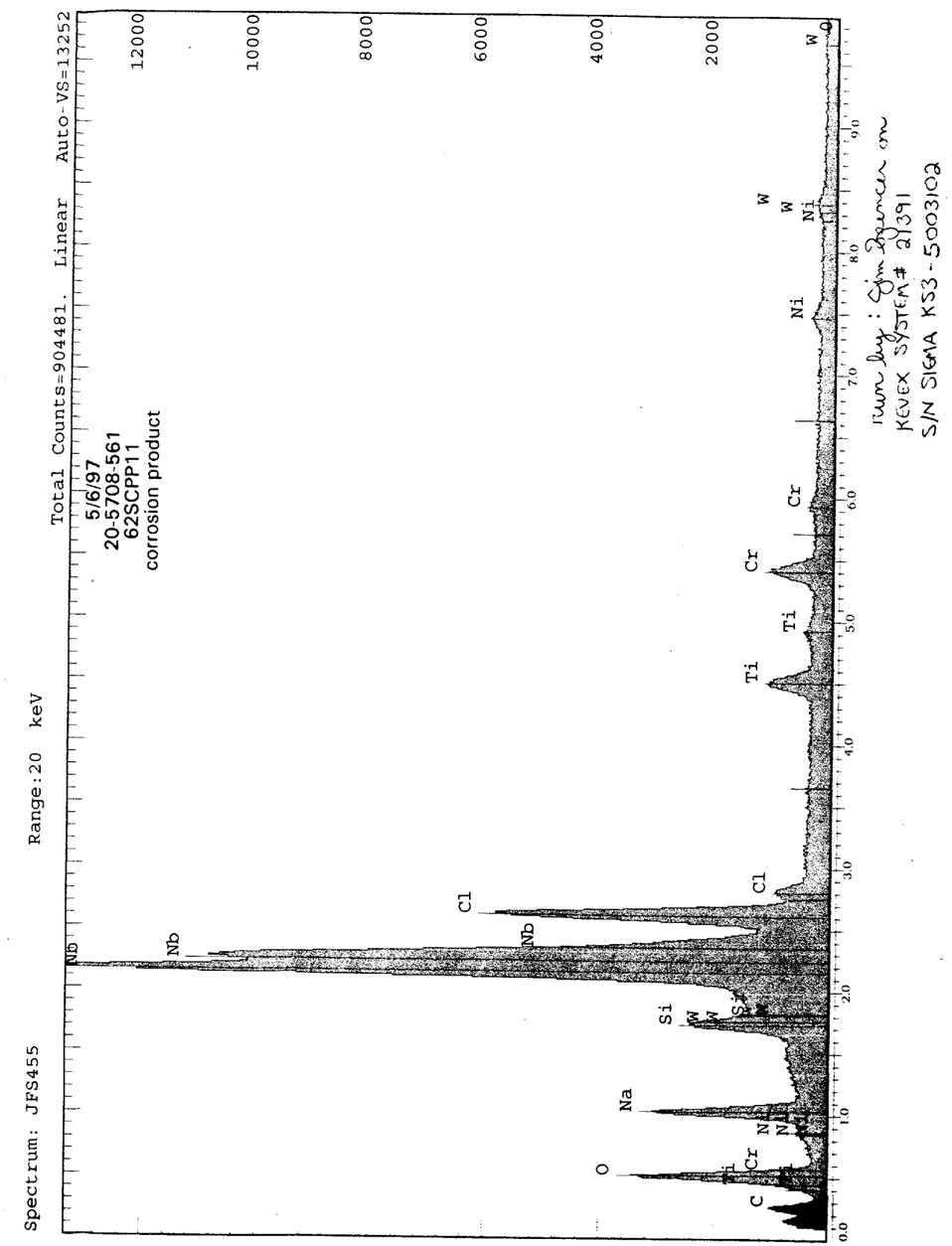
Kimberly Ann Gross 5/27/97

XRD Spectrum of Specimen 625cpp9 – low intensity peaks are those of the scan on P. 97



Kimberly Ann Spencer 5/27/97

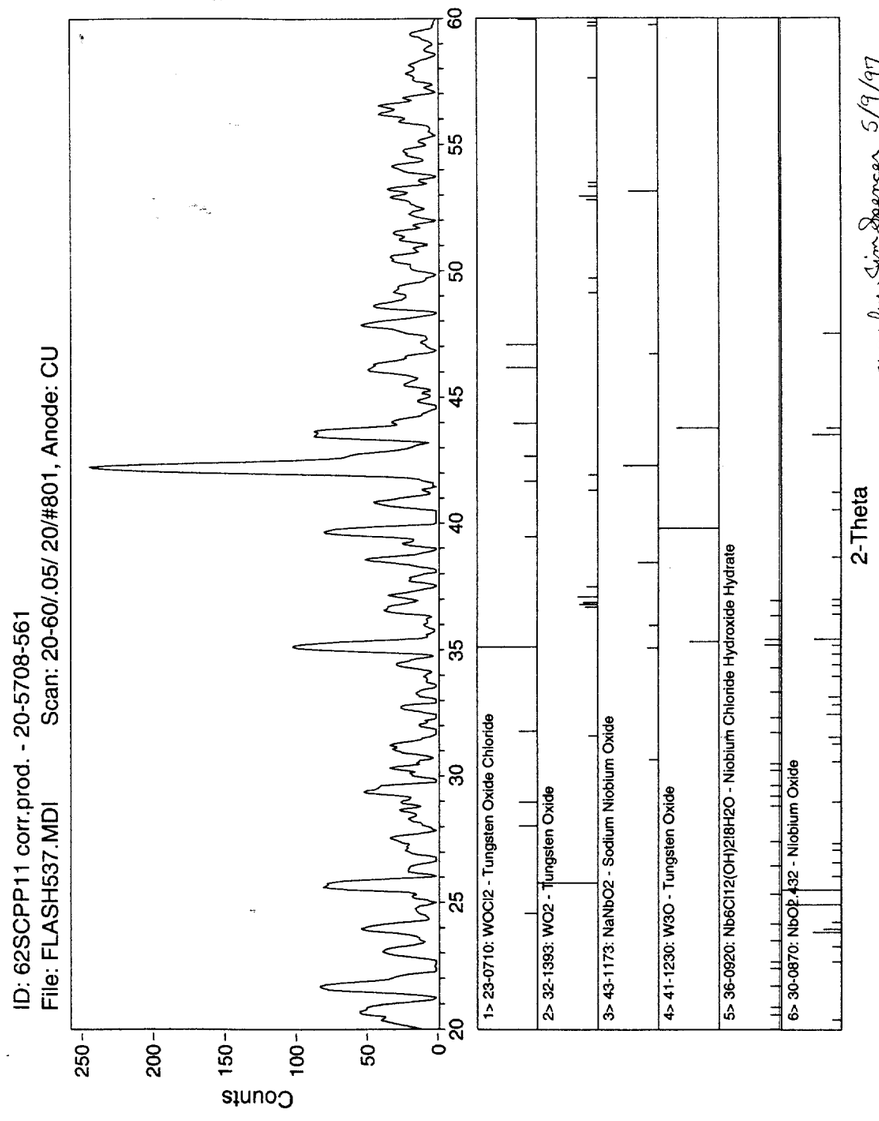
EDS spectrum of the Corrosion Product on 625cpp11



Kimberly Ann Spencer 5/27/97

XRD of the Corrosion Product on 625 cpp 11

Note: Color of this product was a dark black/brown.



run by: Jim Spencer 5/9/97
on SIEMENS D500 XRD SYSTEM
S/N WM800304G4X

Kimberly Ann Grant 5/27/97

EDS results of the Corrosion Product on 625cpp 11

JFS455.RPT

[A N A L Y S I S R E P O R T]

GENERAL CONDITIONS

Result File	: JFS455
File Version	: 1
Background Method	: Auto
Decon Method	: Gaussian
Decon ChiSquared	: 32.11
Analysis Date	: 6-MAY-97
Microscope	: SEM
Comments	: 62SCPP11 corr. product 20-5708-561

ANALYSIS CONDITIONS

Quant. Method	: XPP/ASAP
Acquire Time	: 200 secs
Normalization Factor	: 100.00

SAMPLE CONDITIONS

kV	: 20.0
Beam Current	: 100.0 picoAmps
Working Distance	: 29.5 mm
Tilt Angle	: 0.0 Degrees
TakeOff Angle	: 31.1 Degrees
Solid Angle*BeamCurrent	: 0.5

Element	Line	Weight%	K-Ratio	Cnts/s	Atomic%
Na	Ka	6.54	0.0245	97.01	17.37
Si	Ka	2.24	0.0176	76.39	4.87
Cl	Ka	15.67	0.0868	309.72	26.98
Ti	Ka	2.84	0.0235	53.30	3.63
Cr	Ka	3.52	0.0319	57.33	4.14
Ni	Ka	1.88	0.0193	19.14	1.95
Nb	La	57.55	0.4836	734.64	37.82
W	La	9.75	0.0789	18.62	3.24

Page 1

run by: Jim Spencer on
KEVEX SYSTEM # 21391
S/N SIGMA KS3-5003102

Kimberly Ann Grant 5/27/97

CPP of Alloy 625 0.3M Cl^-, pH 8.5, 95°C
w/crevice geometry

625cpp17.dat

Objective: To measure E_{rp} + E_{pit} w/a crevice corrosion geometry

Specimen: Alloy 625 lot # NX9936AG
Spec. dimension see p.24
600 grit polished 20 cm^2 exposed area
Start wt. 30.78316 g
End wt.

Solution: 0.3M Cl^- (as NaCl) 85 ppm HCO_3^-
20 ppm $SO_4^=$ 10 ppm NO_3^- 2 ppm F^-
17.55860 g NaCl lot 960780
0.23729 g $NaHCO_3$ lot 923337A
20 ml SO_4 6/97
10 ml NO_3 6/97
2 ml F 6/97
} Stock solutions NB 157 p.173
+ DI water to 1000 mL
start pH 7.197 end pH

T = 95°C thermometer
Potentiostat: EG+G Versastat w/ 352C Software

Ref. electrode: Fisher SCE # 13-601-51 S/N 5087374
Counter Electrode: Pt flag

E_{corr} = -499 mV
E_{pt} = +201 mV

Power outage - test interrupted + data lost

Walter J Mackowski
6/30/97

CPP of Alloy 625 0.3M Cl^-, pH 8.5, 95°C
w/crevice geometry

625cpp18.dat

Objective: To measure E_{rp} + E_{pit} w/a crevice geometry

Specimen: Alloy 625 lot # NX9936AG
Spec. dimension see p.24
600 grit polished 20 cm^2 exposed area
Start wt. 30.73314 g
end wt. 30.71455 g

Solution: 0.3M Cl^- (NaCl) 85 ppm HCO_3^-
20 ppm SO_4 10 ppm NO_3 2 ppm F^-
17.55993 ~~17.55855~~ g NaCl lot # 960780
0.11756 ~~0.23729~~ g $NaHCO_3$ lot # 923337A
6/30/97 WJMackowski
20 ml $SO_4^=$ 6/97
10 ml NO_3^- 6/97
2 ml F^- 6/97
} Stock solutions NB 157 p 173
+ DI water to 1000 mL
start pH ~~8.046~~ 7.888 end pH 9.425
6/30/97 WJMackowski
T = 95°C thermometer # 183304

Ref. electrode: Fisher SCE # 13-601-51 S/N 5144349
Counter electrode: Pt flag

E_{corr} = -471 mV
E_{pt} = +57 mV

crevice corrosion in 7 or 8 areas
gold color on all areas away from crevice washers

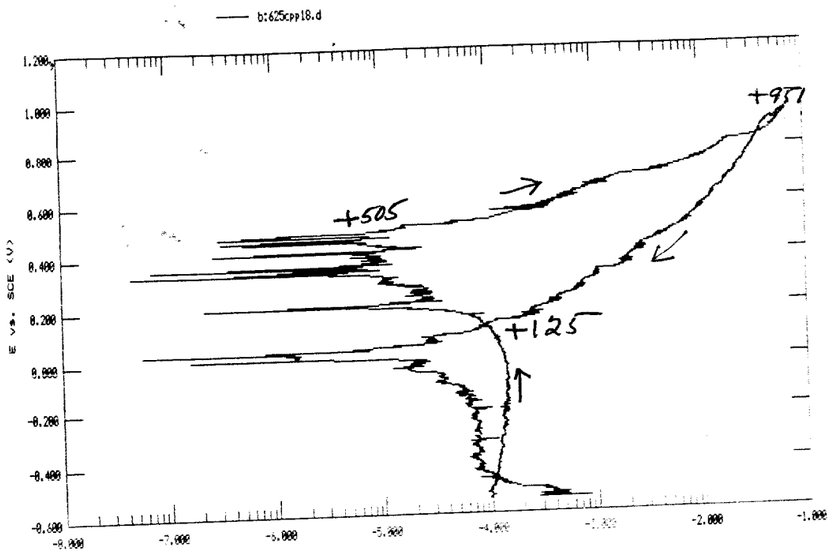
Walter J Mackowski
7/14/97

Model 352/252 Corrosion Analysis Software, v. 2.01
CP CYCLIC POLARIZATION
CP PASS vs. R — CT PASS
SI 1.000E-03 — SR 1.671E-04
FL I 5.3Hz — RT HIGH STABILITY
IT 1.000E-01 — ITA 1.000E+00
Comment: Alloy 625 0.3M Cl 95 C pH ~~8.046~~ 7.888 7/9/97 Walter J Machunski

File Status: NORMAL
IP -0.100 vs. OC
ST 5.983E+00
REF 0.24150 SCE
EW 0.0000E+00

Filename: b:625cpp18.dat
Date Run: 07-01-97 — Time Run: 07:32:36
ID 29 S — VI 0.100 vs. OC
CR AUTO — NP 2999
WRK SOLID — AR 1.000E+00
DEN 8.440E+00 — OC -0.445

Pstat: VStat[] Ver 2
FP -0.100 vs. OC
IR NONE
LS YES



Walter J Machunski 7/14/97

Model 352/252 Corrosion Analysis Software, v. 2.01
Filename: b:625cpp18.dat
Pstat: VStat[] Ver 2
CP CYCLIC POLARIZATION
Date Run: 07-01-97

File Status: NORMAL
Time Run: 07:32:36

Cond. Time	CT	pass	s	Initial Pot.	IP	-0.1000	V oc
Cond. Pot.	CP	pass	V	Vertex 1 Pot.	V1	0.1000	V oc
Initial Delay	ID	26	s	I Threshold	IT	0.1000	A
				Final Pot.	FP	-0.1000	V oc
Scan Rate	SR	0.1671	mV/s	Curr. Range	CR	Auto	
Scan Incr.	SI	1.000	mV	Step Time	ST	5.983	s
No. of Points	NP	2999					
				GI Time Const.	TC	OFF	
				IR Mode	IR	none	
Line Sync.	LS	yes		Filter	FL	I 5.3Hz	
Rise Time	RT	high stability		Ref. Elec.	RE	SCE 0.2415	V
Working Elec.	WE	Solid		Equiv. Wt.	EW	0.0000	g
Sample Area	AR	1.000	cm^2	Open Circuit	OC	-0.4450	V
Density	DE	8.440	g/ml				

Comment: Alloy 625 0.3M Cl 95 C pH 8.046

Walter J Machunski 7/14/97

Walter J Machunski
7/14/97

CPP of Alloy 625 0.3M Cl^-, pH 8.5, 95°C
w/ crevice geometry

625cpp19.dat

Objective: To measure E_{rp} & E_{pit}

Specimen: Alloy 625 Lot # NX9936AC
spec. dimensions see p.29
600 grit polished 20 cm^2 exposed area
start wt. 31.06852 g
finish wt. 31.05259 g

Solution: 0.3M Cl^- (NaCl) 85 ppm HCO_3^-
20 ppm $SO_4^=$ 10 ppm NO_3^- 2 ppm F^-
17.55225 g NaCl lot 960780
0.11681 g $NaHCO_3$ lot 923337A
20 ml $SO_4^=$ 6/97
10 ml NO_3^- 6/97
2 ml F^- 6/97
} Stock solution NB 157 p.173
plus DI water to 1000 ml
start pH 7.895 finish pH 9.425

T = 95°C thermometer # 183304

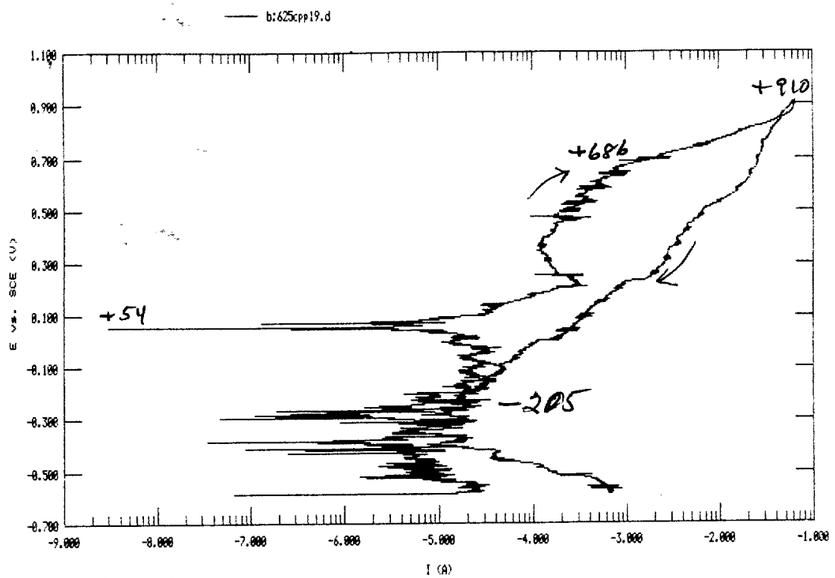
Ref electrode: Fisher SCE #13-620-51 S/N 5144349
Counter electrode Pt flag

E_{corr} = -487 mV
E_{pit} = +114 mV

crevice corrosion in 6 or 7 areas
gold color on all areas away from
crevice washer

Walter J Machunski
7/14/97

Model 352/252 Corrosion Analysis Software, v. 2.01 Filename: b:625cpp19.dat Pstat: VStat[] Ver 2
CP CYCLIC POLARIZATION File Status: NORMAL Date Run: 07-02-97 Time Run: 07:40:03
CP PASS vs. R CT PASS IP -0.100 vs. OC ID 20 S V1 0.100 vs. OC FP -0.100 vs. OC
SI 1.000E-03 SR 1.671E-04 ST 5.983E+00 CR AUTO NP 2999 IR NONE
FL I 5.3Hz RT HIGH STABILITY REF 0.24150 SCE WRK SOLID AR 1.000E+00 LS YES
IT 1.000E-01 ITA 1.000E+00 EW 0.000E+00 DEN 8.440E+00 OC -0.488
Comment: Alloy 625 0.3M Cl 95 C pH 7.895



Walter J Machowski
7/14/97

Model 352/252 Corrosion Analysis Software, v. 2.01
Filename: b:625cpp19.dat
Pstat: VStat[] Ver 2
CP CYCLIC POLARIZATION File Status: NORMAL
Date Run: 07-02-97 Time Run: 07:40:03

Cond. Time	CT	pass	s	Initial Pot.	IP	-0.1000	V oc
Cond. Dwt.	CD	pass	W	Vertex & Dwt.	VS	0.1000	W **
Initial Delay	ID	20	s	I Threshold	IT	0.1000	A
				Final Pot.	FP	-0.1000	V oc
Scan Rate	SR	0.1671	mV/s	Curr. Range	CR	Auto	
Scan Incr.	SI	1.000	mV	Step Time	ST	5.983	s
No. of Points	NP	2999					
				GI Time Const.	TC	Off	
Line Sync.	LS	yes		IR Mode	IR	none	
Rise Time	RT	high stability		Filter	FL	I 5.3Hz	
Working Elec.	WE	Solid		Ref. Elec.	RE	SCE 0.2415	V
Sample Area	AR	1.000	cm^2	Equiv. Wt.	EW	0.0000	g
Density	DE	8.440	g/ml	Open Circuit	OC	-0.4880	V

Comment: Alloy 625 0.3M Cl 95 C pH 7.895
Walter J Machowski 7/14/97

Walter J Machowski
7/14/97

CPP of Alloy 625 0.1M Cl^-, pH 8.5, 95°C
w/crevice geometry

625cpp20.dat

Objective: To measure E_{rp} + E_{pit}

Specimen: Alloy 625 Lt # NX9936AG
spec. dimension see p. 29
600 grit polished 20 cm^2 exposed area
start wt. 31.13156 g
end wt. 31.12533 g

Solution: 0.1M Cl^- (NaCl) 85 ppm $HCO_3^=$
20 ppm $SO_4^=$ 10 ppm NO_3^- 2 ppm F^-
5.84809 g NaCl lot 960780
0.11872 g $NaHCO_3$ lot 923337A
20 ml $SO_4^=$ 6/97
10 ml NO_3^- 6/97 } stock solutions NB157 p. 173
2 ml F^- 6/97
plus DI water to 1000 mL
start pH 7.643 end pH 9.931
T = 95°C thermometer # 183304

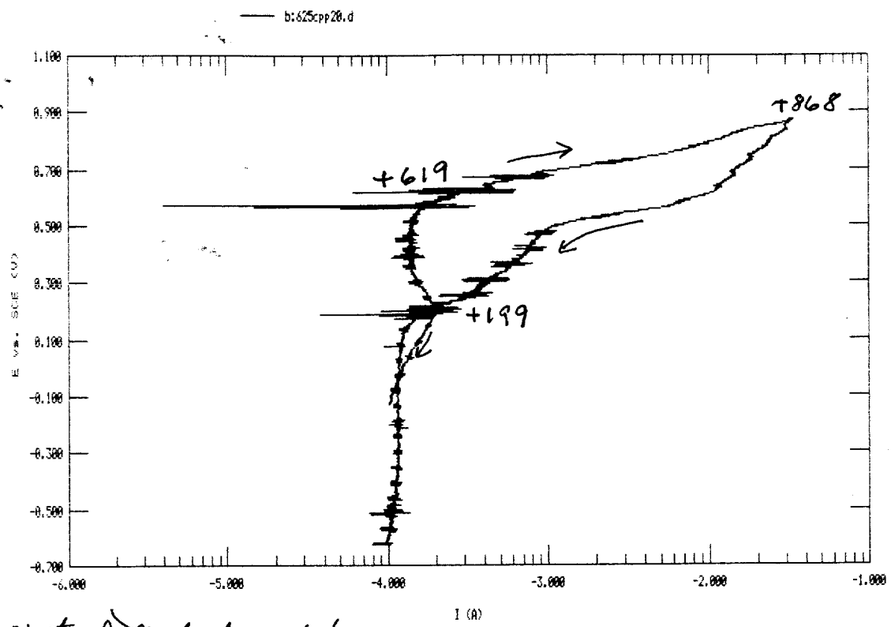
Ref electrode: Fisher SCE #13-620-51 S/N 5144349
Counter electrode: Pt flag

E_{corr} = -531 mV
E_{pt} = +186 mV

crevice corrosion in three areas
light gold color on all areas away from crevice washers

Walter J Machowski
7/14/97

Model 352/252 Corrosion Analysis Software, v. 2.01 Filename: b:625cpp20.dat Pstat: VStat[] Ver 2
CP CYCLIC POLARIZATION File Status: NORMAL Date Run: 07-03-97 Time Run: 07:26:43
CP PASS vs. R CT PASS IP -0.100 vs. OC ID 20 S V1 0.100 vs. OC FP -0.100 vs. OC
SI 1.000E-03 SR 1.671E-04 ST 5.983E+00 CR AUTO NP 2501 IR NONE
FL I 5.3Hz RT HIGH STABILITY REF 0.24150 SCE WRK SOLID AR 1.000E+00 LS YES
IT 1.000E-01 ITA 1.000E+00 EW 0.000E+00 DEN 8.440E+00 OC -0.526
Comment: Alloy 625 0.1M Cl 95 C pH 7.643



Walter J Mackowski 7/14/97

Model 352/252 Corrosion Analysis Software, v. 2.01
Filename: b:625cpp20.dat
Pstat: VStat[] Ver 2
CP CYCLIC POLARIZATION File Status: NORMAL
Date Run: 07-03-97 Time Run: 07:26:43

Cond. Time	CT	pass	s	Initial Pot.	IP	-0.1000	V oc
Cond. Pot.	CP	pass	V	Vertex 1 Pot.	V1	0.1000	V oc
Initial Delay	ID	20	s	I Threshold	IT	0.1000	A
				Final Pot.	FP	-0.1000	V oc
Scan Rate	SR	0.1671	mV/s	Curr. Range	CR	Auto	
Scan Incr.	SI	1.000	mV	Step Time	ST	5.983	s
No. of Points	NP	2501					
				GI Time Const.	TC	Off	
				IR Mode	IR	none	
Line Sync.	LS	yes		Filter	FL	I 5.3Hz	
Rise Time	RT	high stability		Ref. Elec.	RE	SCE 0.2415	V
Working Elec.	WE	Solid		Equiv. Wt.	EW	0.0000	g
Sample Area	AR	1.000	cm^2	Open Circuit	OC	-0.5260	V
Density	DE	8.440	g/ml				

Comment: Alloy 625 0.1M Cl 95 C pH 7.643 7/14/97 Walter J Mackowski

Walter J Mackowski 7/14/97

CPP of Alloy 625 9M Cl^- as LiCl, 95°C
w/ wire geometry

625cpp21.dat

Objective: To measure E_{rp} + E_{pit}

Specimen: Alloy 625 lot # NX 9936 AG
specimen dimensions see p.29
600 grit polished
start wt. 31.28153 g
end wt. 31.22833 g

Solution: 9M LiCl

296.9 g LiCl lot# 954236
+ DI water to 775 mL
start pH 5.827 end pH 6.123

T = 95°C Hg thermometer # 183304

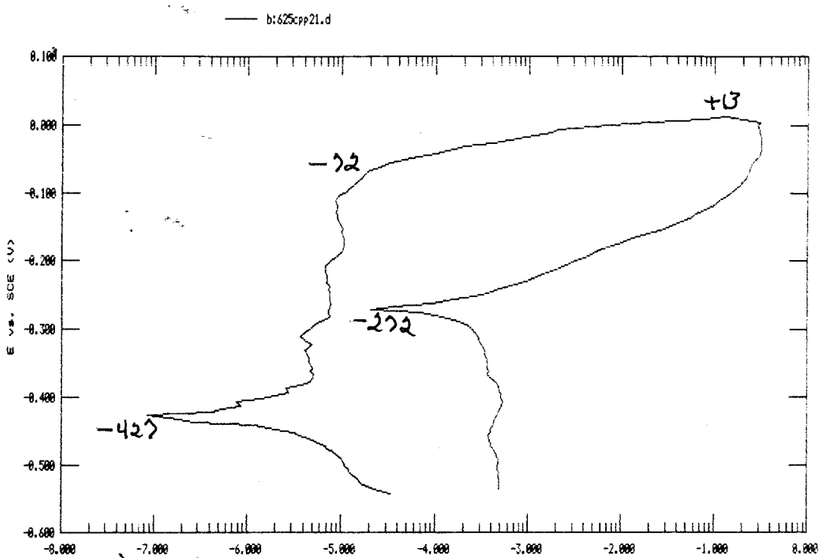
Ref. electrode: Fisher SCE # 13-620-51 S/N 3106339
Counter electrode: Pt flag

E_{corr} = -448 mV
E_{pt} = +349 mV

no crevice or pitting corrosion
some general attack

Walter J Mackowski 7/21/97

Model 352/252 Corrosion Analysis Software, v. 2.01 Filename: b:625cpp21.dat Pstat: VStat[] Ver 2
CP CYCLIC POLARIZATION File Status: NORMAL Date Run: 07-14-97 Time Run: 11:41:42
CP PASS v5.0 CT PASS IP -0.100 vs. OC VI 0.100 vs. OC FP -0.100 vs. OC
SI 5.000E-03 SR 1.670E-04 ST 29.93 CR AUTO AP 222 IR NONE
FL I 5.3Hz RT HIGH STABILITY REF 0.24150 SCE WRK SOLID AR 1.000E+00 LS YES
IT 1.000E-01 ITA 1.000E+00 EW 0.000E+00 DEN 8.440E+00 OC -0.442
Comment: Alloy 625, 9M LiCl, 95 C



Walter J Machunski 7/15/97

Model 352/252 Corrosion Analysis Software, v. 2.01
Filename: b:625cpp21.dat
Pstat: VStat[] Ver 2
CP CYCLIC POLARIZATION File Status: NORMAL
Date Run: 07-14-97 Time Run: 11:41:42

Cond. Time	CT	pass	s	Initial Pot.	IP	-0.1000	V oc
Cond. Pot.	CP	pass	V	Vertex 1 Pot.	V1	0.1000	V oc
Initial Delay	ID	20	s	I Threshold	IT	0.1000	A
				Final Pot.	FP	-0.1000	V oc
Scan Rate	SR	0.1670	mV/s	Curr. Range	CR	Auto	
Scan Incr.	SI	5.000	mV	Step Time	ST	29.93	s
No. of Points	NP	222					
				GI Time Const.	TC	Off	
Line Sync.	LS	yes		IR Mode	IR	none	
Rise Time	RT	high stability		Filter	FL	I 5.3Hz	
Working Elec.	WE	Solid		Ref. Elec.	RE	SCE 0.2415	V
Sample Area	AR	1.000	cm^2	Equiv. Wt.	EW	0.0000	g
Density	DE	8.440	g/ml	Open Circuit	OC	-0.4420	V

Comment: Alloy 625, 9M LiCl, 95 C

Walter J Machunski 7/15/97

Walter J Machunski
7/15/97

CPP of alloy 625 4M Cl^- as LiCl, 95°C
w/crevice geometry

625cpp22.dat

Objective: to measure E_{rp} + E_{pit}

Specimen: Alloy 625 lot # NX9936AC
dimension see p.29
600 grit polished
start wt. 31.40611 g
end wt. 31.30578 g

Solution: 4M LiCl
84.7 g LiCl lot # 954236
+ DI water to 500 mL
start pH 7.410 end pH 8.251

T = 95°C Hg thermometer # 183304

Refelectrode: Fisher SCE # 13-650 51 S/N 3106339
Counter electrode: Pt flag

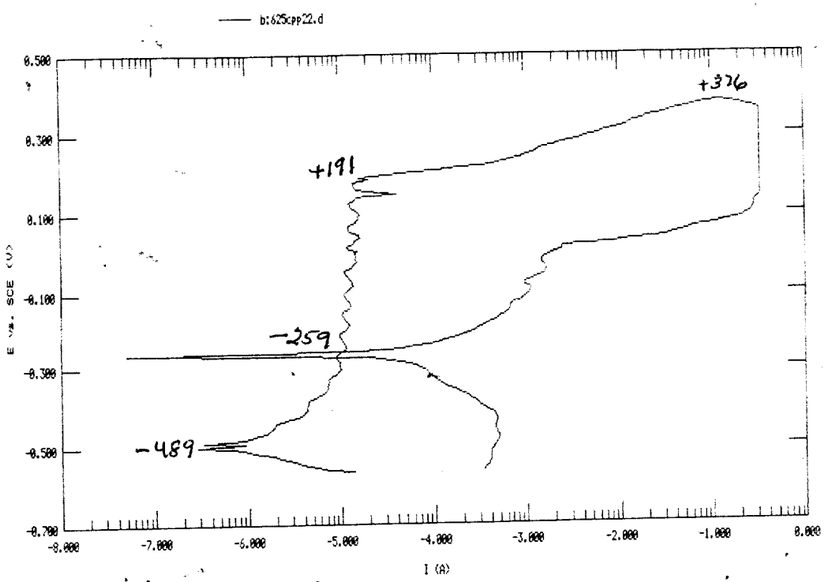
E_{corr} ≈ −460 mV

E_{pt} = +146 mV

some pitting attack on corners + edges away from crevice washer
some crevice attack at circumference of hole in specimen

Walter J Machunski
7/21/97

Model 352/252 Corrosion Analysis Software, v. 2.01 Filename: b:625cpp22.dat Pstat: VStat[] Ver 2
CP CYCLIC POLARIZATION File Status: NORMAL Date Run: 07-15-97 Time Run: 07:32:54
CP PASS vs. R CT PASS IP -0.100 vs. OC ID 20 S V1 0.100 vs. OC FP -0.100 vs. OC
SI 5.000E-03 SR 1.670E-04 ST 2.993E+01 CR AUTO HP 378 IR NONE
FL I 5.3Hz RT HIGH STABILITY REF 0.24150 SCE WRX SOLID AR 1.000E+00 LS YES
IT 1.000E-01 ITA 1.000E+00 EW 0.000E+00 DEN 8.440E+00 OC -0.464
Comment: Alloy 625, 4M LiCl, 95 C



Walter J Machowski 7/15/97

Model 352/252 Corrosion Analysis Software, v. 2.01
Filename: b:625cpp22.dat
Pstat: VStat[] Ver 2
CP CYCLIC POLARIZATION File Status: NORMAL
Date Run: 07-15-97 Time Run: 07:32:54

Cond. Time	CT	pass	s	Initial Pot.	IP	-0.1000	V oc
Cond. Pot.	CP	pass	V	Vertex 1 Pot.	V1	0.1000	V oc
Initial Delay	ID	20	s	I Threshold	IT	0.1000	A
				Final Pot.	FP	-0.1000	V oc
Scan Rate	SR	0.1670	mV/s	Curr. Range	CR	Auto	
Scan Incr.	SI	5.000	mV	Step Time	ST	29.93	s
No. of Points	HP	378					
				GI Time Const.	TC	Off	
Line Sync.	LS	yes		IR Mode	IR	none	
Rise Time	RT	high stability		Filter	FL	I 5.3Hz	
Working Elec.	WE	Solid		Ref. Elec.	RE	SCE 0.2415	V
Sample Area	AR	1.000	cm^2	Equiv. Wt.	EW	0.0000	g
Density	DE	8.440	g/ml	Open Circuit	OC	-0.4640	V

Comment: Alloy 625, 4M LiCl, 95 C

Walter J Machowski 7/15/97

Walter J Machowski
7/15/97

CPP of Alloy 625 11.5M Cl^- as LiCl, 95°C
w/crevice geometry

625cpp23.dat

Objective: To measure E_{rp} + E_{pit}
625 w/Machowski 7/17/97

Specimen: Alloy ~~825~~ Lot # NX9936AG
dimensions see p.29
600 grit polished
Start wt. 30.81041 g
end wt. 30.78505 g

Solution: 11.5M LiCl
243.7 g LiCl lot # 954236
+ DI water to 500 mL
start pH 5.580 end pH 6.879

T = 95°C Hg thermometer # 183304

Ref electrode: Fisher SCE # 13-620-51 S/N 3106339
Counter electrode: Pt flag

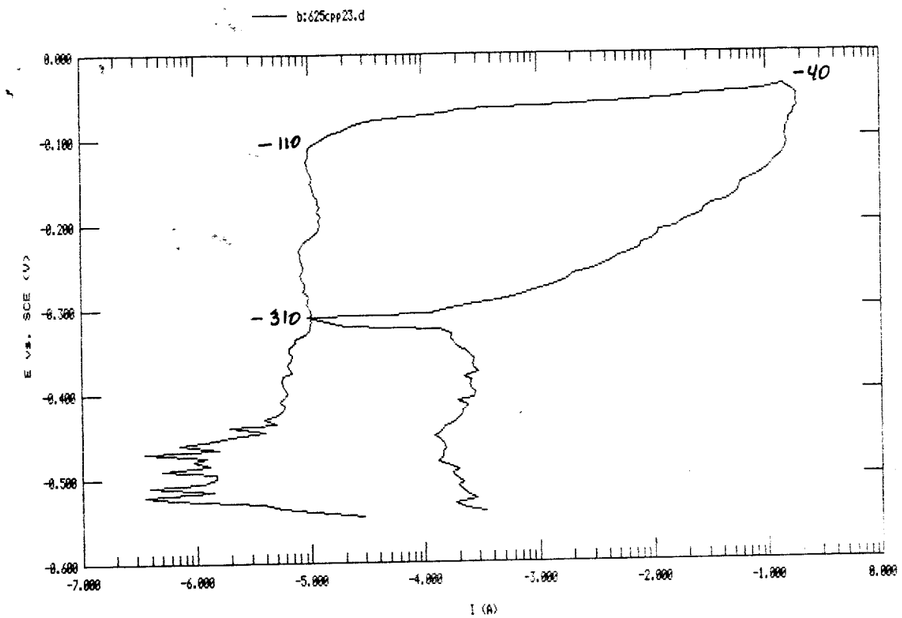
E_{corr} = -459 mV

E_{pt} = +375 mV

no crevice or pitting corrosion
some general attack

Walter J Machowski
7/21/97

Model 352/252 Corrosion Analysis Software, v. 2.01 Filename: b:625cpp23.dat Pstat: VStat[] Ver 2
CP CYCLIC POLARIZATION File Status: NORMAL Date Run: 07-16-97 Time Run: 07:35:27
CP PASS VS. R CT PASS IP -0.100 vs. OC ID 20.0 VI 0.100 vs. OC FP -0.100 vs. OC
SI 5.000E-03 SR 1.670E-04 ST 2.993E+01 CR AUTO NP 202 IR NONE
FL I 5.3Hz RT HIGH STABILITY REF 0.24150 SCE WRK SOLID AR 1.000E+00 LS YES
IT 1.000E-01 ITA 1.000E+00 EW 0.000E+00 DEN 8.440E+00 OC -0.445
Comment: Alloy 625, 11.5M LiCl, 95 C



Walter J. Mackowski 7/17/97

Model 352/252 Corrosion Analysis Software, v. 2.01
Filename: b:625cpp23.dat
Pstat: VStat[] Ver 2
CP CYCLIC POLARIZATION File Status: NORMAL
Date Run: 07-16-97 Time Run: 07:35:27

Cond. Time	CT	pass	s	Initial Pot.	IP	-0.1000	V oc
Cond. Pot.	CP	pass	V	Vertex 1 Pot.	VI	0.1000	V oc
Initial Delay	ID	20	s	I Threshold	IT	0.1000	A
				Final Pot.	FP	-0.1000	V oc
Scan Rate	SR	0.1670	mV/s	Curr. Range	CR	Auto	
Scan Incr.	SI	5.000	mV	Step Time	ST	29.93	s
No. of Points	NP	202					
				GI Time Const.	TC	Off	
Line Sync.	LS	yes		IR Mode	IR	none	
Rise Time	RT	high stability		Filter	FL	I 5.3Hz	
Working Elec.	WE	Solid		Ref. Elec.	RE	SCE 0.2415	V
Sample Area	AR	1.000	cm^2	Equiv. Wt.	EW	0.0000	g
Density	DE	8.440	g/ml	Open Circuit	OC	-0.4450	V

Comment: Alloy 625, 11.5M LiCl, 95 C

Walter J. Mackowski 7/17/97

Walter J. Mackowski 7/17/97

Cpp of Alloy 625 4M NaCl, 60°C, w/crevice security

625cpp24.dat

Objective: To measure E_{rp} and E_{pit}

Specimen: Alloy 625 lot # NX9936AG
dimensions see p.29
600 grit polished
start wt 31.23661 g.
end wt. 31.23290 g

Solution: 4M NaCl
233.73416 g NaCl lot # 960780
+ DI water to 1000 mL
start pH 7.248 end pH 7.625

T = 60°C Hg Thermometer # 183304

Ref electrode: Fisher SCE #13-620-51 S/N 3106345
Counter electrode: Pt flag

E_{corr} = -420 mV

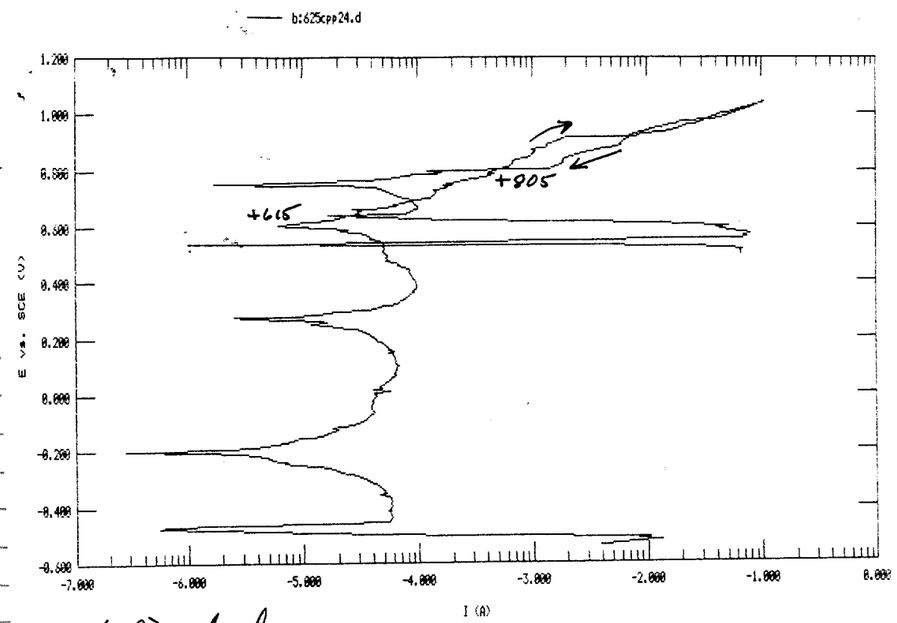
E_{pt} = +125 mV

NOTE: one crevice washer was put on backwards
i.e. flat side to specimen.

Some crevice corrosion visible in 4 or 5 areas.

Walter J. Mackowski
7/18/97

Model 352/252 Corrosion Analysis Software, v. 2.01 Filename: b:625cpp24.dat Pstat: VStat[] Ver 2
CP CYCLIC POLARIZATION File Status: NORMAL Date Run: 07-17-97 Time Run: 06:53:34
CP PASS vs. R CT PASS IP -0.100 vs. OC ID 20 S VI 0.100 vs. OC FP -0.100 vs. OC
SI 5.000E-03 SR 1.670E-04 ST 2.993E+01 CR AUTO NP 424 IR NONE
FL I 5.3Hz RT HIGH STABILITY REF 0.24150 SCE WRK SOLID AR 1.000E+00 LS YES
IT 1.000E-01 ITA 1.000E+00 EW 0.000E+00 DEN 8.440E+00 OC -0.435
Comment: Alloy 625, 4M NaCl, 60 C



Walter J Machonkin 7/18/97

Model 352/252 Corrosion Analysis Software, v. 2.01
Filename: b:625cpp24.dat
Pstat: VStat[] Ver 2
CP CYCLIC POLARIZATION
Date Run: 07-17-97

File Status: NORMAL
Time Run: 06:53:34

Cond. Time	CT	pass	s	Initial Pot.	IP	-0.1000	V oc
Cond. Pot.	CP	pass	V	Vertex 1 Pot.	V1	0.1000	V oc
Initial Delay	ID	20	s	I Threshold	IT	0.1000	A
				Final Pot.	FP	-0.1000	V oc
Scan Rate	SR	0.1670	mV/s	Curr. Range	CR	Auto	
Scan Incr.	SI	5.000	mV	Step Time	ST	29.93	s
No. of Points	NP	424					
				GI Time Const.	TC	Off	
				IR Mode	IR	none	
Line Sync.	LS	yes		Filter	FL	I 5.3Hz	
Rise Time	RT	high stability		Ref. Elec.	RE	SCE 0.2415	V
Working Elec.	WE	Solid		Equiv. Wt.	EW	0.0000	g
Sample Area	AR	1.000	cm^2	Open Circuit	OC	-0.4350	V
Density	DE	8.440	g/ml				

Comment: Alloy 625, 4M NaCl, 60 C

Walter J Machonkin 7/18/97

Walter J Machonkin
7/18/97

wJMachonkin 7/18/97

cpp of Alloy 625 11.5M LiCl, ~~75~~ 60°C
w/crevice geometry

625 cpp25.dat

Objective: To measure E_{rp} and E_{pt}

Specimen: Alloy 625 lot # NX9936AP
dimensions see p.29
600 grit polished
start wt. 31.16610 g
end wt. 31.19349 g

Solution: 11.5M LiCl
243.81 g LiCl lot # 954236
+ DI water to 500 mL
start pH 5.672 end pH 6.723

T = 60°C Hg thermometer # 183304

Ref. electrode: Fisher SCE #13-620-51 S/N 5129169

Counter electrode: Pt flag

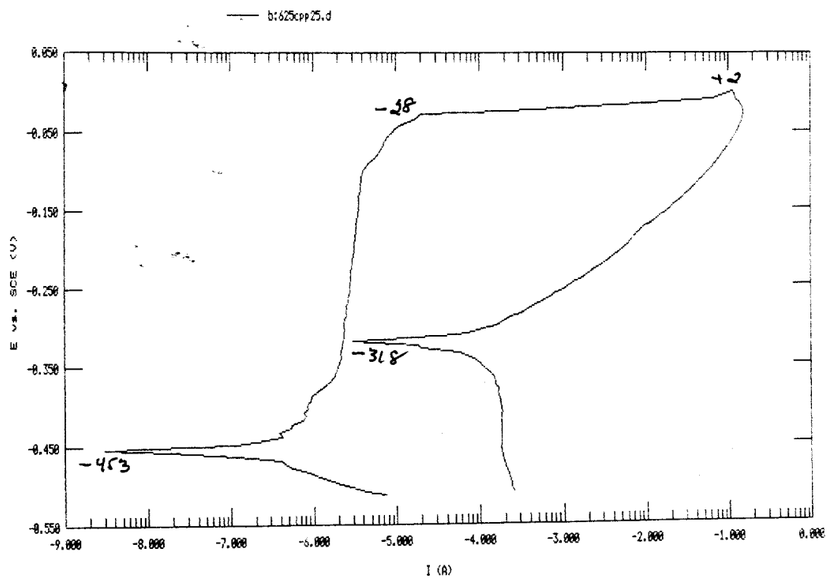
E_{corr} = -409 mV

E_{pt} = +392 mV

no crevice or pitting corrosion

Walter J Machonkin
7/22/97

Model 352/252 Corrosion Analysis Software, v. 2.01 Filename: b:625cpp25.dat Pstat: VStat[] Ver 2
CP CYCLIC POLARIZATION File Status: NORMAL Date Run: 07-18-97 Time Run: 07:13:59
CP PASS vs. R CT PASS IP -0.100 vs. OC ID 20 S VI 0.100 vs. OC FP -0.100 vs. OC
SI 5.000E-03 SR 1.670E-04 ST 2.993E+01 CR AUTO NP 286 IR NONE
FL I 5.3Hz RT HIGH STABILITY REF 0.24150 SCE WRK SOLID AR 1.000E+00 LS YES
IT 1.000E-01 ITA 1.000E+00 EW 0.000E+00 DEN 8.440E+00 OC -0.413
Comment: Alloy 625, 11.5M LiCl, 60 C



Walter J. Mackowski 7/22/97

Model 352/252 Corrosion Analysis Software, v. 2.01
Filename: b:625cpp25.dat
Pstat: VStat[] Ver 2
CP CYCLIC POLARIZATION File Status: NORMAL
Date Run: 07-18-97 Time Run: 07:13:59

Cond. Time	CT	pass	s	Initial Pot.	IP	-0.1000	V oc
Cond. Pot.	CP	pass	V	Vertex 1 Pot.	V1	0.1000	V oc
Initial Delay	ID	20	s	I Threshold	IT	0.1000	A
				Final Pot.	FP	-0.1000	V oc
Scan Rate	SR	0.1670	mV/s	Curr. Range	CR	Auto	
Scan Incr.	SI	5.000	mV	Step Time	ST	29.93	s
No. of Points	NP	286					
				GI Time Const.	TC	Off	
Line Sync.	LS	yes		IR Mode	IR	none	
Rise Time	RT	high stability		Filter	FL	I 5.3Hz	
Working Elec.	WE	Solid		Ref. Elec.	RE	SCE 0.2415	V
Sample Area	AR	1.000	cm^2	Equiv. Wt.	EW	0.0000	g
Density	DE	8.440	g/ml	Open Circuit	OC	-0.4130	V

Comment: Alloy 625, 11.5M LiCl, 60 C

Walter J. Mackowski 7/22/97

Walter J. Mackowski
7/22/97

CPP of Alloy 625 9M LiCl, 60°C, crevice geometry

625cpp26.dat

Objective: To measure E_{rp} and E_{pt}

Specimen: Alloy 625 lot # NX9936AC
dimension see p.29
600 grit polished
start wt. 31.34307 g
end wt. 31.34055 g

Solution: 9M LiCl
190.79 g LiCl lot # 954236
+ DI water to 500 mL
start pH 5.987 end pH 3.926

T = 60°C Hg thermometer # 183304

Ref. electrode: Fisher SCE #13-620-51 S/N 5129169

Counter electrode: Pt flag

E_{corr} = -414 mV
E_{Pt} = +237 mV

some crevice corrosion which was widespread but very shallow, almost like general attack

Walter J. Mackowski
7/22/97

Model 352/252 Corrosion Analysis Software, v. 2.01
CP CYCLIC POLARIZATION
CP PASS vs. R
SI 5.000E-03
FL 1 5.3Hz
IT 1.000E-01
Comment: Alloy 625, 9M LiCl, 60 C

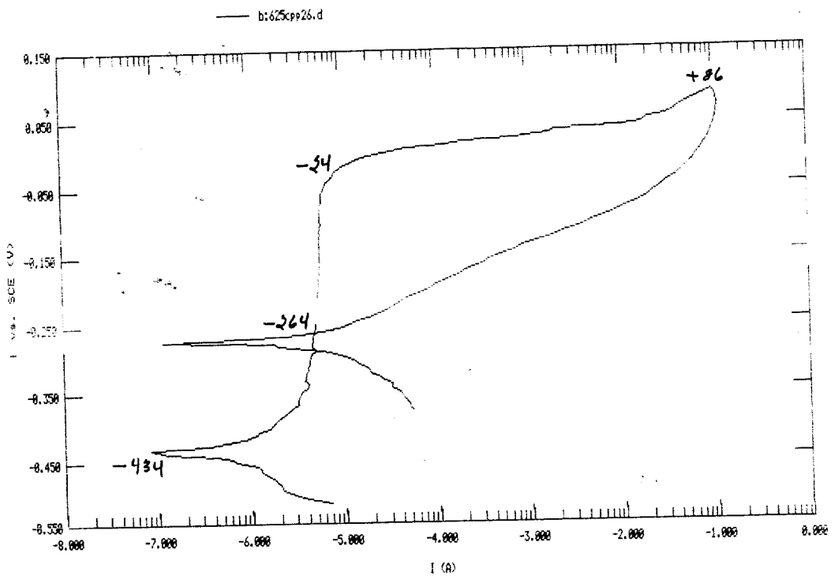
CT PASS
SR 1.670E-04
RT HIGH STABILITY
ITA 1.000E+00

File Status: NORMAL
IP -0.100 vs. OC
ST 2.993E+01
REF 0.24150 SCE
EW 0.000E+00

Filename: b:625cpp26.dat
Date Run: 07-18-97
ID 20.S
CR AUTO
WRK SOLID
DEN 8.440E+00

Time Run: 11:28:21
VI 0.100 vs. OC
NP 214
AR 1.000E+00
OC -0.414

Pstat: VStat[] Ver 2
FP -0.100 vs. OC
IR NONE
LS YES



Walter J Mackanik 7/22/97

Model 352/252 Corrosion Analysis Software, v. 2.01
Filename: b:625cpp26.dat
Pstat: VStat[] Ver 2
CP CYCLIC POLARIZATION
Date Run: 07-18-97

File Status: NORMAL
Time Run: 11:28:21

Cond. Time	CT	pass	s
Cond. Pot.	CP	pass	V
Initial Delay	ID	20	s
Scan Rate	SR	0.1670	mV/s
Scan Incr.	SI	5.000	mV
No. of Points	NP	214	–
Line Sync.	LS	yes	
Rise Time	RT	high stability	
Working Elec.	WE	Solid	
Sample Area	AR	1.000	cm^2
Density	DE	8.440	g/ml

Initial Pot.	IP	-0.1000	V oc
Vertex-1 Pot.	V1	0.1000	V oc
I Threshold	IT	0.1000	A
Final Pot.	FP	-0.1000	V oc
Curr. Range	CR	Auto	
Step Time	ST	29.93	s
GI Time Const.	TC	Off	
IR Mode	IR	none	
Filter	FL	1 5.3Hz	
Ref. Elec.	RE	SCE 0.2415	V
Equiv. Wt.	EW	0.0000	g
Open Circuit	OC	-0.4140	V

Comment: Alloy 625, 9M LiCl, 60 C

Walter J Mackanik 7/22/97

Walter J Mackanik
7/22/97

CPP of Alloy 625 4M LiCl, 60°C, crevice geometry

625cpp27.dat

Objective: To measure E_{rp} and E_{pit}

Specimen: Alloy 625 lot # NX 9936 AC
dimension see p.29
600 grit polished W J Mackanik 7/22/97
start wt. ~~31.28684 g~~ 31.28684 g
end wt. 31.28705 g

Solution: 4M LiCl
84.85 g LiCl lot # 954236
+ DI water to 500 mL
Start pH 6.347 end pH 6.382

T = 60°C Hg thermometer # 183301

Ref electrode: Fisher SCE #13-620-51 S/N 5129169

Counter electrode: Pt flag

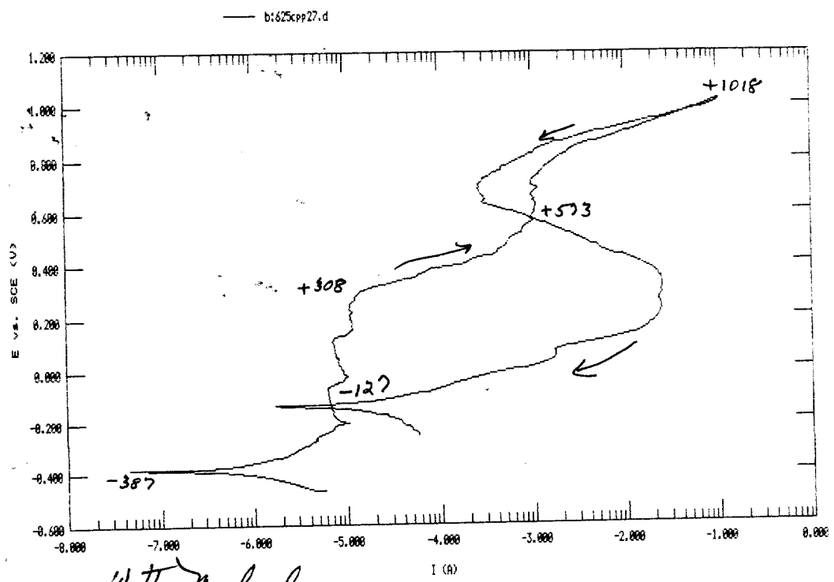
E_{corr} = -371 mV

E_{pit} = +66 mV

Crevice corrosion in many areas.

Walter J Mackanik
7/22/97

Model 352/252 Corrosion Analysis Software, v. 2.01 Filename: b:625cpp27.dat Pstat: VStat[] Ver 2
CP CYCLIC POLARIZATION File Status: NORMAL Date Run: 07-19-97 Time Run: 07:51:16
CP PASS vs. R CT PASS IP -0.100 vs. OC ID 20 S VI 0.100 vs. OC FP -0.100 vs. OC
SI 5.000E-03 SR 1.670E-04 ST 2.993E+01 CR AUTO NP 554 IR NONE
FL I 5.3Hz RT HIGH STABILITY REF 0.24150 SCE WRK SOLID AR 1.000E+00 LS YES
IT 1.000E-01 ITA 1.000E+00 EW 0.000E+00 DEN 8.440E+00 OC -0.372
Comment: Alloy 625, 4M LiCl, 60 C



Walter Mochowski 7/22/97

Model 352/252 Corrosion Analysis Software, v. 2.01
Filename: b:625cpp27.dat
Pstat: VStat[] Ver 2
CP CYCLIC POLARIZATION File Status: NORMAL
Date Run: 07-19-97 Time Run: 07:51:16

Cond. Time	CT	pass	s	Initial Pot.	IP	-0.1000	V oc
Cond. Pot.	CP	pass	V	Vertex 1 Pot.	V1	0.1000	V oc
Initial Delay	ID	20	s	I Threshold	IT	0.1000	A
				Final Pot.	FP	-0.1000	V oc
Scan Rate	SR	0.1670	mV/s	Curr. Range	CR	Auto	
Scan Incr.	SI	5.000	mV	Step Time	ST	29.93	s
No. of Points	NP	554					
				GI Time Const.	TC	Off	
Line Sync.	LS	yes		IR Mode	IR	none	
Rise Time	RT	high stability		Filter	FL	I 5.3Hz	
Working Elec.	WE	Solid		Ref. Elec.	RE	SCE 0.2415	V
Sample Area	AR	1.000	cm^2	Equiv. Wt.	EW	0.0000	g
Density	DE	8.440	g/ml	Open Circuit	OC	-0.3720	V

Comment: Alloy 625, 4M LiCl, 60 C

Walter Mochowski 7/22/97

Walter J Mochowski
7/22/97

CPP of Alloy 625 1M NaCl, 60°C, crevice geometry

625cpp28.dat

Objective: To measure E_{rp} and E_{pit}

Specimen: Alloy 625 lot # NX 9936AC
dimension see p.29
600 grit polished
start wt. 31.37016 g
end wt. 31.35458 g

Solution: 1M NaCl
58.42992 g NaCl lot# 960780
+ DI water to 1000 mL
start pH 6.239 end pH 5.477

T = 60°C Hg thermometer #183304

Ref. electrode: Fisher SCE #13-620-51 S/N 3106345

Counter electrode: Pt flag

E_{corr} = −386 mV

E_{pt} = +339 mV

some crevice corrosion in 2 or 3 areas

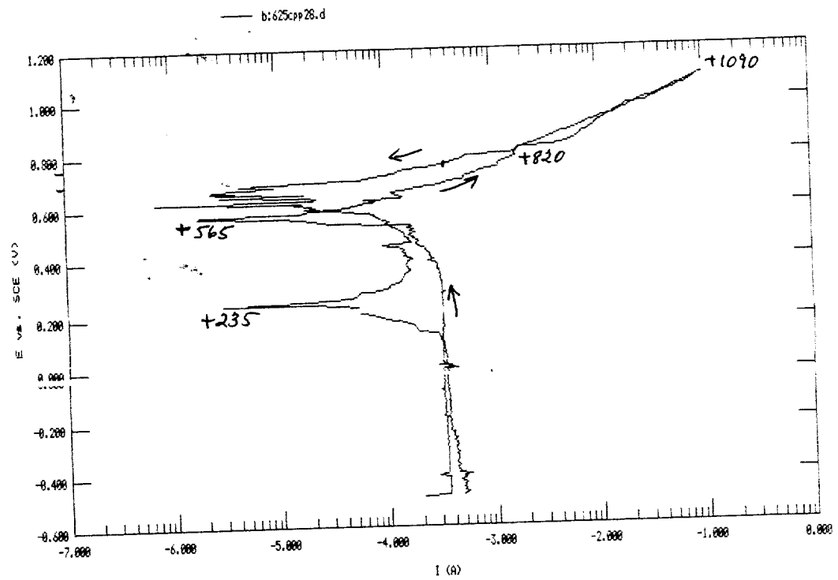
Walter J Mochowski
7/25/97

Model 352/252 Corrosion Analysis Software, v. 2.01
CP CYCLIC POLARIZATION
CP PASS vs. R — CT PASS
SI 5.000E-03 — SR 1.670E-04
FL I 5.3Hz — RT HIGH STABILITY
IT 1.000E-01 — ITA 1.000E+00
Comment: Alloy 625, 1M NaCl, 60 C

File Status: NORMAL
IP -0.100 vs. OC
ST 2.993E+01
REF 0.24150 SCE
EW 0.000E+00

Filename: b:625cpp28.dat
Date Run: 07-20-97 — Time Run: 13:11:22
ID 20 S
CR AUTO
WRK SOLID
DEN 8.440E+00

Pstat: VStatII Ver 2
VI 0.100 vs. OC — FP -0.100 vs. OC
HP 638 — IR NONE
AR 1.000E+00 — LS YES
OC -0.365



Walter J Mochowski 7/25/97

Model 352/252 Corrosion Analysis Software, v. 2.01
Filename: b:625cpp28.dat
Pstat: VStatII Ver 2
CP CYCLIC POLARIZATION — File Status: NORMAL
Date Run: 07-20-97 — Time Run: 13:11:22

Cond. Time	CT	pass	s	Initial Pot.	IP	-0.1000	V oc
Cond. Pot.	CP	pass	V	Vertex 1 Pot.	V1	0.1000	V oc
Initial Delay	ID	20	s	I Threshold	IT	0.1000	A
				Final Pot.	FP	-0.1000	V oc
Scan Rate	SR	0.1670	mV/s	Curr. Range	CR	Auto	
Scan Incr.	SI	5.000	mV	Step Time	ST	29.93	s
No. of Points	NP	638					
				GI Time Const.	TC	Off	
Line Sync.	LS	yes		IR Mode	IR	none	
Rise Time	RT	high stability		Filter	FL	I 5.3Hz	
Working Elec.	WE	Solid		Ref. Elec.	RE	SCE 0.2415	V
Sample Area	AR	1.000	cm^2	Equiv. Wt.	EW	0.0000	g
Density	DE	8.440	g/ml	Open Circuit	OC	-0.3850	V

Comment: Alloy 625, 1M NaCl, 60 C

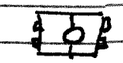
Walter J Mochowski 7/25/97

Walter J Mochowski
7/25/97

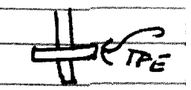
CPP of Alloy 625 — 0.3M NaCl, 60°C — crevice geometry

625cpp29.dat

Objective: To measure E_{rp} & E_{pt}



Specimen: Alloy 625 lot # NX 9936AB



cylindrical specimen w/ "clamp on" crevice
↳ 20 in/oz torque
600 grit polished
start wt. 12.25203 g
end wt. 12.25816 g

Solution: 0.3M NaCl
12.54990 g NaCl lot # 960780
+ DI water to 1000 mL
start pH ~~5.514~~ 7.707 [illegible] 7/28/97 — end pH 7.325

T = 60°C — Hg thermometer # 183304

Ref electrode: Fisher SCE #13-620-51 S/N 5129169
counter electrode: Pt flag

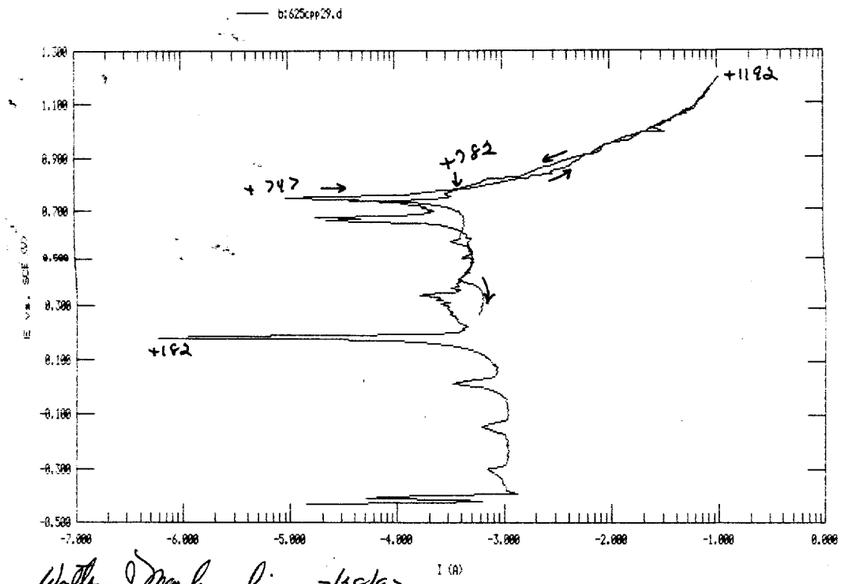
E_{corr} = -332 mV

E_{pt} = +553 mV

no crevice corrosion apparent

Walter J Mochowski
7/28/97

Model 352/252 Corrosion Analysis Software, v. 2.01 Filename: b:625cpp29.dat Pstat: VStat[] Ver 2
CP CYCLIC POLARIZATION File Status: NORMAL Date Run: 07-22-97 Time Run: 08:09:57
CP PASS vs. R CT PASS IP -0.100 vs. OC ID 20 S V1 0.100 vs. OC FP -0.100 vs. OC
SI 5.000E-03 SR 1.670E-04 ST 2.993E+01 CR AUTO HP 512 IR NONE
FL 1 5.3Hz RT HIGH STABILITY REF 0.24150 SCE WSK SOLID AR 1.000E+00 LS YES
IT 1.000E-01 ITA 1.000E+00 EW 0.000E+00 DEN 8.440E+00 OC -0.333
Comment: Alloy 625, 0.3M NaCl, 60 C



Walter J Machrowski 7/28/97

Walter J Machrowski 7/28/97

Model 352/252 Corrosion Analysis Software, v. 2.01
Filename: b:625cpp29.dat
Pstat: VStat[] Ver 2
CP CYCLIC POLARIZATION
Date Run: 07-22-97

File Status: NORMAL
Time Run: 08:09:57

Cond. Time	CT	pass	s	Initial Pot.	IP	-0.1000	V oc
Cond. Pot.	CP	pass	V	Vertex 1 Pot.	VI	0.1000	V oc
Initial Delay	ID	20	s	I Threshold	IT	0.1000	A
				Final Pot.	FP	-0.1000	V oc
Scan Rate	SR	0.1670	mV/s	Curr. Range	CR	Auto	
Scan Incr.	SI	5.000	mV	Step Time	ST	29.93	s
No. of Points	NP	512					
				GI Time Const.	TC	Off	
Line Sync.	LS	yes		IR Mode	IR	none	
Rise Time	RT	high stability		Filter	FL	1 5.3Hz	
Working Elec.	WE	Solid		Ref. Elec.	RE	SCE 0.2415	V
Sample Area	AR	1.000	cm^2	Equiv. Wt.	EW	0.0000	g
Density	DE	8.440	g/cm3	Open Circuit	OC	-0.3330	V
Density	DE	8.440	g/cm3	Open Circuit	OC	-0.3330	V

Comment: Alloy 625, 0.3M NaCl, 60 C

Walter J Machrowski
7/28/97

CPP of Alloy 625 0.1M NaCl, 60°C, crevice geometry

625cpp 30.dat

Objective: To measure E_{rp} and E_{pit}

Specimen: Alloy 625 lot # NX 9936AG
crevice geometry see p. 125
600 grit polished
start wt 12.23460 g
end wt. 12.24143 g

Solution: 0.1M NaCl
5.83000 g NaCl lot # 960780
+ DI water to 1000 mL
start pH 7.451 end pH 7.273

T = 60°C Hg thermometer # 183304

Ref. electrode: Fisher SCE #13-620-51 S/N 5129169
Counter electrode: Pt flag

E_{cor} = -233 mV

E_{pt} = +463 mV

no crevice corrosion

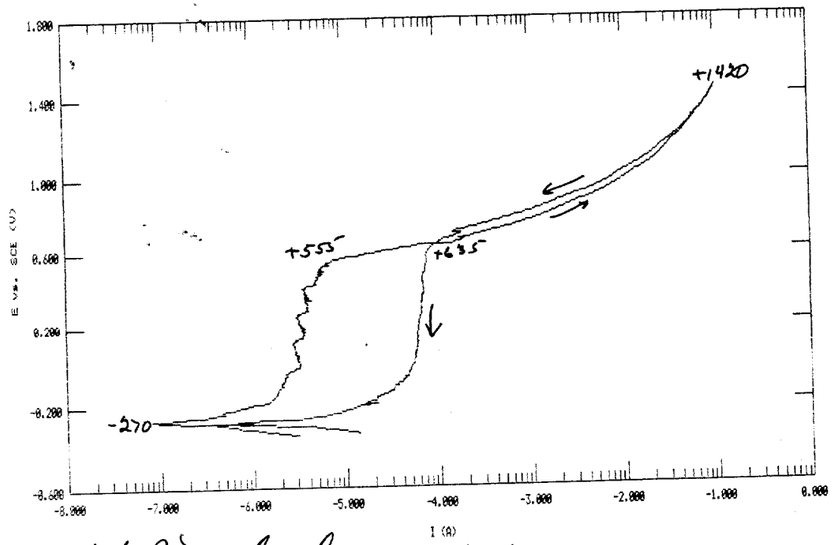
Walter J Machrowski
7/30/97

Model 352/252 Corrosion Analysis Software, v. 2.01
CP CYCLIC POLARIZATION
File Status: NORMAL
Date Run: 07-23-97
Filename: b:625cpp38.dat
Time Run: 07:11:28
Pstat: VStat[] Ver 2

CP	PASS vs. R	CT	PASS	IP	-0.100 vs. OC	ID	20 S	VI	0.100 vs. OC
SI	5.000E-03	SR	1.670E-04	ST	2.993E-01	CR	AUTO	NP	710
FL	I 5.3Hz	RT	HIGH STABILITY	REF	0.24150 SCE	WRK	SOLID	AR	1.000E+00
IT	1.000E-01	ITA	1.000E+00	EW	0.000E+00	DEN	8.440E+00	OC	-0.240

FP -0.100 vs. OC
IR NONE
LS YES

Comment: Alloy 625, 0.1M NaCl, 50 C



Walter J Machowski 7/29/97

Model 352/252 Corrosion Analysis Software, v. 2.01
Filename: b:625cpp38.dat
Pstat: VStat[] Ver 2
CP CYCLIC POLARIZATION
Date Run: 07-23-97
File Status: NORMAL
Time Run: 07:11:28

Cond. Time	CT	pass	s	Initial Pot.	IP	-0.1000	V oc
Cond. Pot.	CP	pass	V	Vertex I Pot.	VI	0.1000	V oc
Initial Delay	ID	20	s	I Threshold	IT	0.1000	A
				Final Pot.	FP	-0.1000	V oc
Scan Rate	SR	0.1670	mV/s	Curr. Range	CR	Auto	
Scan Incr.	SI	5.000	mV	Step Time	ST	29.93	s
No. of Points	NP	710					
				GI Time Const.	TC	OFF	
Line Sync.	LS	yes		IR Mode	IR	none	
Rise Time	RT	high stability		Filter	FL	I 5.3Hz	
Working Elec.	WE	Solid		Ref. Elec.	RE	SCE 0.2415	V
Sample Area	AR	1.000	cm^2	Equiv. Wt.	EW	0.0000	g
Density	DE	8.440	g/ml	Open Circuit	OC	-0.2400	V

Comment: Alloy 625, 0.1M NaCl, 50 C

Walter J Machowski 7/29/97

Walter J Machowski
7/29/97

CPP of C-22 4M NaCl aqueous 95°C

C22cpp31.dat

Objective: To measure E_{rp} and E_{pit}

Specimen: alloy C-22 lot# 2277-8-3175
spec. dimensions p.24
600 grit finish
start wt. 31.22254 g
end wt. 31.20502 g

Solution: 4M Cl^- as NaCl 20ppm $SO_4^=$ 10ppm NO_3^- 2ppm F^-
232.99177 g NaCl lot# 960780
20ml $SO_4^=$ 7/97
10ml NO_3^- 7/97
2ml F^- 7/97
} stock solution NB 157 p.174
+DI water to 1000mL
start pH 7.438 end pH 6.005

T = 95°C Hg thermometer # 183304

Ref. electrode: Fisher SCE #13-620-51 S/N 5129169
Counter electrode: Pt flag

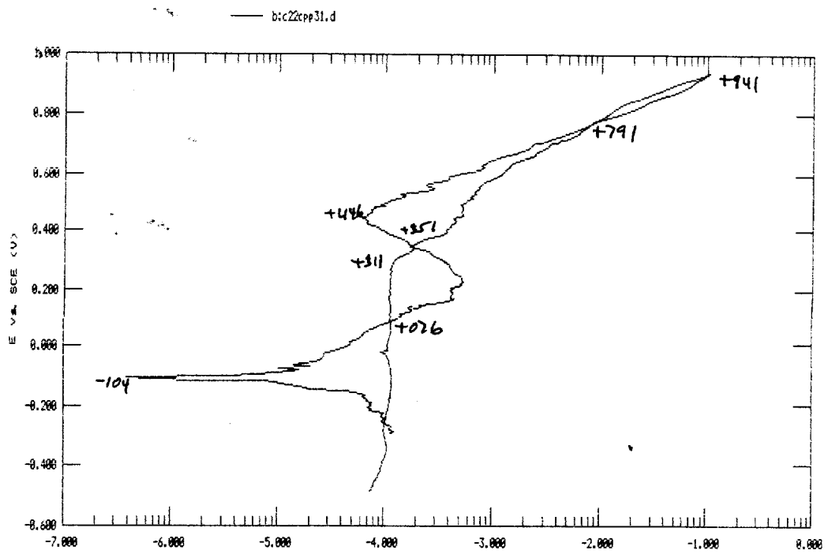
E_{corr} = -384mV

E_{pit} = +268mV

Some crevice corrosion in a few areas
gold color on areas away from crevice washer

Walter J Machowski
7/30/97

Model 352/252 Corrosion Analysis Software, v. 2.01 Filename: b:c22cpp31.dat Pstat: VStat[] Ver 2
CP CYCLIC POLARIZATION File Status: NORMAL Date Run: 07-24-97 Time Run: 07:38:28
CP PASS vs. A CT PASS IP -0.100 vs. OC ID 20 S V1 0.100 vs. OC FP -0.100 vs. OC
SI 5.000E-03 SR 1.670E-04 ST 2.993E+01 CR AUTO NP 533 IR NONE
FL I 5.3Hz RT HIGH STABILITY REF 0.24150 SCE WRK SOLID AR 1.000E+00 LS YES
IT 1.000E-01 ITA 1.000E+00 EW 0.000E+00 DEN 8.440E+00 OC -0.384
Comment: Alloy C-22, 4M NaCl, 95 C



Walter J Mackowski 7/30/97

Model 352/252 Corrosion Analysis Software, v. 2.01
Filename: b:c22cpp31.dat
Pstat: VStat[] Ver 2
CP CYCLIC POLARIZATION
Date Run: 07-24-97
File Status: NORMAL
Time Run: 07:38:28

Cond. Time	CT	pass	s	Initial Pot.	IP	-0.1000	V oc
Cond. Pot.	CP	pass	V	Vertex 1 Pot.	V1	0.1000	V oc
Initial Delay	ID	20	s	I Threshold	IT	0.1000	A
				Final Pot.	FP	-0.1000	V oc
Scan Rate	SR	0.1670	mV/s	Curr. Range	CR	Auto	
Scan Incr.	SI	5.000	mV	Step Time	ST	29.93	s
No. of Points	NP	533					
				GI Time Const.	TC	Off	
Line Sync.	LS	yes		IR Mode	IR	none	
Rise Time	RT	high stability		Filter	FL	I 5.3Hz	
Working Elec.	WE	Solid		Ref. Elec.	RE	SCE 0.2415	V
Sample Area	AR	1.000	cm^2	Equiv. Wt.	EW	0.0000	g
Density	DE	8.440	g/ml	Open Circuit	OC	-0.3840	V

Comment: Alloy C-22, 4M NaCl, 95 C

Walter J Mackowski 7/31/97

Walter J Mackowski
7/30/97

CPP of C-22 11.5M LiCl, 95°C, crevice geometry

C22 cpp 32.dat

Objective: To measure E_{rp} and E_{pit}

Specimen: Alloy C-22 lot # 2277-8-3175
specimen dimensions see p. 24
600 grit finish
start wt. 31.22112 g ⊕
end wt. 31.~~20502~~ g 31.19592 g
WJ Mackowski 7/30/97

Solution: 11.5M LiCl
243.6 g. LiCl lot # 972239
+ DI water to 500 mL
start pH 5.666 end pH 6.697

T = 95°C Hg thermometer # 183304

Reference electrode: Fisher SCE #13-620-51 S/N 5129169
counter electrode: Pt flag

E_{corr} = ~~-384 mV~~ -405 mV
WJ Mackowski 7/30/97

E_{pt} = ~~+268 mV~~ +357 mV

no crevice or pitting corrosion

⊕ not accurate wt – inadvertantly repolished after initial weighing and not re-weighed

Walter J Mackowski
7/31/97

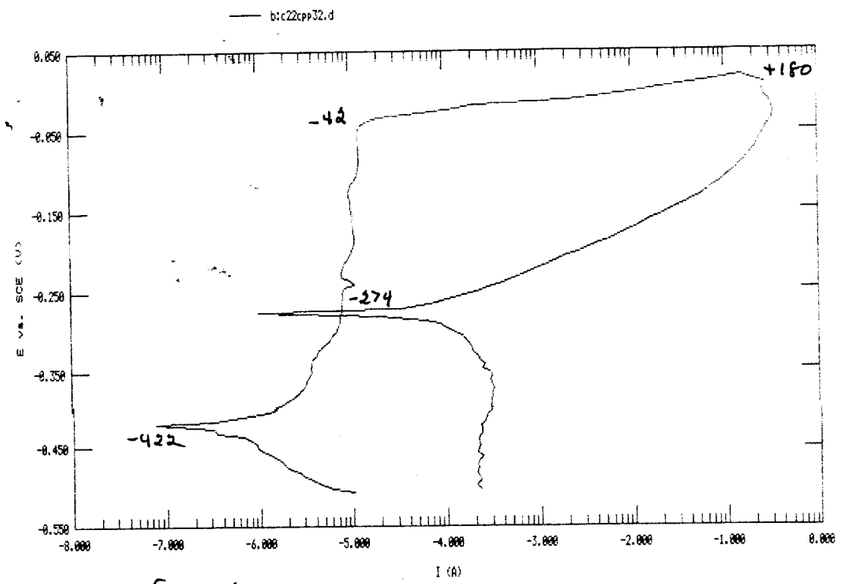
Model 352/252 Corrosion Analysis Software, v. 2.01
CP CYCLIC POLARIZATION
CP PASS vs. R — CT PASS
SI 5.000E-03 — SR 1.670E-04
FL I 5.3Hz — RT HIGH STABILITY
IT 1.000E-01 — ITA 1.000E+00
Comment: Alloy C-22, 11.5M LiCl, 95 C

File Status: NORMAL
IP -0.100 vs. OC
ST 2.993E+01
REF 0.24158 SCE
EW 0.000E+00

Filename: b:c22cpp32.dat
Date Run: 07-25-97
ID 20 S
CR AUTO
WRK SOLID
DEN 8.440E+00

Time Run: 07:09:41
V1 0.100 vs. OC
NP 210
AR 1.000E+00
OC -0.407

Pstat: VStat[] Ver 2
FP -0.100 vs. OC
IR NONE
LS YES



Walter J Machonkin 7/31/97

Model 352/252 Corrosion Analysis Software, v. 2.01
Filename: b:c22cpp32.dat
Pstat: VStat[] Ver 2
CP CYCLIC POLARIZATION — File Status: NORMAL
Date Run: 07-25-97 — Time Run: 07:09:41

Cond. Time	CT	pass	s	Initial Pot.	IP	-0.1000	V oc
Cond. Pot.	CP	pass	V	Vertex 1 Pot.	V1	0.1000	V oc
Initial Delay	ID	20	s	I Threshold	IT	0.1000	A
				Final Pot.	FP	-0.1000	V oc
Scan Rate	SR	0.1670	mV/s	Curr. Range	CR	Auto	
Scan Incr.	SI	5.000	mV	Step Time	ST	29.93	s
No. of Points	NP	210					
				GI Time Const.	TC	Off	
Line Sync.	LS	yes		IR Mode	IR	none	
Rise Time	RT	high stability		Filter	FL	I 5.3Hz	
Working Elec.	WE	Solid		Ref. Elec.	RE	SCE 0.2415	V
Sample Area	AR	1.000	cm^2	Equiv. Wt.	EW	0.0000	g
Density	DE	8.440	g/ml	Open Circuit	OC	-0.4070	V

Comment: Alloy C-22, 11.5M LiCl, 95 C

Walter J Machonkin 7/31/97

Walter J Machonkin
7/31/97

CPP of C-22 9M LiCl, 95°C, crevice geometry

C22cpp33.dat

Objective: To measure E_{rp} and E_{pit}.

Specimen: Alloy C-22 lot # 2277-8-3175
specimen dimensions sep 24
600 grit finish
start wt. 31.57601 g
end wt. 31.55392 g

Solution: 9M LiCl
190.7 g LiCl lot # 972239
+ DI Water to 500 mL
start pH 6.901 end pH 5.194

T = 95°C Hg thermometer # 183304

Reference electrode: Fisher SCE #13-620-51 S/N 5129169
Counter electrode: Pt flag

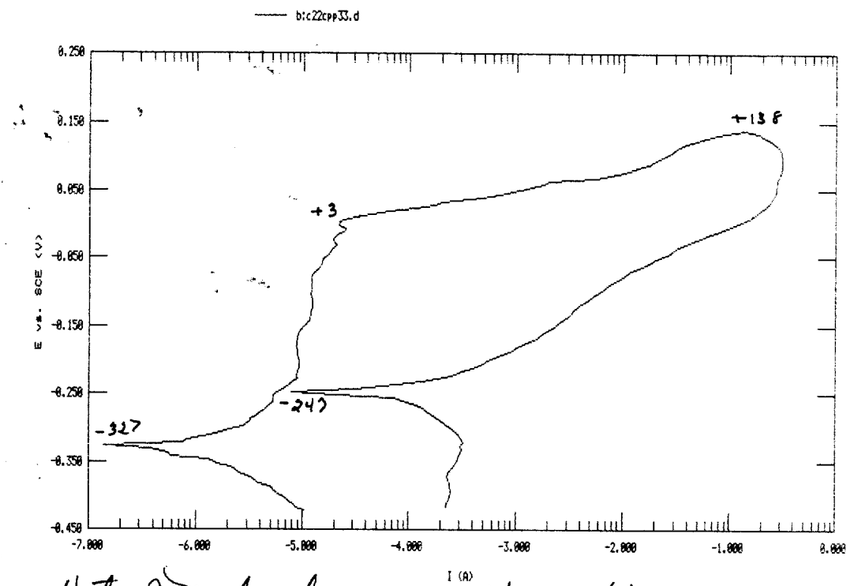
E_{corr} = -323 mV

E_{pit} = +65 mV

widespread crevice corrosion, very shallow, looks similar to general attack

Walter J Machonkin
8/1/97

Model 352/252 Corrosion Analysis Software, v. 2.01 Filename: b:c22cpp33.dat Pstat: VStat[] Ver 2
CP CYCLIC POLARIZATION File Status: NORMAL Date Run: 07-26-97 Time Run: 06:53:48
CP PASS vs. R CT PASS IP -0.100 vs. OC ID 20 S VI 0.100 vs. OC FP -0.100 vs. OC
SI 5.000E-03 SR 1.670E-04 ST 2.993E+01 CR AUTO NP 224 IR NONE
FL I 5.3Hz RT HIGH STABILITY REF 0.24150 SCE WRK SOLID AR 1.000E+00 LS YES
IT 1.000E-01 ITA 1.000E+00 EW 0.000E+00 DEN 8.440E+00 OC -0.322
Comment: Alloy C-22, 9M LiCl, 95 C



Walter J Machowski ~~8/1/8~~ 8/1/97

Model 352/252 Corrosion Analysis Software, v. 2.01
Filename: b:c22cpp33.dat
Pstat: VStat[] Ver 2
CP CYCLIC POLARIZATION File Status: NORMAL
Date Run: 07-26-97 Time Run: 06:53:48

Cond. Time	CT	pass	s	Initial Pot.	IP	-0.1000	V oc
Cond. Pot.	CP	pass	V	Vertex 1 Pot.	VI	0.1000	V oc
Initial Delay	ID	20	s	I Threshold	IT	0.1000	A
				Final Pot.	FP	-0.1000	V oc
Scan Rate	SR	0.1670	mV/s	Curr. Range	CR	Auto	
Scan Incr.	SI	5.000	mV	Step Time	ST	29.93	s
No. of Points	NP	224					
				GI Time Const.	TC	OFF	
Line Sync.	LS	yes		IR Mode	IR	none	
Rise Time	RT	high stability		Filter	FL	I 5.3Hz	
Working Elec.	WE	Solid		Ref. Elec.	RE	SCE 0.2415	V
Sample Area	AR	1.000	cm^2	Equiv. Wt.	EW	0.0000	g
Density	DE	8.440	g/cm3	Open Circuit	OC	-0.3220	V

Comment: Alloy C-22, 9M LiCl, 95 C

Walter J Machowski 8/1/97

Walter J Machowski
8/1/97

CPP of C-22 4M LiCl, 95°C, crevice geometry

C22cpp34.dat

Objective: To measure E_{rp} and E_{pit}.

Specimen: Alloy C-22 lot # 2277-8-3175
specimen dimensions see p. 24
600 grit finish
start wt. 31.56623 g
end wt. 31.55100 g

Solution: 4M LiCl
84.80g LiCl lot # 972239
+ DI water to 500 mL
start pH 7.355 end pH 6.060

T = 95°C Hg thermometer # 183304

Reference electrode: Fisher SCE # 13-620-51 S/N 5129169
Counter electrode: Pt flag

E_{corr} = -345 mV

E_{pt} = +320 mV

slight crevice corrosion in 2 places
gold color on areas away from crevice washers

Walter J Machowski
8/4/97

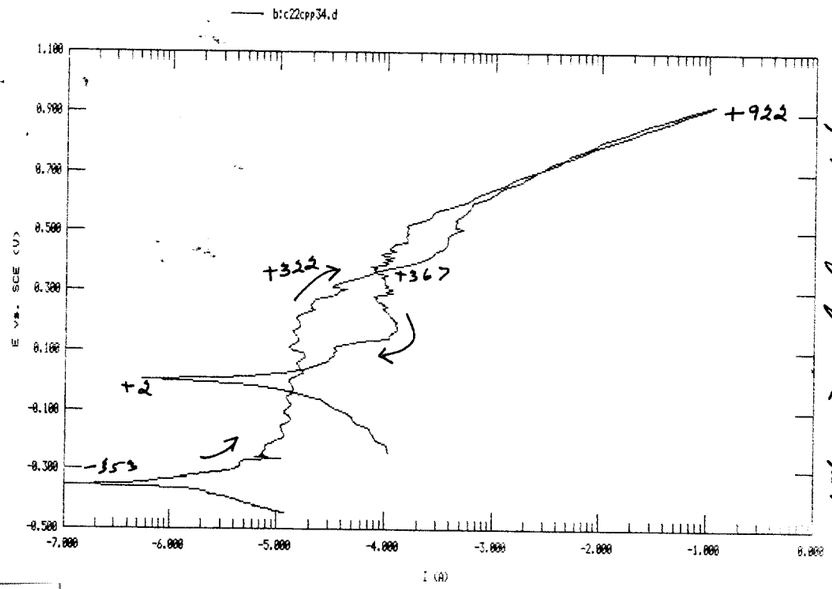
Model 352/252 Corrosion Analysis Software, v. 2.01
CP CYCLIC POLARIZATION
CP PASS vs. R — CT PASS
SI 5.000E-03 — SR 1.670E-04
FL I 5.3Hz — RT HIGH STABILITY
IT 1.000E-01 — ITA 1.000E+00
Comment: Alloy C-22, 4M LiCl, 95 C

File Status: NORMAL
IP -0.100 vs. OC
ST 2.993E+01
REF 0.24150 SCE
EW 0.000E+00

Filename: b:c22cpp34.dat
Date Run: 07-27-97
ID 20 S
CR AUTO
WRK SOLID
DEN 8.440E+00

Time Run: 07:11:43
V1 0.100 vs. OC
NP 507
AR 1.000E+00
OC -0.343

Pstat: VStat[] Ver 2
FP -0.100 vs. OC
IR NONE
LS YES



Walter J. Mackowski 8/4/97

Model 352/252 Corrosion Analysis Software, v. 2.01
Filename: b:c22cpp34.dat
Pstat: VStat[] Ver 2
CP CYCLIC POLARIZATION — File Status: NORMAL
Date Run: 07-27-97 — Time Run: 07:11:43

Cond. Time	CT	pass	s	Initial Pot.	IP	-0.1000	V oc
Cond. Pot.	CP	pass	V	Vertex 1 Pot.	V1	0.1000	V oc
Initial Delay	ID	20	s	I Threshold	IT	0.1000	A
				Final Pot.	FP	-0.1000	V oc
Scan Rate	SR	0.1670	mV/s	Curr. Range	CR	Auto	
Scan Incr.	SI	5.000	mV	Step Time	ST	29.93	s
No. of Points	NP	507					
				RT Time Const.	TC	Off	
Line Sync.	LS	yes		IR Mode	IR	none	
Rise Time	RT	high stability		Filter	FL	I 5.3Hz	
Working Elec.	WE	Solid		Ref. Elec.	RE	SCE 0.2415	V
Sample Area	SA	1.000	cm^2	Equiv. Wt.	EW	0.0000	g
Density	DE	8.440	g/ml	Open Circuit	OC	-0.3430	V

Comment: Alloy C-22, 4M LiCl, 95 C

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8/4/97

CPP of C-22 1M NaCl 95°C crevice geometry

C22 cpp 35.dat

Objective: To measure E_{rp} and E_{pit}.

Specimen: Alloy C-22 lot # 2277-8-3175
spec. dimensions see p.24
600 grit finish
start wt. 31.72355 g
end wt. 31.70109 g

Solution: 1M NaCl
58.46678 g NaCl lot # 960780
dilute to 1000 mL w/DI water

start pH 7.940 end pH 6.337

T = 95°C Hg thermometer # 183304

Reference electrode: Fisher SCE #13-620-51 S/N 5129169
Counter electrode: Pt flag

E_{corr} = -325 mV

E_{pp} = +695 mV

No crevice corrosion or pitting

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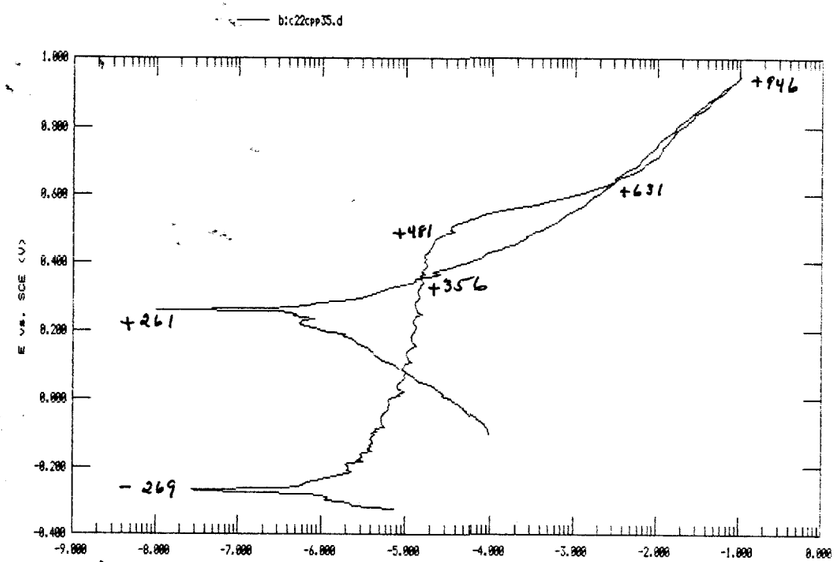
8/7/97

Model 352/252 Corrosion Analysis Software, v. 2.01 Filename: b:c22cpp35.dat Pstat: VStat[] Ver 2
CP CYCLIC POLARIZATION File Status: NORMAL Date Run: 07-28-97 Time Run: 08:03:07
CP PASS vs. R CT PASS IP -0.100 vs. OC ID 20 S V1 0.100 vs. OC FP -0.100 vs. OC
SI 5.000E-03 SR 1.670E-04 ST 2.993E+01 CR AUTO NP 465 IR NONE
FL I 5.3Hz RT HIGH STABILITY REF 0.24150 SCE WRK SOLID AR 1.000E+00 LS YES
IT 1.000E-01 ITA 1.000E+00 EW 0.000E+00 DEN 8.440E+00 OC -0.224
Comment: Alloy C-22, 1M NaCl, 95 C



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Model 352/252 Corrosion Analysis Software, v. 2.01
Filename: b:c22cpp35.dat
Pstat: VStat[] Ver 2
CP CYCLIC POLARIZATION File Status: NORMAL
Date Run: 07-28-97 Time Run: 08:03:07

Cond. Time	CT	pass	s	Initial Pot.	IP	-0.1000	V oc
Cond. Pot.	CP	pass	V	Vertex 1 Pot.	V1	0.1000	V oc
Initial Delay	ID	20	s	I Threshold	IT	0.1000	A
				Final Pot.	FP	-0.1000	V oc
Scan Rate	SR	0.1670	mV/s	Curr. Range	CR	Auto	
Scan Incr.	SI	5.000	mV	Step Time	ST	29.93	s
No. of Points	NP	465					
				GI Time Const.	TC	Off	
Line Sync.	LS	yes		IR Mode	IR	none	
Rise Time	RT	high stability		Filter	FL	I 5.3Hz	
Working Elec.	WE	Solid		Ref. Elec.	RE	SCE 0.2415	V
Sample Area	AR	1.000	cm^2	Equiv. Wt.	EW	0.0000	g
Density	DE	8.440	g/ml	Open Circuit	OC	-0.2240	V

Comment: Alloy C-22, 1M NaCl, 95 C

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8/7/97

C-22 Repassivation Potential

Objective: Measure E_{RP} of C-22

6/23/99

Specimen: Alloy C-22 #2277-8-3715 19 wetted
polished to 600 grit (re-used from C22RP20 p. 298 NB 086)
PTFE crevice gasket, total immersion
start wt. 37.44912 g
end wt. 37.18126 g

Solution: 4M Cl^- 85 ppm HCO_3^-
20 ppm $SO_4^=$ 10 ppm NO_3^- 2 ppm F^-
467.52 g NaCl #986519
0.25736 g $NaHCO_3$ #897789
40 ml $SO_4^=$
20 ml NO_3^- } 5/99 NB 086 p. 284
4 ml F^-
+ DI water to 2000 mL
start pH 7.450 end pH 7.504
95°C de-aerated w/zero N2
Potentiostat: EG+G 273 S/N 41108
Counter electrode: Pt flag
Ref: SCE 13-620-51 S/N 9214074

E_{corr} -501 mV Keithly 614 SN 704934
E_{Pt} -141 mV " "

hold @ +800 mV for ~ 2½ days

black smut, steel transpassive dissolution

same as C22RP20.DAT

6/23/99
Walter J Mackowski

Darrell D. 6/28/99

C-22 Repassivation Potential

Objective: Measure E_{RP} of C22

Specimen: C-22 same specimen as p.139 re-polished to 600 grit
neoprene gasket; fully immersed
PTFE crevice washer @ 100 in-oz

Solution: Saturated NaCl pH 3

600g NaCl Lot # 986519
+ DI water to 2000 mL
adjust pH w/ HCl Lot # 971828

95°C de-aerated w/ pure N_2

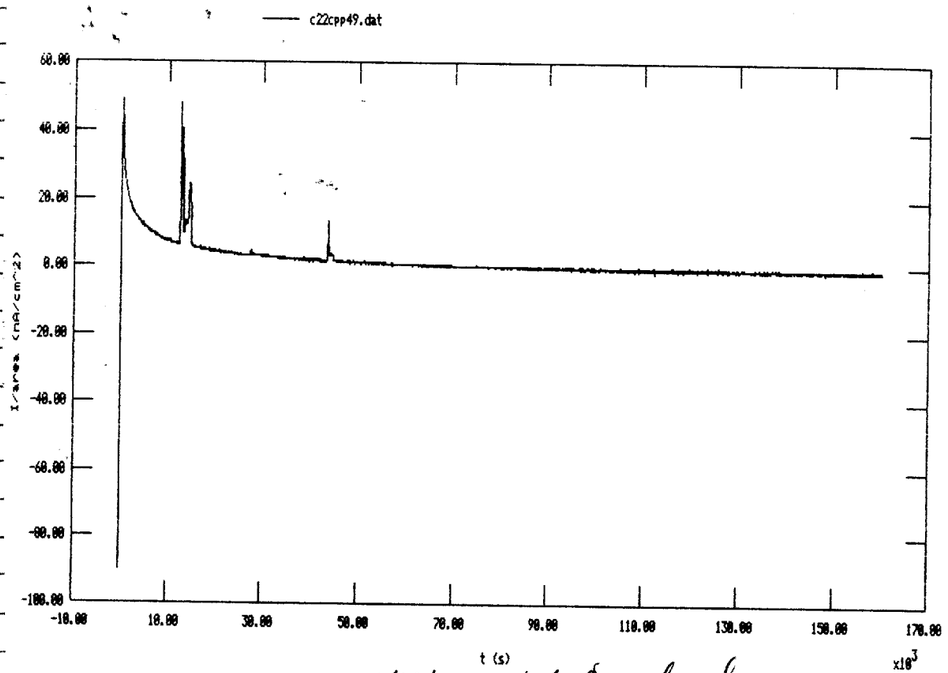
Potentiostat: EG&G 273 S/N 41108
Counter electrode: Pt flag
Reference: SCE 13-620-51 S/N 9214074

E_{corr} -347 mV Keithly 614 S/N 704934
E_{pt} -347 mV " "

take up to +850 and come down immediately to +750 and hold for ~6 days
end pH 4.701

Darrell D. 6/28/99

Model 352/252 Corrosion Analysis Software, v. 2.30 Filename: a:\c22cpp49.dat Pstat: VStat[] Ver 2
PS POTENTIOSTATIC File Status: NORMAL Date Run: 06-07-99 Time Run: 06:03:51
CP PASS vs. R CT PASS IP -0.200 vs. R ID 5 S TP 5.333E+01 TI 1.600E+05
CR AUTO MP 3000 SO Pass IR NONE FL I 5.3Hz RT HIGH STABILITY
REF 0.24150 SCE WRK SOLID AR 8.000E+00 LS YES EW 0.000E+00 DEN 8.900E+00 AU NO
OC -0.056
Comment: Alloy C-22 2277-8-3175 treated @ 870°c FOR 4 HRS; 4M Cl 95°C; -200mV



6/28/99 Walter J Machowski

Model 352/252 Corrosion Analysis Software, v. 2.30
Filename: a:\c22cpp49.dat
Pstat: VStat[] Ver 2
PS POTENTIOSTATIC File Status: NORMAL
Date Run: 06-07-99 Time Run: 06:03:51

Cond. Time	CT	pass	s	Initial Pot.	IP	-200.0E-3	V
Cond. Pot.	CP	pass	V	Time Step 1	T1	160.0E3	s
Initial Delay	ID	5	s	Stop On	SO	Pass	
Time/Pt.	TP	53.33	s	Curr. Range	CR	Auto	
No. of Points	MP	3000					
Line Sync.	LS	yes		IR Mode	IR	none	
Rise Time	RT	high stability		Filter	FL	I 5.3Hz	
Working Elec.	WE	Solid		Ref. Elec.	RE	SCE 241.5E-3V	
Sample Area	AR	8.000	cm^2	Equiv. Wt.	EW	0.0000	g
Density	DE	8.900	g/ml	AUX A/D	AU	no	
Open Circuit	OC	-56.00E-3	V				

Comment: Alloy C-22 2277-8-3175 treated @ 870°c FOR 4 HRS; 4M Cl 95°C; -200mV
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6/28/99
Walter J Machowski

C-22 Passive Current Density

Specimen: C-22 heat 2277-8-3715
polished to 600 grit heat treated 870°C 4 hrs
and water quenched

Solution: 4M Cl^- 85 ppm HCl_3^-
20 ppm $SO_4^=$ 10 ppm NO_3^- 2 ppm F^-
467.52 g NaCl # 985302
0.23588 g $NaHCl_3$ # 897789
40 ml $SO_4^=$
20 ml NO_3^- } 6/99 NB 218 p.145
4 ml F^-
+ DI water to 2000 mL

start pH 7.483

start wt. 12.31662 g

95°C de-aerated w/ gen N_2

Potentiostat: Versastat # 20104
Counter: Pt flag
Reference: SCE 13-620-51 s/N 8122010

E_{corr} -346 mV Keithly 614 s/N 704936
E_{Pt} -136 mV

$E_{applied}$ -200 mV SCE

specimen still silvery + uncorroded
current density ~ -.2 → +.2 nA
chart on p.142
←

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Duell D
5/31/2000

6/99

Stock Solutions

1000 ppm $SO_4^=$ as Na_2SO_4

1.47745 g Na_2SO_4 Lot # 901213
+ DI water to 1 liter
prep 6/24/99 exp 7/24/99

1000 ppm NO_3^- as $NaNO_3$

1.38059 g $NaNO_3$ Lot # 961772A
+ DI water to 1 liter
prep 6/24/99 exp 7/24/99

1000 ppm F^- as NaF

2.21871 g NaF Lot # 876405
+ DI water to 1 liter
prep 6/24/99 exp 7/24/99

6/24/99
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C-22 Passive Current Density

Specimen C-22 same on as p. 143 re-immersed

Solution: Same as p. 143 used for continuation

95°C de-aerated w/zero N_2

Potentiostat: Versastat #20104
Counter: Pt flag
Reference: SCE 13-620-51 S/N 8122010

E_{corr} −203 mV Keithly 614 S/N 704936
E_{Pt} −172 mV

$E_{applied}$ Ø mV SCE

specimen has crevice attack at the TPE interface

6/9/99
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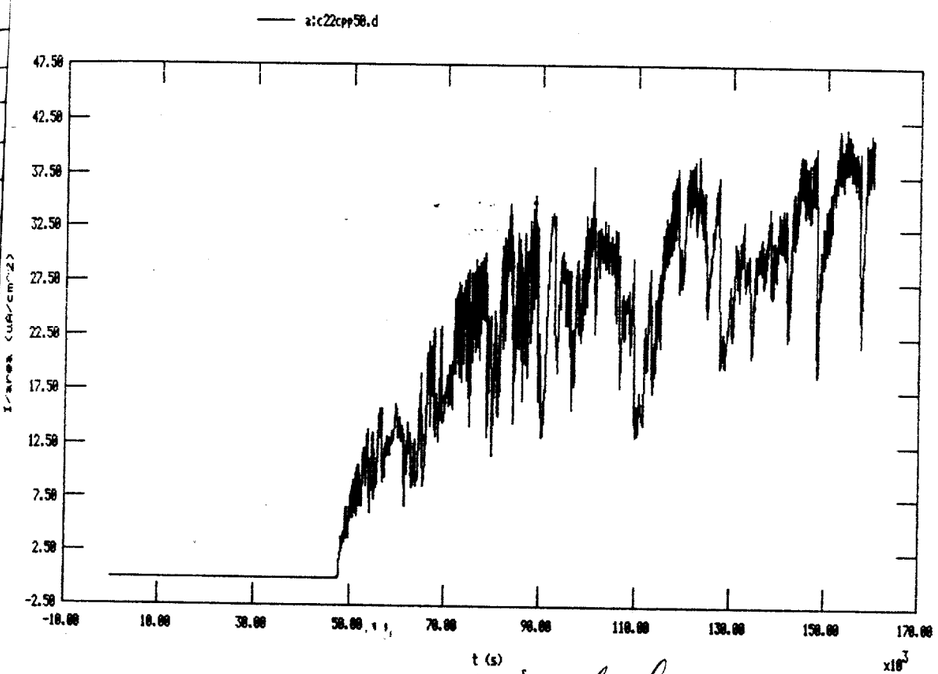
Model 352/252 Corrosion Analysis Software, v. 2.30 Filename: a:c22cpp50.dat Pstat: VStat[] Ver 2
PS POTENTIOSTATIC File Status: NORMAL Date Run: 06-09-99 Time Run: 10:25:01
CP PASS vs. R CT PASS IP 0.000 vs. R ID 5 S TP 5.333E+01 TI 1.600E+05
CR AUTO NP 3000 SO Pass IR NONE FL I 5.3Hz RT HIGH STABILITY
REF 0.24150 SCE WRK SOLID AR 0.000E+00 LS YES EW 0.000E+00 DEN 8.900E+00 AU NO
OC -0.184
Comment: Alloy C-22 2277-0-3175 treated @ 870°C for 4 hrs; 4M Cl 95°C; 0mV



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Model 352/252 Corrosion Analysis Software, v. 2.30
Filename: a:c22cpp50.dat
Pstat: VStat[] Ver 2
PS POTENTIOSTATIC File Status: NORMAL
Date Run: 06-09-99 Time Run: 10:25:01

Cond. Time	CT	pass	s	Initial Pot.	IP	0.0000	V
Cond. Pot.	CP	pass	V	Time Step 1	TI	160.0E3	s
Initial Delay	ID	5	s	Stop On	SO	Pass	
Time/Pt.	TP	53.33	s	Curr. Range	CR	Auto	
No. of Points	NP	3000					
Line Sync.	LS	yes		IR Mode	IR	none	
Rise Time	RT	high stability		Filter	FL	I 5.3Hz	
Working Elec.	WE	Solid		Ref. Elec.	RE	SCE 241.5E-3V	
Sample Area	AR	0.000	cm^2	Equiv. Wt.	EW	0.0000	g
Density	DE	8.900	g/ml	AUX A/D	AU	no	
Open Circuit	OC	-104.0E-3	V				

Comment: Alloy C-22 2277-0-3175 treated @ 870°C for 4 hrs; 4M Cl 95°C; 0mV

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7/8/99
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Passive Current Density

Specimen: C-22 ht 2277-8-3715
treated @ 870°C 18 hrs + water quenched
600 grit polished

Start wt. 12.31345

Solution: 4M Cl^- 85 ppm HCO_3^-
20 ppm $SO_4^=$ 10 ppm NO_3^- 2 ppm F^-
467.52 g NaCl # 985302
0.23588 g $NaHCO_3$ # 897789
40 ml $SO_4^=$
20 ml NO_3^- } 6/99 p. 145
4 ml F^-
+ DI water to 2000 mL

Start pH 7.400 end pH 8.691

95°C de-aerated w/ new N_2

Potentiostat: Versastat # 20104
Counter: Pt flag
Reference: SCE 13-620-51 S/N 8122010

E corr -150 mV Kirchly 614 S/N 704936
E Pt -624 mV " "

Eaphid +400 mV SCE

specimen has crevice attack at TFE interface

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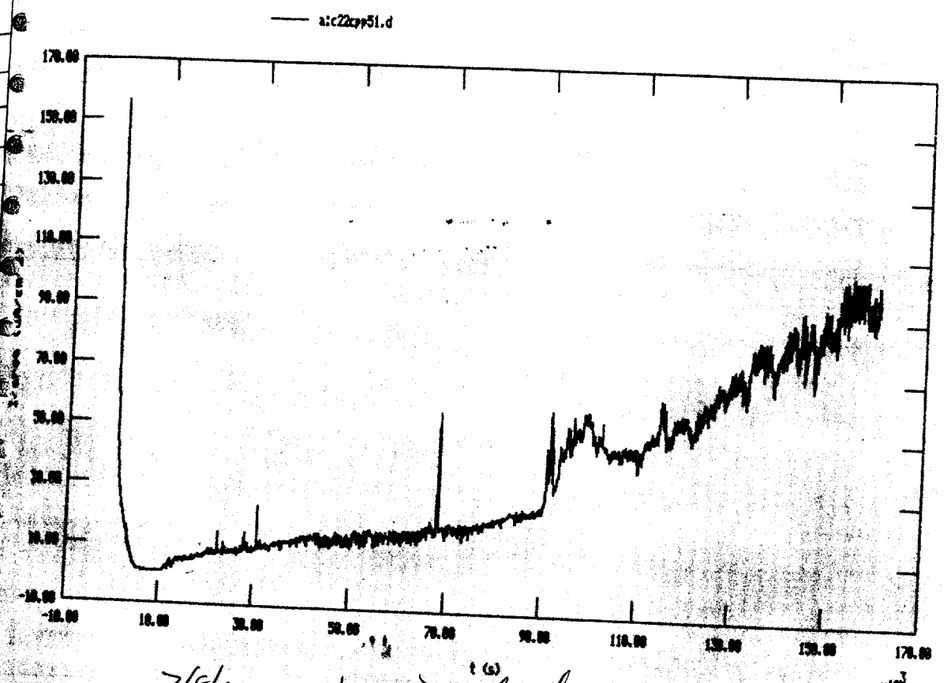
Model 352/252 Corrosion Analysis Software, v. 2.30 Filename: a:c22cpp51.dat Pstat: VStat[] Ver 2
PS POTENTIOSTATIC File Status: NORMAL Date Run: 06-10-99 Time Run: 14:16:14
CP PASS vs. R CT PASS IP 0.400 vs. R ID 5 S TP 5.333E+01 T1 1.600E+05
CR AUTO NP 3000 SO Pass IR NONE FL I 5.3Hz RT HIGH STABILITY
REF 0.24150 SCE WRK SOLID AR 8.000E+00 LS YES EW 8.000E+00 DEN 8.900E+00 AU NO
OC -0.615
Comment: C-22 ht# 2277-8-3175 treated @ 870°C for 8 hrs; 4M Cl 95°C; +400mV sce



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Model 352/252 Corrosion Analysis Software, v. 2.30
Filename: a:c22cpp51.dat
Pstat: VStat[] Ver 2
PS POTENTIOSTATIC File Status: NORMAL
Date Run: 06-10-99 Time Run: 14:16:14

Cond. Time	CT	pass	s	Initial Pot.	IP	400.0E-3	V
Cond. Pot.	CP	pass	V	Time Step 1	T1	160.0E3	s
Initial Delay	ID	5	s	Stop On	SO	Pass	
Time/Pt.	TP	53.33	s	Curr. Range	CR	Auto	
No. of Points	NP	3000					
Line Sync.	LS	yes		IR Mode	IR	none	
Rise Time	RT	high stability		Filter	FL	I 5.3Hz	
Working Elec.	WE	Solid		Ref. Elec.	RE	SCE 241.5E-3V	
Sample Area	AR	8.000	cm^2	Equiv. Wt.	EW	0.0000	g
Density	DE	8.900	g/ml	AUX A/D	AU	no	
Open Circuit	OC	-615.0E-3	V				

Comment: C-22 ht# 2277-8-3175 treated @ 870°C for 8 hrs; 4M Cl 95°C; +400mV sce

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Walter J Machowski

LT 825 P5

Specimen: Alloy 825 Ht. 4371FG
Start Wt. 39.08451 g
End Wt. 39.07482 g
2 PTFE crevice washers @ 100 in-oz

Solution: 1000 ppm Cl^- 85 ppm HCO_3^-
20 ppm $SO_4^=$ 10 ppm NO_3^- 2 ppm F^-
1.64138 g NaCl # 986519
0.11863 g $NaHCO_3$ # 897789
20 ml $SO_4^=$
10 ml NO_3^- } 6/99 NB 218 p.145
2 ml F^-
+ DI water to 1000 mL

Start pH 7.705 End pH 8.294

Temp 95°C Hg thermometer #0323007

Potentiostat: ESC 440 #1 Channel #1
Counter Electrode: Pt flag
Reference: Fisher SCE 13-620-51 S/N 8122010

E_{corr} + 25 mV KEITHLEY 617 SN 537418

E_{Pt} + 246 mV "

$E_{applied}$ +100 mV

Darrell Dean 12/15/99

C22 1 C

Specimen: C-22 Heat # 2277-8-3715
Start Wt. 47.41868 g
End Wt.
2 PTFE crevice washers @ 100 in-oz

Solution: 4M Cl^- 85 ppm HCO_3^-
20 ppm $SO_4^=$ 10 ppm NO_3^- 2 ppm F^-
467.52 g NaCl #985302
0.23617 g $NaHCO_3$ # 897789
40 ml $SO_4^=$
20 ml NO_3^- } 6/99 NB 218 p.145
4 ml F^-
+ DI water to 2000 mL

Start pH 7.237 End pH 8.827

Temp 95°C ~~Hg thermometer~~ 7/14/99 [illegible]

Potentiostat: ESC 440 #1 Channel #2
Counter Electrode: Pt flag
Reference: Fisher SCE 13-620-51 S/N 3106345

E_{corr} − 22 mV KEITHLEY 617 SN 537418
E_{Pt} + 172 mV "

$E_{applied}$ + 300 mV

Darrell Dean 12/15/99

C2225A

Specimen: C-22 Welded
Start wt. 38.99176 g
End wt.
2 PTFE crevice washers @ 100 in-oz

Solution: 4M Cl^- 85 ppm HCO_3^-
20 ppm $SO_4^=$ 10 ppm NO_3^- 2 ppm F^-
467.52 g NaCl # 985302
0.23467 g $NaHCO_3$ # 897789
40 ml $SO_4^=$
20 ml NO_3^- } 6/99 NB 218 p.145
4 ml F^-
+ DI water to 2000 mL

Start pH 7.176 End pH 8.200 T = 95°C

Potentiostat: ESC 440 #1 Channel #3
Counter electrode: Pt flag
Reference: Fisher SCE 13-620-51 S/N 0165403

E_{corr} −300 mV KEITHLEY 617 SN 537418

E_{Pt} +193 mV "

$E_{applied}$ 0.400 V_{SCE}

[signature] 12/15/99

C2223C

Specimen: C-22 Heat 2277-8-3175
Start Wt. 47.21603 g
End Wt. 47.21857 g
2 PTFE washers @ 100 in-oz

Solution: 1000 ppm Cl^- 85 ppm HCO_3^-
20 ppm $SO_4^=$ 10 ppm NO_3^- 2 ppm F^-
3.29100 g NaCl # 986519
0.23335 g $NaHCO_3$ # 897789
40 ml $SO_4^=$
20 ml NO_3^- } 6/99 NB 218 p.145
4 ml F^-
+ DI water to 2000 mL 4/ 7/16/99 wom

Start pH ~~7.874~~ 7.155 End pH
T = 95°C aerated w/ gen air

Potentiostat: ESC 440 #1 Channel # ~~5~~ 4
Counter electrode: none
Reference: Fisher SCE 13-620-51 S/N 9214083

E_{corr} −136 mV SCE KEITHLEY 617 SN 537418
E_{Pt} +61 mV SCE "

$E_{applied}$ ⇒ open circuit

Solution: 4M Cl^- 85 ppm HCO_3^-
20 ppm $SO_4^=$ 10 ppm NO_3^- 2 ppm F^-
467.52 g NaCl # 985302
0.23577 g $NaHCO_3$ # 897789
40 ml $SO_4^=$
20 ml NO_3^- } 6/99 NB 218 p.145 END pH 9.05
4 ml F^-
+ DI water to 2000 mL [signature] 12/15/99

OC 825 C I AA

Specimen: Alloy 825 Ht. # 4371FC
Start wt. 39.29845 g
End wt. 39.29057 g

2 PTFE crevice washers @ 100 in-oz

Solution: 1000 ppm Cl^- 85 ppm HCO_3^-
20 ppm $SO_4^=$ 10 ppm NO_3^- 2 ppm F^-
3.29100 g NaCl # 986519
0.23335 g $NaHCO_3$ # 897789
40 ml $SO_4^=$
20 ml NO_3^- } 6/99 NB 218 p.145
4 ml F^-
+ DI water to 2000 mL

Start pH 7.874 End pH 8.417

T = 95°C Hg thermometer 183502
aerated w/ zero air

Potentiostat: ESC 440 #1 Channel #5
Counter Electrode: none
Reference: Fisher SCE 13620-51 S/N 5129169

E corr -311 mV Keithley 617 SN 587418
E pt. +136 mV "

E applied ⇒ open circuit

Darrell Dunn 12/15/99

Passive Current Density

Specimen: C-22 Ht. 2277-8-3715
treated @ 870°C for 12 hrs water quenched
600 grit polished
Start wt. 12.26784 g

Solution: 4M Cl^- 85 ppm HCO_3^-
20 ppm $SO_4^=$ 10 ppm NO_3^- 2 ppm F^-
467.52 g NaCl # 985302
0.23564 g $NaHCO_3$ # 897789
40 ml $SO_4^=$
20 ml NO_3^- } 6/99 NB 218 p.145
4 ml F^-
+ DI water to 2000 mL

Start pH 7.137

TEST WAS NOT CONDUCTED

Darrell Dunn

12/15/99

Pages 156 Through 160 Are Intentionally
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ADDITIONAL INFORMATION FOR SCIENTIFIC NOTEBOOK #: 218

Document Date:	04/10/1997
Availability:	Southwest Research Institute® Center for Nuclear Waste Regulatory Analyses 6220 Culebra Road San Antonio, Texas 78228
Contact:	Southwest Research Institute® Center for Nuclear Waste Regulatory Analyses 6220 Culebra Road San Antonio, TX 78228-5166 Attn.: Director of Administration 210.522.5054
Data Sensitivity:	■"Non-Sensitive" □ Sensitive □"Non-Sensitive - Copyright" □ Sensitive - Copyright
Date Generated:	04/07/1997
Operating System: (including version number)	IMB compatible
Application Used: (including version number)	NA
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File Types: (.exe, .bat, .zip, etc.)	dat
Remarks: (computer runs, etc.)	Media contains: Data files containing electrochemical information