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Scientific Notebook # 366, continue testing in S/N # 485

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C-22 PASSIVE CURRENT DENSITY

CONTINUED FROM SCIENTIFIC NOTEBOOK 157 Pg. 208

VJ 7/22

SPECIMEN ALLOY C22 WELDED

BASE METAL HEAT 2277-8-3235

FILLER ROD 622 XX1045BG11

SPECIMEN POLISHED TO 600 GRIT FINISH

NO PTFE CREVICE WASHERS

START WT ~~38.0~~ 38.50656 g 8/25/2000

SOLUTION 4M Cl^- 85PPM HCO_3 20PPM $SO_4^=$

10 PPM NO_3^- 2PPM F^- 2000 ML PREPARED AS FOLLOWS

467.5 g NaCl 985362

0.240 g $NaHCO_3$ 897789

40 mL SO_4 -8/99 P6 STOCK SOLUTION

20 mL NO_3 -8/99 P6

4 mL F^- 8/99 P6 STOCK SOLUTION.

+ DI WATER TO 2000 mL

START pH 7.648 FISHER ACCUMET SN 3340

T = 95°C Hg THERMOMETER ~~C96-106~~ 8/23/99 C98-106

SOLUTION DEAERATED W/ 99.999% N_2 PASSED THROUGH

OXYGEN TRAP W/ STAINLESS LINE

POTENTIOSTAT EG&G VERSASTAT SN 20104

FISHER SCG 13-620-51 SN 813146

Ecorr -676 mV KEITHLEY 614 SN 467374

Ept -123 mV

E APPLIED 0.0 mV

TEST STARTED. 8/16/99

END WT 38.50848g

DATA SAVED AS C22CPP53.DAT

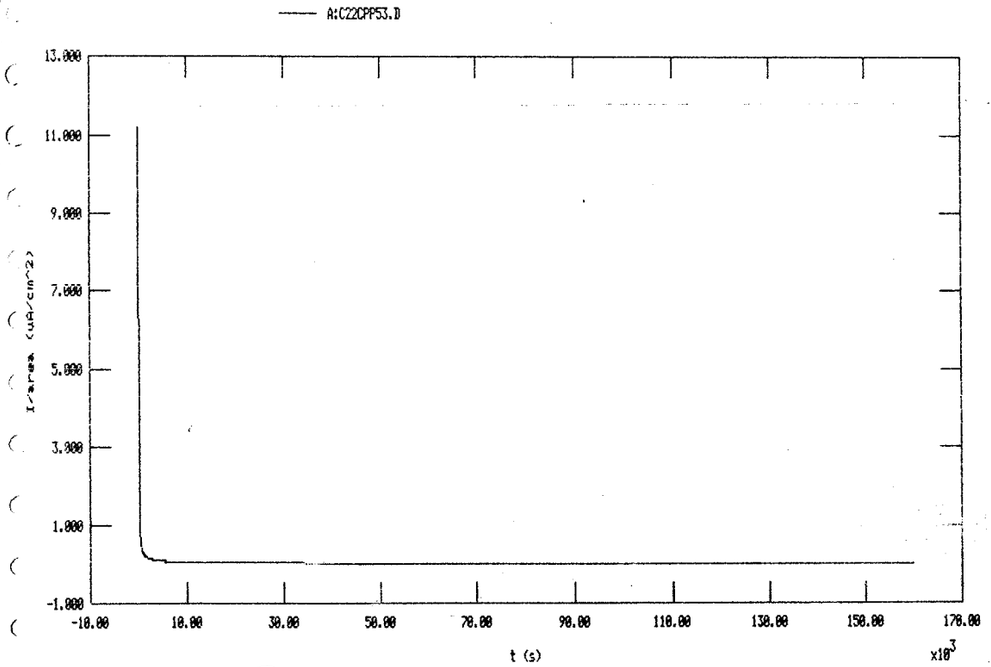
PASSIVE CD 0.027 - 0.028 μA/cm²

NO SIGN OF ATTACK

8/19/99

C-22 PASSIVE CURRENT DENSITY.

Model 352/252 Corrosion Analysis Software, v. 2.30 Filename: A:C22CPP53.DAT Pstat: VStat[] Ver 2
PS POTENTIOSTATIC File Status: NORMAL Date Run: 07-28-99 Time Run: 12:30:23
CP PASS vs. R CT PASS IP 0.000 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 2.000E+01 LS YES EW 0.000E+00 DEN 8.900E+00 AU NO
OC -0.676
Comment: Alloy C-22 2277-8-3235 welded 4M Cl deaerated



8/19/99

Model 352/252 Corrosion Analysis Software, v. 2.30
Filename: A:C22CPP53.DAT
Pstat: VStat[] Ver 2
PS POTENTIOSTATIC File Status: NORMAL
Date Run: 07-28-99 Time Run: 12:30:23

Cond. Time	CT	pass	s	Initial Pot.	IP	0.0000	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	20.00	cm^2	Equiv. Wt.	EW	0.0000	g
Density	DE	8.900	g/ml	AUX A/D	AU	no	
Open Circuit	OC	-676.0E-3	V				

Comment: Alloy C-22 2277-8-3235 welded 4M Cl deaerated

8/19/99

STOCK SOLUTIONS 8/99

1000 ppm $SO_4^=$ – 8/99

1.47827 g Na_2SO_4 Lot # 901213
prep 8/13/99 exp 9/13/99

1000 ppm NO_3^- – 8/99

1.38013 g $NaNO_3$ Lot # 961772A
prep 8/13/99 exp 9/13/99

1000 ppm F^- – 8/99

2.21068 g NaF Lot # 876405
prep 8/13/99 exp 9/13/99

Walter J Maeburch
9/10/99

STOCK SOLUTIONS 9/99

1000 ppm $SO_4^=$ – 9/99

1.48161 g Na_2SO_4 LOT 901213
PREP 9/23/99 EXP 10/23/99

1000 ppm NO_3 – 9/99

1.37904 g $NaNO_3$ LOT 961772A
PREP 9/23/99 EXP 10/23/99

1000 ppm F – 9/99
2.21107 g NaF LOT 876405
PREP 9/23/99 EXP 10/23/99

9/23/99

C-22 REPASSIVATION POTENTIAL

SPECIMEN C-22 HEAT 2277-8-3175
600 GRIT FINISH
PTFE CREVICE BLOCKS 50 in·oz w/ PROTO 6/02
PTFE BLOCKS NEW w/ C-276 HARDWARE

SOLUTION 4M Cl^- 85 PPM HCO_3 20 PPM SO_4^{2-}
10 PPM NO_3 100 PPM F^- 2000 mL
467.3 g NaCl LOT 985302
0.240 g $NaHCO_3$ LOT ~~985302~~ DD 8/12/99 897784
0.442 g NaF LOT 896405
40 mL SO_4 - 8/99 STOCK SOLUTION P6
20 mL NO_3 - 8/99 STOCK SOLUTION P6
+ DI WATER TO 2000 mL
START pH 7.47 FISHER ACCUMET SN 3390
T = 95°C Hg THERMOMETER 183303
SOLUTION DEAERATED w/ 99.999 % N_2

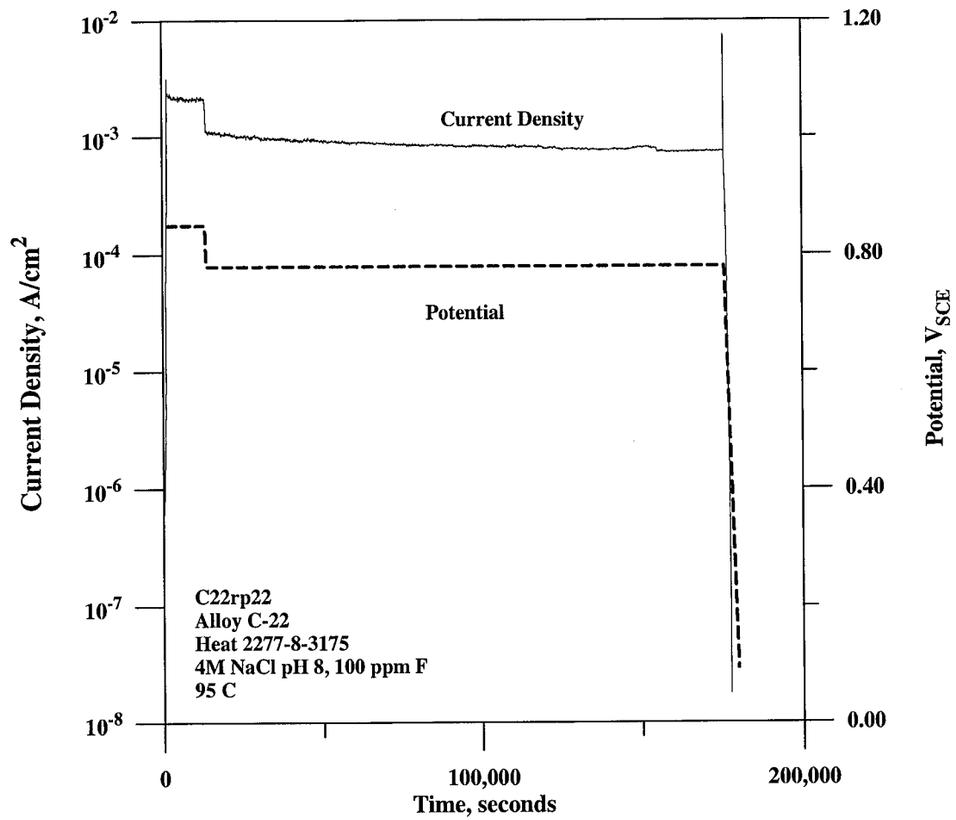
POTENTIOSTAT EG&G 273

E_{corr} -651 mV SCE KEITHLEY 614 SN 704934
E_{pt} -239 mV SCE " " "

TEST STARTED 8/17/99
Had one small area of local'd corrosion
DATA SAVED AS ~~C22RP20.DAT~~ C22RP22.DAT
end pH 5.606 end wt. 38.19980 g

This specimen was repolished + used for C22RP28

8/20/99



$i < 10^{-5}$ A/cm² AT 588 mV
$i < 10^{-6}$ A/cm² AT 529 mV
$i < 0$ A/cm² AT 489 mV

8/20/99

C-22 Repassivation Potential

Specimen: C-22 Heat 2277-8-3175
600 grit finish
PTFE crevice blocks as on p. 8

Solution: 4M Cl^- 85 ppm HCO_3^-
20 ppm $SO_4^=$ 10 ppm NO_3^- 2 ppm F^-
467.3 g NaCl Lot # 985302
0.23494 g $NaHCO_3$ Lot # 897789
40 ml $SO_4^=$
20 ml NO_3^- } Stock sol'ns p. 6
4 ml F^-
+ DI water to 2000 mL

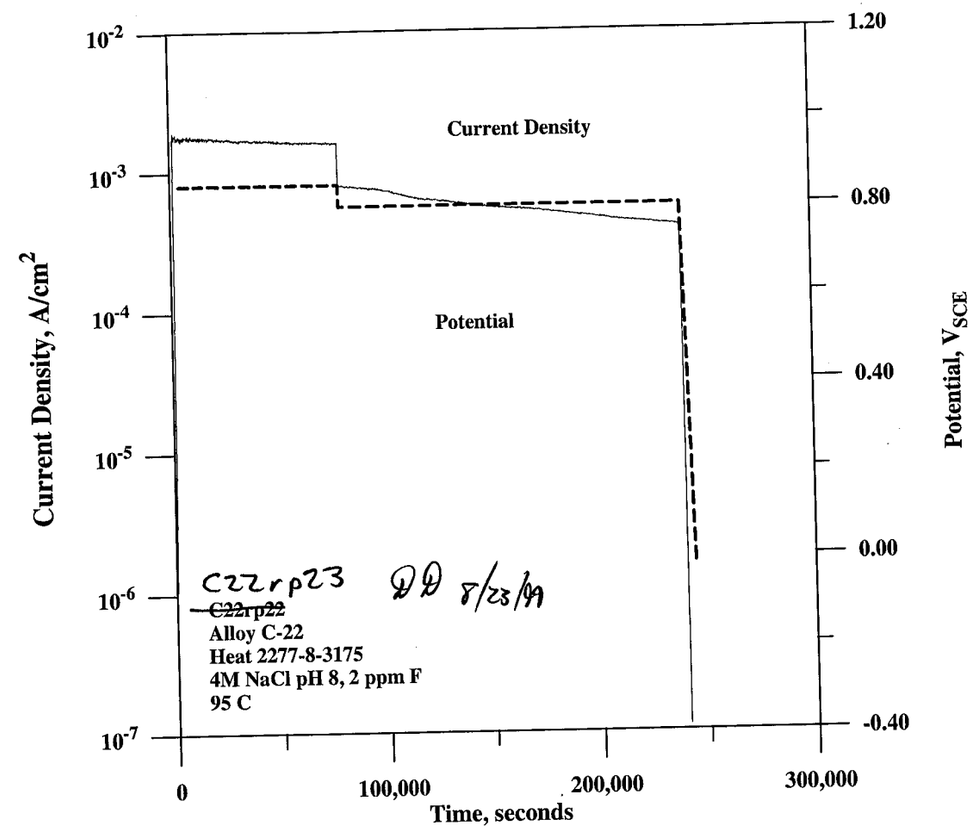
Start pH 7.043
Start wt 39.82059 g

T = 95°C Hg thermometer # 183303
de-aerated w/ 99.999% N_2

Potentiostat EG&G 273

E corr − 248 mV Keithley 614 S/N 704934
E pt − 462 mV " " " "

TEST STARTED 8/20/99
DATA SAVED AS C22rp23.DAT
TRANSPASSIVE DISSOLUTION - GRAINS VISABLE
CREVICE AREAS LOOK PROTECTED IN MOST
AREAS SOME SHALLOW CREVICE CORROSION IN
A FEW AREAS
END WT 38.96864 g
END pH 5.38
SPECIMEN NOT SAVED - REUSED IN LATER TEST
8/24/99



$i < 10^{-5}$ A/cm² 668 mV SCE

$i < 10^{-6}$ A/cm² 616 mV SCE

$i < 0$ A/cm² 583 mV SCE

8/23/99

C-22 PASSIVE CURRENT DENSITY

SPECIMEN C-22 2277-8-3235
FILLER ROD 622 XX 1045 BG11
SPECIMEN POLISHED TO 600 GRIT FINISH
NO PTFE CREVICE WASHERS
START WT 38.50848 g
SAME AS p 4
END WT ~~38.50057 g~~ DD 8/23/99 38.50226 g
SOLUTION 4M Cl⁻ 85PPM HCO_3 20PPM $SO_4^{=}$ 10 PPM NO_3
2PPM F^- SAME AS p 4

T = 95 °C Hg THERMOMETER ~~C96-106~~ DD 8/23/99 C98-106
SOLUTION DEAERATED W/ 99.999% N_2 GAS PASSED
THROUGH O_2 TRAP

POTENTIOSTAT VERSASTAT SN 20104
FISHER SCE 13-620-51 SN 8131146

E_{CORR} − 688 mV KEITHLEY 614 SN 467374
E_{PT} −107 mV "
$E_{APPLIED}$ 200 mV SCE

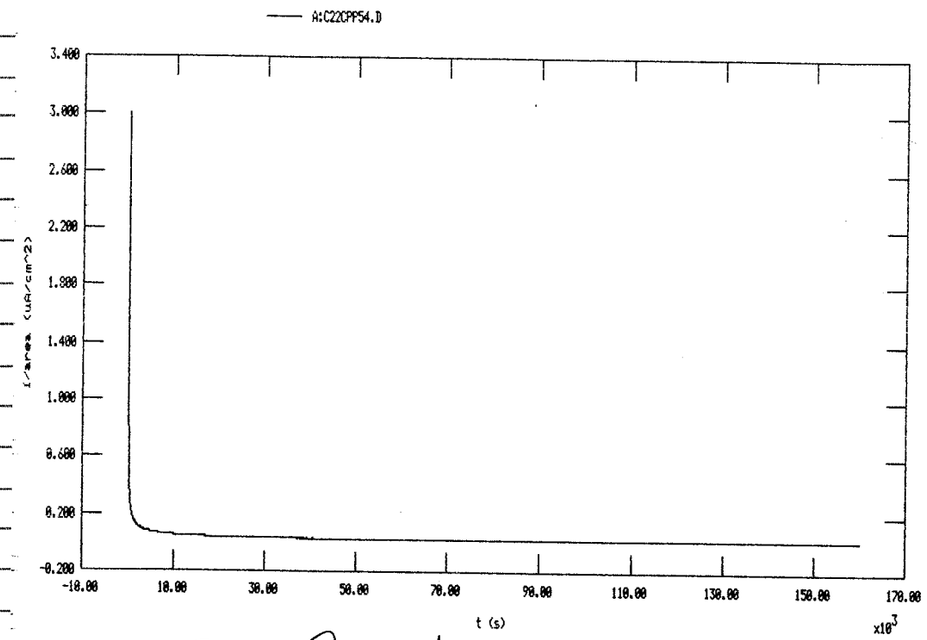
TEST STARTED 8/20/99
DATA SAVED AS ~~C22CPP54~~ DD 8/20/99 C22CPP54.DAT

PASSIVE CURRENT DENSITY 0.022 − 0.024 μA/cm²

NO SIGN OF ATTACK

[signature] 8/23/99

Model 352/252 Corrosion Analysis Software, v. 2.30 Filename: A:C22CPP54.DAT Pstat: VStat[] Ver 2
PS POTENTIOSTATIC File Status: NORMAL Date Run: 07-31-99 Time Run: 11:56:10
CP PASS vs. R CT PASS IP 0.200 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 2.000E+01 LS YES EW 0.000E+00 DEN 8.900E+00 AU NO
OC -0.688
Comment: Alloy C-22 2277-8-3235 welded 4M Cl deaerated



[signature] 8/23/99

Model 352/252 Corrosion Analysis Software, v. 2.30
Filename: A:C22CPP54.DAT
Pstat: VStat[] Ver 2
PS POTENTIOSTATIC File Status: NORMAL
Date Run: 07-31-99 Time Run: 11:56:10

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	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	20.00	cm^2	Equiv. Wt.	EW	0.0000	g
Density	DE	8.900	g/ml	AUX A/D	AU	no	
Open Circuit	OC	-688.0E-3	V				

Comment: Alloy C-22 2277-8-3235 welded 4M Cl deaerated

[signature] 8/23/99

C-22 PASSIVE CURRENT DENSITY

SPECIMEN ALLOY C-22
HEAT 2277-8-3235
FILLER ROD 622 XX 1045 BG11
ND PTFE CREVICE WASHER
START WT 38.50226 g
SAME AS p 4, 12
END WT 38.50058 g
SOLUTION 4 M Cl 85 PPM HCO_3^- 20 PPM $SO_4^=$
10 PPM NO_3^- 2 PPM F^- SAME AS p 4, 12

T = 95 °C Hg THERMOMETER C-98-106
SOLUTION DEAERATED w/ 99.999% N_2 PASSED THROUGH
O_2 TRAP

POTENTIOSTAT EG&G VERSASTAT SN 20104
FISHER SCE 13-620-51 SN 8131146

E_{corr} −663 mV$_{SCE}$ KEITHLEY 614 SN 467374
E_{pc} −144 mV$_{SCE}$ "
$E_{APPLIED}$ 400 mV$_{SCE}$

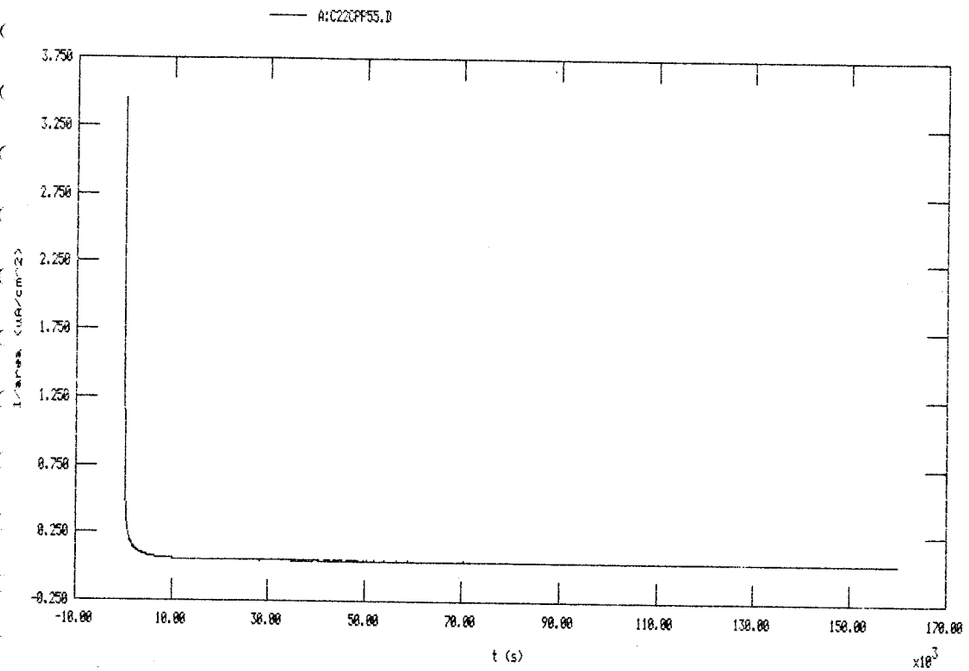
DATA SAVED AS C22CPP55.DAT
TEST STARTED 8/23/99

ANODIC CURRENT DENSITY 0.043 μA/cm²

NO SIGN OF LOCALIZED ATTACK

8/25/99

Model 352/252 Corrosion Analysis Software, v. 2.30 Filename: A:C22CPP55.DAT Pstat: VStat[] Ver 2
PS POTENTIOSTATIC File Status: NORMAL Date Run: 08-02-99 Time Run: 14:17:12
CP PASS vs. R CT PASS IP 0.400 vs. R ID 5 S TP 5.333E+01 T1 1.600E+05
CR AUTO HP 3000 SO Pass IR NONE FL I 5.3Hz RT HIGH STABILITY
REF 0.24150 SCE WRK SOLID AR 2.000E+01 LS YES EW 0.000E+00 DEN 8.900E+00 AU NO
OC -0.663
Comment: Alloy C-22 2277-8-3235 welded 4M Cl deaerated



8/25/99

Model 352/252 Corrosion Analysis Software, v. 2.30
Filename: A:C22CPP55.DAT
Pstat: VStat[] Ver 2
PS POTENTIOSTATIC File Status: NORMAL
Date Run: 08-02-99 Time Run: 14:17:12

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	HP	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	20.00	cm^2	Equiv. Wt.	EW	0.0000	g
Density	DE	8.900	g/ml	AUX A/D	AU	no	
Open Circuit	OC	-663.0E-3	V				

Comment: Alloy C-22 2277-8-3235 welded 4M Cl deaerated

8/25/99

REPASSIVATION POTENTIAL C-22

SPECIMEN ALLOY C-22 2277-8-3175
START WT 38.50177 g
600 GRIT FINISH PTFE CREVICE WASHERS
ATTACHED w/ C-276 HARDWARE 50 IN·OZ PROTO 6102

SOLUTION 4M Cl^- 85 PPM HCO_3 20 PPM $SO_4^=$
10 PPM NO_3^- 200 ppm F^- 2000 mL
467.5 g NaCl LOT 985302
0.245 g $NaHCO_3$ LOT 897789
40 mL SO_4 - 8/99 STOCK SOLUTION
20 mL NO_3 - 8/99 STOCK SOLUTION
0.884 g NaF LOT 896405
+ DI WATER TO 2000 mL
START pH 7.630 FISHER ACCUMET SN 3340
T = 95 °C Hg THERMOMETER 183303
SOLUTION DEAERATED w/ 99.999 % N_2
END pH 6.190 FISHER ACCUMET SN 3340
POTENTIOSTAT EG&G 273

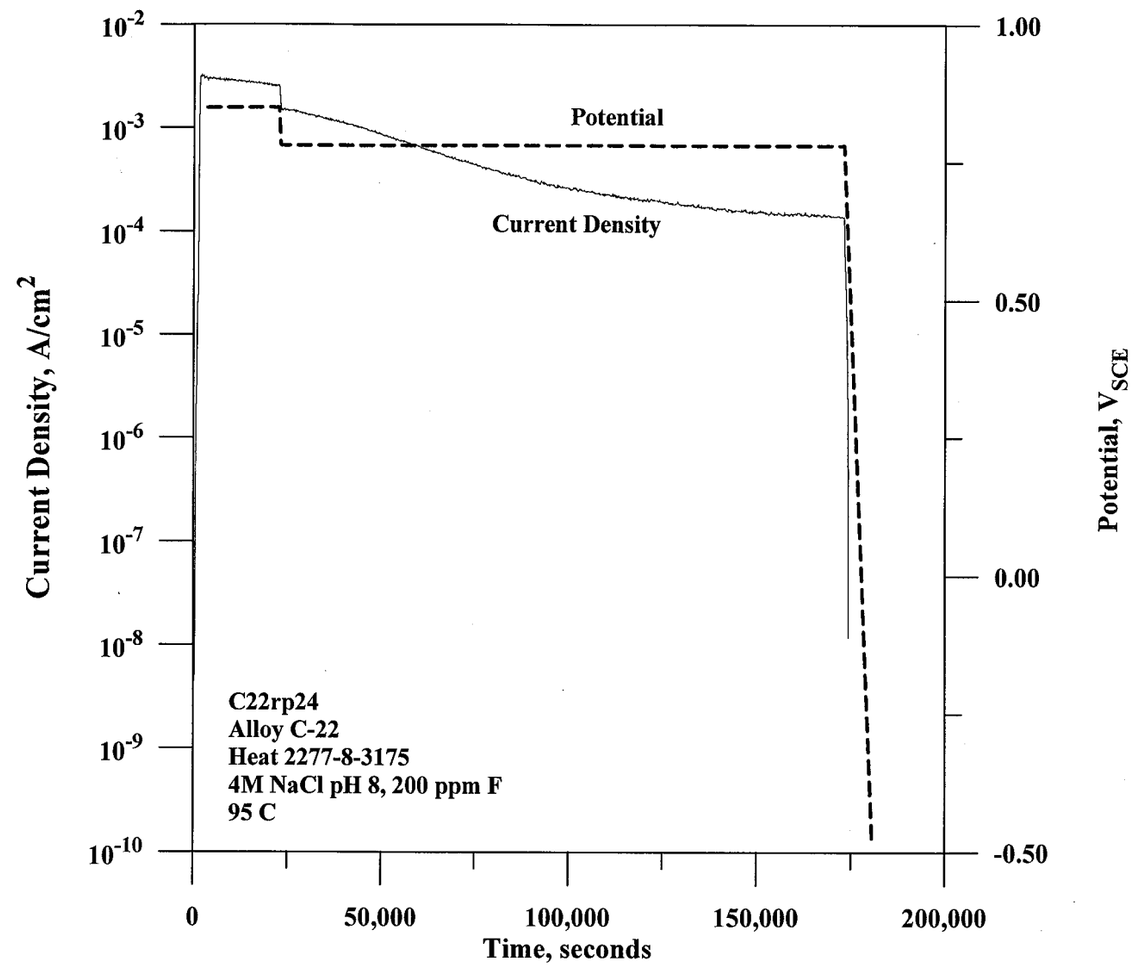
E_{corr} -673 mV_{SCE} KEITHLEY 614 SN 704934
E_{pt} -372

TEST STARTED 8/25/99
DATA SAVED AS. C22RP24.DAT.

VERY SHALLOW CREVICE CORROSION AT
A FEW LOCATIONS

SPECIMEN NOT SAVED REUSED IN LATER TEST

8/30/99



8/30/99

$i < 10^{-5}$ A/cm² 650 mV_{SCE}

$i < 10^{-6}$ A/cm² 597 mV_{SCE}

$i < 0$ 579 mV_{SCE}

8/30/99

C-22 PASSIVE CURRENT DENSITY

SPECIMEN ALLOY - C-22 WELDED SAME AS p 4, 12, 14
HEAT 2277-8-3235
FILLER ROD 622 XX 1045BG11
NO PTFE CREVICE WASHER
START WT 38.50058 g
END WT NOT RECORDED

SOLUTION 4 M Cl^- 85PPM HCO_3 20 PPM $SO_4^=$
10 PPM NO_3^- 2PPM F^- SAME AS p 4, 12, 14

T = 95 °C Hg THERMOMETER C98-106
SOLUTION DEAERATED w 99.999 % N_2 PASSED
THROUGH O_2 TRAP.

POTENTIOSTAT EG&G VERSASTAT SN 20104
FISHER SCE 13-620-51 SN 8131146

E_{corr} −665 mV SCE KEITHLEY 614 SN 4673494
E_{pt} −101 mV SCE "
E APPLIED 600 mV SCE

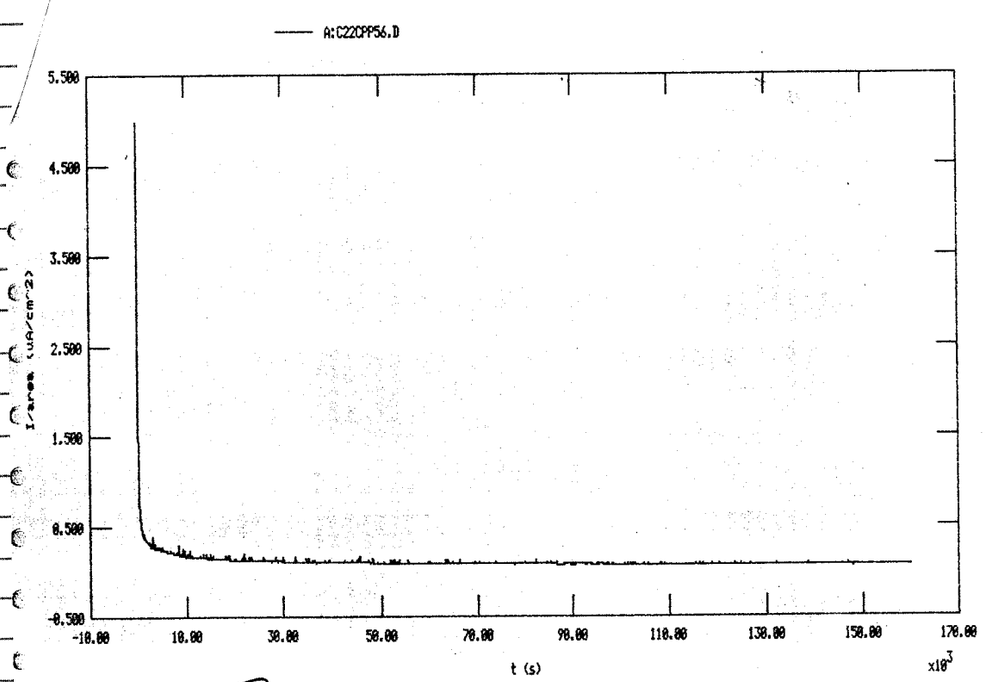
DATA SAVED AS C22CPP56.XLS
TEST STARTED. 8/26/99

NO SIGN OF ATTACK IN WELD REGION
LIGHT GOLD COLOR

PASSIVE C.D. ~ 0.058 − 0.064 μA/cm²

8/28/98

Model 352/252 Corrosion Analysis Software, v. 2.30 Filename: A:C22CPP56.DAT Pstat: VStat[] Ver 2
POTENTIOSTATIC File Status: NORMAL Date Run: 08-04-99 Time Run: 07:26:16
PASS vs. R CT PASS IP 0.600 vs. R ID 5 S TP 5.333E+01 TI 1.600E+05
AUTO WP 3000 SO Pass IR NONE FL I 5.3Hz RT HIGH STABILITY
EF 0.24150 SCE WRK SOLID AR 2.000E+01 LS YES EW 0.000E+00 DEN 8.900E+00 AU NO
OC -0.665
Comment: Alloy C-22 2277-8-3235 welded 4M Cl deaerated



8/28/99

Model 352/252 Corrosion Analysis Software, v. 2.30
Filename: A:C22CPP56.DAT
Pstat: VStat[] Ver 2
PS POTENTIOSTATIC File Status: NORMAL
Date Run: 08-04-99 Time Run: 07:26:16

Cond. Time	CT	pass	s	Initial Pot.	IP	600.0E-3	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	20.00	cm^2	Equiv. Wt.	EW	0.0000	g
Density	DE	8.900	g/ml	AUX A/D	AU	no	
Open Circuit	OC	-665.0E-3	V				

Comment: Alloy C-22 2277-8-3235 welded 4M Cl deaerated

8/29/99

C-22 PASSIVE CURRENT DENSITY

SPECIMEN ALLOY C-22 WELDED SAME AS p 4,14,12,18
NEAT 2277-8-3235
FILLER ROD 622 NEAT XX1045BG11
NO PTFE CREVICE WASHER

SOLUTION 4M Cl^- 85PPM NCO_3 20PPM $SO_4^=$
10PPM NO_3^- 2PPM F^- SAME AS p 4,12,14,18

T>95°C Hg THERMOMETER C98-106
SOLUTION DEAERATED W/ 99.999% N_2 PASSED THROUGH
O_2 TRAP

POTENTIOSTAT EG&G VERSASTAT SN 20104
FISHER SCE 13-620-51 SN 8131146

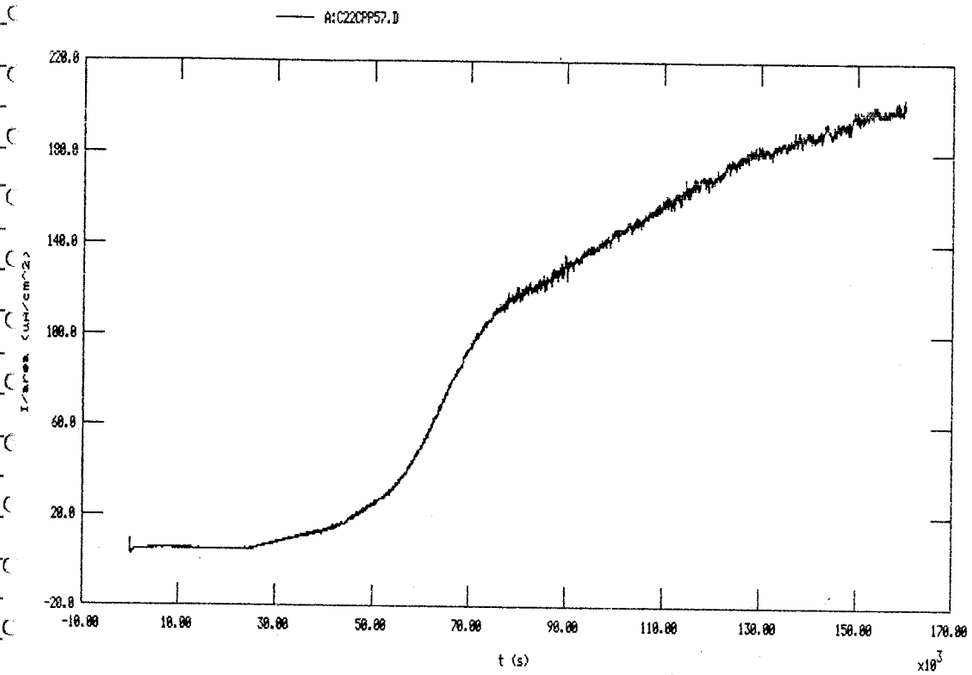
E_{corr} −665 mV SCE KEITHLEY 614 SN 467374
E_{pt} −56 mV SCE
$E_{applied}$ 800 mV SCE

DATA SAVED AS C22CPP57.DAT
TEST STARTED 8/29/99

* Specimen Not Saved
Repolished 9-4-01 for Further Testing
9-5-01

8/31/99

Model 352/252 Corrosion Analysis Software, v. 2.30
PS POTENTIOSTATIC File Status: NORMAL Date Run: 08-06-99 Filename: A:C22CPP57.DAT Time Run: 12:20:38 Pstat: VStat[] Ver 2
CP PASS vs. R CT PASS IP 0.800 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 2.000E+01 LS YES EW 0.000E+00 DEN 8.900E+00 AU NO
OC -0.666
Comment: Alloy C-22 2277-8-3235 welded 4M Cl deaerated



8/31/99

Model 352/252 Corrosion Analysis Software, v. 2.30
Filename: A:C22CPP57.DAT
Pstat: VStat[] Ver 2
PS POTENTIOSTATIC File Status: NORMAL
Date Run: 08-06-99 Time Run: 12:20:38

Cond. Time	CT	pass	s	Initial Pot.	IP	800.0E-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	20.00	cm^2	Equiv. Wt.	EW	0.0000	g
Density	DE	8.900	g/ml	AUX A/D	AU	no	
Open Circuit	OC	-666.0E-3	V				

Comment: Alloy C-22 2277-8-3235 welded 4M Cl deaerated

8/31/99

REPASSIVATION POTENTIAL C-22

SPECIMEN ALLOY C-22 2277.8-3175
START WT ~~38.50~~ 8/30/99 39.50500g
600 GRIT FINISH PTFE CREVICE WASHERS
ATTACHED w/ C-276 HARDWARE 50 in-oz PHOTO 6102

SOLUTION 4m Cl⁻ 85PPM HCO_3 20PPM $SO_4^=$ 10 PPM NO_3^-
100 ppm F⁻ 2000 mL MADE AS FOLLOWS
467.5 g NaCl LOT 985302
0.245 g $NaHCO_3$ LOT 897789
40 mL SO_4 - 8/99
20 mL NO_3 - 8/99
0.442 g NaF LOT 896405
+ DI WATER TO 2000 mL
START pH 7.366 FISHER ACCUMET SN 3340
T=95°C Hg THERMOMETER 183303
SOLUTION DEAERATED W/ 99.999 % N_2

END pH not taken

POTENTIOSTAT EG&G 273

E_{corr} -562 mV KEITHLEY 614 SN 704934
E_{pt} -189 mV "

TEST STARTED 8/31/99
DATA SAVED AS C22RP25.DAT

plot on p.24

Walter J Machowski
9/15/99

Repassivation Potential C-22

Specimen: Alloy C-22 2277-8-3175
Start wt. 39.86249 g
end wt. 38.88748 g
600 grit finish; PTFE crevice washers @ 50 in-oz
(photo 6102)

Solution: 4m Cl⁻ 85 ppm HCO_3^-
20 ppm $SO_4^=$ 10 ppm NO_3^- 2 ppm F⁻
467.52 g NaCl Lot # 985302
0.23781 g $NaHCO_3$ " # 897789
40 ml $SO_4^=$
20 ml NO_3^- } 8/99 p.6
4 ml F⁻
+ DI water to 2000 mL
Start pH 6.784 end pH 5.065

T = 95°C Hg thermometer #183303
Solution de-aerated w/ 99.999% N_2

Potentiostat EG&G 273
E_{corr} = -841 mV Keithley 614 s/N 704934
E_{pt} = -345 mV "

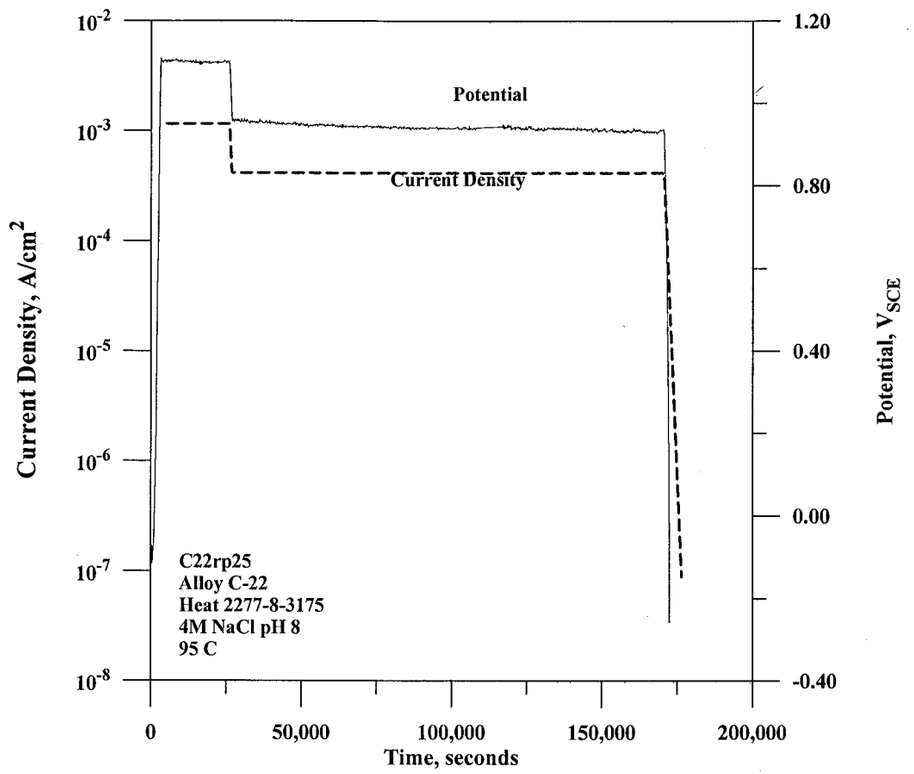
Test started 9/3/99 ramped to +820 mV and held until 9/7/99 (~96 Hrs) then ramped down
Data saved as C22RP26.DAT

Plot is on p.25

SPECIMEN NOT SAVED - REUSED IN LATER TEST

Walter J Machowski
9/15/99

10/28/99



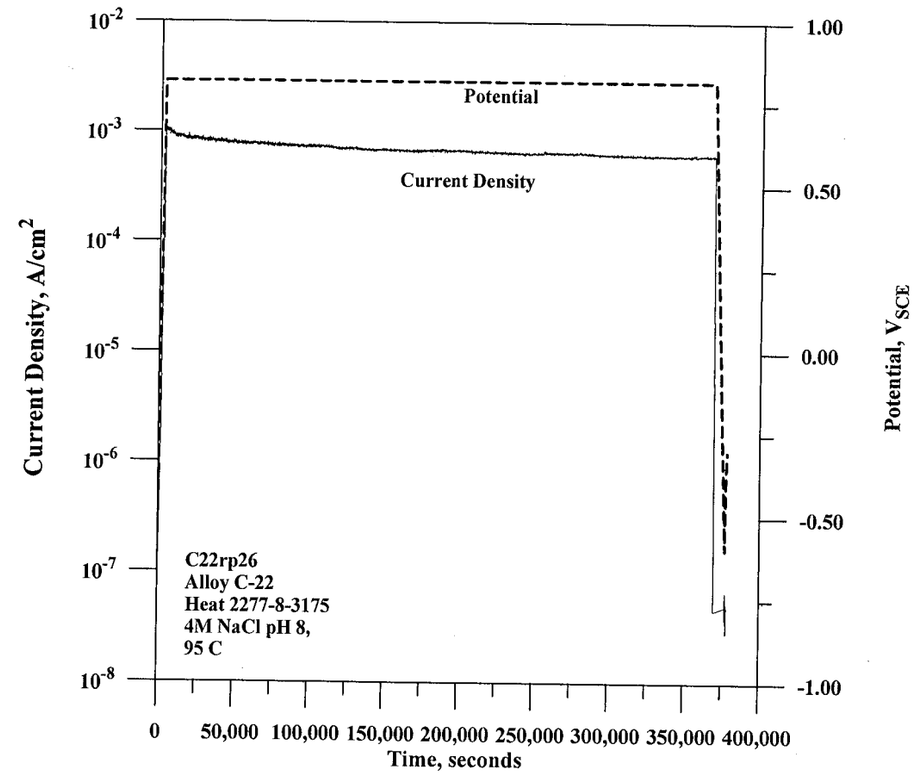
$i < 10^{-5}$ A/cm² @ 616 mV$_{SCE}$

$i < 10^{-6}$ A/cm² @ 557 mV$_{SCE}$

$i < 0$ 524

Walter J Machowski 9/15/99

Walter J Machowski
9/15/99



$i < 10^{-5}$ A/cm² @ 696 mV$_{SCE}$

$i < 10^{-6}$ A/cm² @ 651 mV$_{SCE}$

$i < 0$ 636 mV$_{SCE}$

Walter J Machowski
9/15/99

Walter J Machowski
9/15/99

C-22 Passive Current density

Specimen: Alloy C-22 welded same as p.4
Heat 2277-8-3235
600 grit polished - w/ crevice washers

start wt. 38.70122 g end wt. 38.70404 g

Solution: 4M Cl 2.7 pH
20 ppm $SO_4^=$ 10 ppm NO_3^- 2 ppm F^-
467.52 g NaCl Lot # 985302
few drops HCl Lot #
10 ml $SO_4^=$
20 ml NO_3^- } 8/99 p.6
4 ml F^-
+ DI water to 2000 mL

start pH 2.675 end pH
T = 95°C H_2 thermometer C98-106
deaerated w/ 99.999% N_2 passed thru O_2 trap

Potentiostat EG&G Versastat SN 20104
Fisher SCE 13-620-51 SN 813146

E corr -416 mV Keithley 614 SN 467394
E pt +141 mV " " "

E applied -400 mV passive CD 10-12 nA/cm²

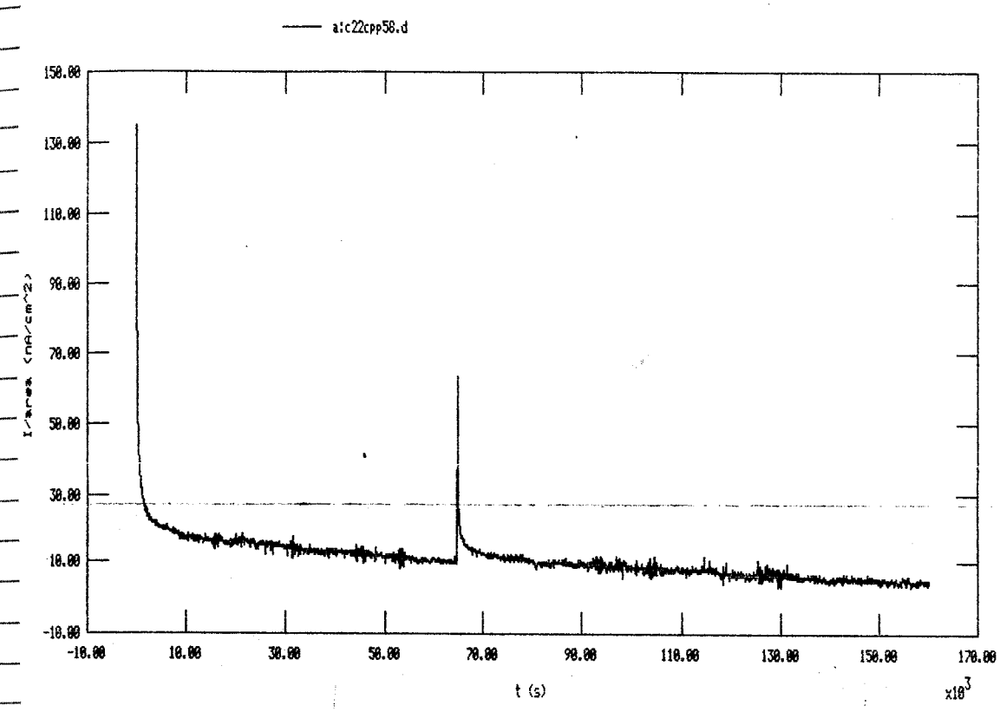
Data saved C22CPP58.DAT

no sign of localized attack

* Specimen Not Saved
Repolished 9-4-01 for further Testing
[illegible] 9-5-01

Walter J Machowski
9/9/99

Model 352/252 Corrosion Analysis Software, v. 2.30 Filename: a:c22cpp58.dat Pstat: VStat[] Ver 2
PS POTENTIOSTATIC File Status: NORMAL Date Run: 08-10-99 Time Run: 07:25:11
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 2.000E+01 LS YES EW 0.000E+00 DEN 8.900E+00 AU NO
OC -0.405
Comment: Alloy C-22 2277-8-3235 welded 4M Cl pH 2.7 deaeratrd



Walter J Machowski 9/9/99

Model 352/252 Corrosion Analysis Software, v. 2.30
Filename: a:c22cpp58.dat
Pstat: VStat[] Ver 2
PS POTENTIOSTATIC File Status: NORMAL
Date Run: 08-10-99 Time Run: 07:25:11

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	20.00	cm^2	Equiv. Wt.	EW	0.0000	g
Density	DE	8.900	g/ml	AUX A/D	AU	no	
Open Circuit	OC	-405.0E-3	V				

Comment: Alloy C-22 2277-8-3235 welded 4M Cl pH 2.7 deaeratrd

Walter J Machowski 9/9/99

Walter J Machowski
9/9/99

C-22 Passive Current Density

Specimen: Same as p. 26 (continuation

Solution: Same as p. 26

Conditions Same as p. 26

Ecorr −410 mV Keithly 614 SN 467894
Epp +59 mV

Eapplied −200 mV

Data saved C22CPP59.DAT

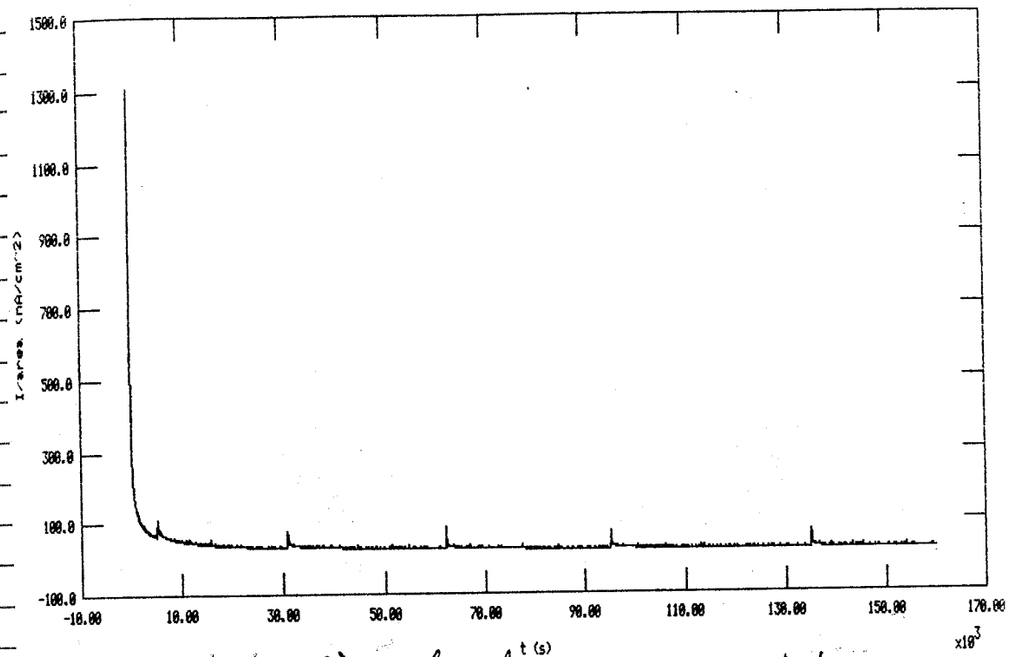
no localized corrosion

end at 38.70099

passive C.D. 24 − 30 nA/cm²

Walter J Machowski
9/13/99

Model 352/252 Corrosion Analysis Software, v. 2.30
PS POTENTIOSTATIC File Status: NORMAL Date Run: 08-11-99 Filename: a:c22cpp59.dat Time Run: 10:52:29 Pstat: VStat[] Ver 2
CP PASS vs. R CT PASS IP -0.200 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 2.000E+01 LS YES EW 0.000E+00 DEN 8.900E+00 AU NO
OC -0.410
Comment: Alloy C-22 2277-8-3235 welded 4M Cl pH 2.7 deaeratrd



Walter J Machowski 9/13/99

Model 352/252 Corrosion Analysis Software, v. 2.30
Filename: a:c22cpp59.dat
Pstat: VStat[] Ver 2
PS POTENTIOSTATIC File Status: NORMAL
Date Run: 08-11-99 Time Run: 10:52:29

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	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	20.00	cm^2	Equiv. Wt.	EW	0.0000	g
Density	DE	8.900	g/ml	AUX A/D	AU	no	
Open Circuit	OC	-410.0E-3	V				

Comment: Alloy C-22 2277-8-3235 welded 4M Cl pH 2.7 deaeratrd

Walter J. Machowski 9/13/99

Walter J Machowski
9/13/99

Repassivation Potential C-22

Specimen: Alloy C-22 2277-8-3175
Start wt. 39.75421 g
End wt.
600 grit finish on all edge sides – as received finish on test faces
PTFE crevice washer @ 50 in-oz

Solution: 4M Cl^- 85 ppm HCO_3^-
20 ppm $SO_4^=$ 10 ppm NO_3^- 2 ppm F^-
467.52 g NaCl Lot # 985302
0.23596 g $NaHCO_3$ " # 897789
40 ml $SO_4^=$
20 ml NO_3^- } 8/99 p.6
4 ml F^-
+ DI water to 2000 mL
Start pH 7.195 End pH 5.558

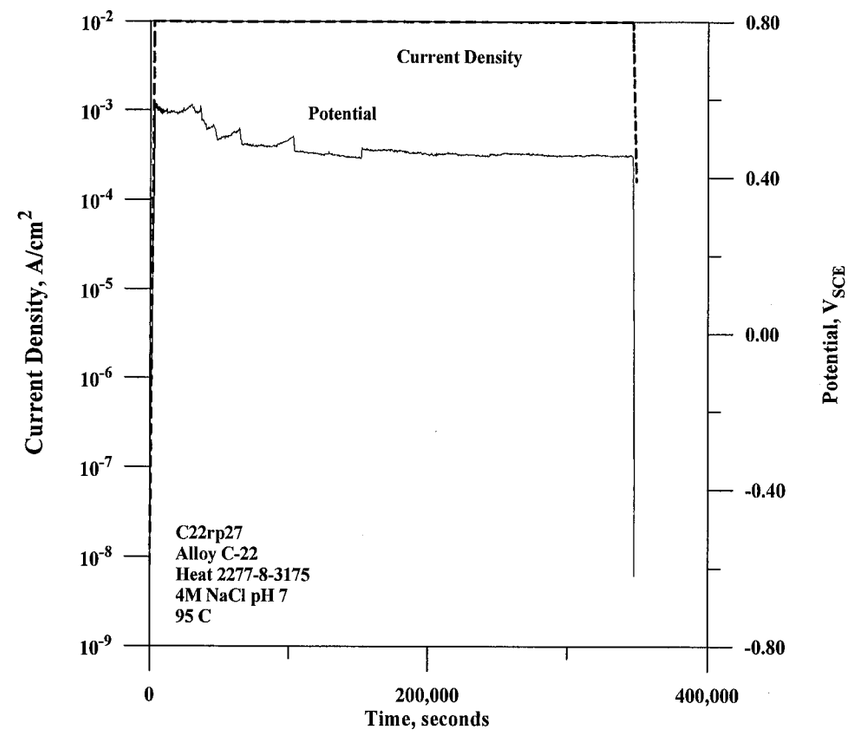
T = 95°C Hg thermometer #183303
deaerated w/ 99.999% N_2
Potentiostat EG&G 273
Ecor -578 mV Keithly 614 S/N 704934
Ept -368 mV " " "

Started @ 12:50 PM 9/10/99
stopped downscan on 9/14/99 @ ~1 PM

Stored as C22RP27.DAT

many spots of localized corrosion

Walter J. Mackowski
9/15/99



$i < 10^{-5}$ A/cm² at 676 mV$_{SCE}$
$i < 10^{-6}$ A/cm² at 618 mV$_{SCE}$
$i < 0$ A/cm² at 596 mV$_{SCE}$

5/30/2000

C-22 Passive Current Density

Specimen: Same as p.26 (continuation)

Solution: Same as p.26

Conditions: Same as p.26

E_{corr} −433 mV Rathly 614 SN 467394

E_{PP} −31 mV

$E_{applied}$ 0 mV

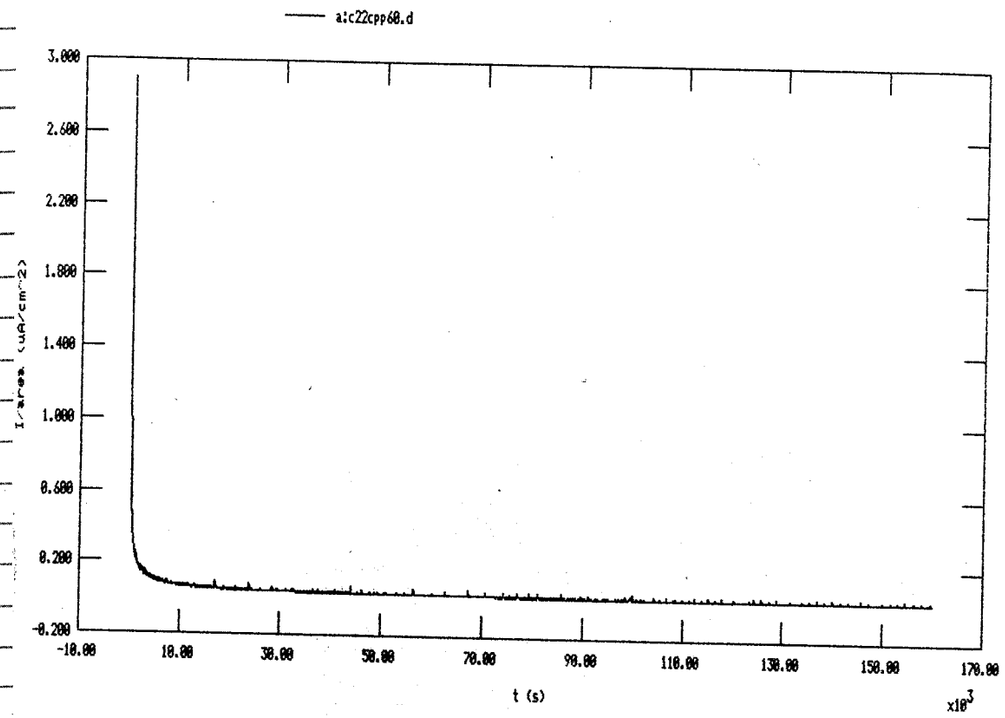
Start at: 38.70099 end at: 38.705788

passive C.D. 0.02–0.03 μA/cm²

no localized or general corrosion

Walter J Machowski 9/15/99

Model 352/252 Corrosion Analysis Software, v. 2.30
PS POTENTIOSTATIC File Status: NORMAL Date Run: 08-13-99 Time Run: 12:55:21 Filename: a:c22cpp60.dat Pstat: VStat[] Ver 2
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 2.000E+01 LS YES EW 0.000E+00 DEN 8.900E+00 AU NO
OC -0.433
Comment: Alloy C-22 2277-0-3235 welded 4M Cl pH 2.7 deaeratrd



Walter J Machowski 9/15/99

Model 352/252 Corrosion Analysis Software, v. 2.30
Filename: a:c22cpp60.dat
Pstat: VStat[] Ver 2
PS POTENTIOSTATIC File Status: NORMAL
Date Run: 08-13-99 Time Run: 12:55:21

Cond. Time	CT	pass	s	Initial Pot.	IP	0.0000	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	20.00	cm^2	Equiv. Wt.	EW	0.0000	g
Density	DE	8.900	g/ml	AUX A/D	AU	no	
Open Circuit	OC	-433.0E-3	V				

Comment: Alloy C-22 2277-0-3235 welded 4M Cl pH 2.7 deaeratrd

Walter J. Machowski 9/15/99

Walter J Machowski 9/15/99

Repassivation Potential C-22

Specimen: Alloy C-22 Ht 2277-8-3175 9/14/99 WJM
repolished to 600 grit from ~~C22CPP~~ C22RP22 (p. 8)

start wt. 37.16757 g
end wt. 36.53670 g
PTFE crevice washers attached @ 50 in-oz

Solution: Sat'd NaCl 85 ppm HCO_3^-
20 ppm $SO_4^=$ 10 ppm NO_3^- 2 ppm F^-
720 g NaCl Lot # 972274
0.23580 g $NaHCO_3$ Lot # 897789
40 ml $SO_4^=$
20 ml NO_3^- } 8/99 p. 6
4 ml F^-
+ DI water to 2000 mL

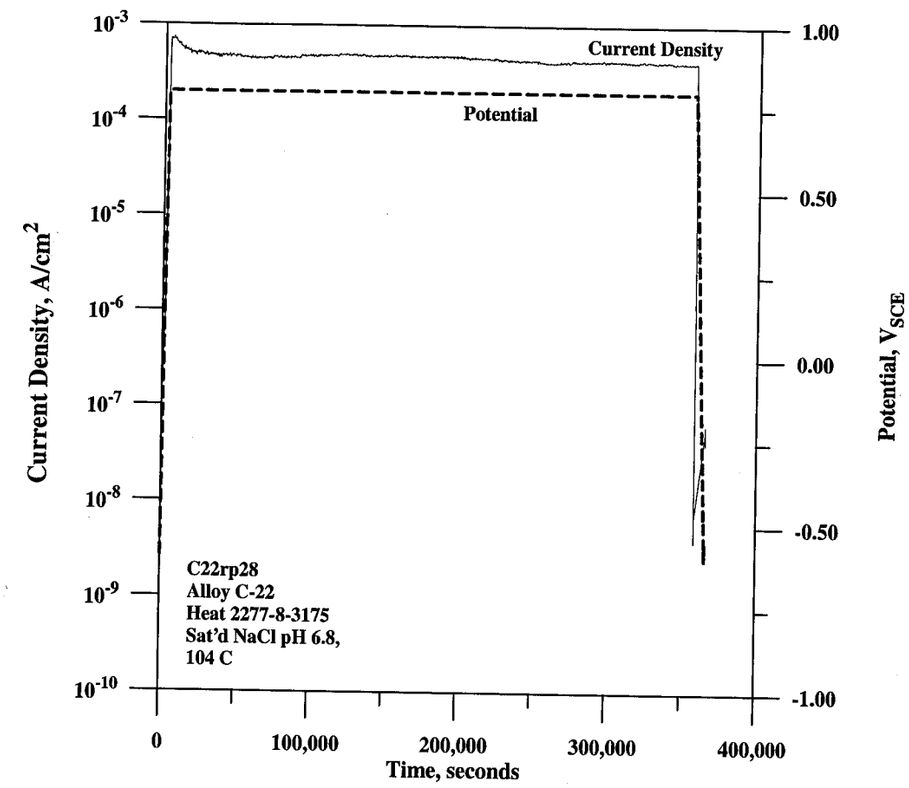
Start pH 6.885 End pH 5.365

T = 104°C Hg thermometer #183303
de-aerated w/ 99.995% N_2
Potentiostat EG&G 273
E_{corr} ~~-423 mV~~ Keithly 614 S/N 704934
E_{pt} ~~-161 mV~~ " " "
9/16/99
WJM
E_{corr} -542 mV
E_{pt} -222 mV
Start 9:10 AM 9/16/99

Started down scan @ ~12:30 PM 9/20/99

no local corrosion; Transpassive dissolution

[signature] 10/31/99



$i < 10^{-5}$ A/cm² @ 684 mV$_{SCE}$

$i < 10^{-6}$ A/cm² @ 630 mV$_{SCE}$

$i < 0$ @ 609 mV$_{SCE}$

[signature] 10/28/99

C-22 Passive Current density

Specimen: Same as p.26 (continuation)

Solution: Same as p.26

Conditions: Same as p.26

Ecor -423 mV Keithly 614 S/N 467394
Epc +61 mV " " "

E applied +200 mV

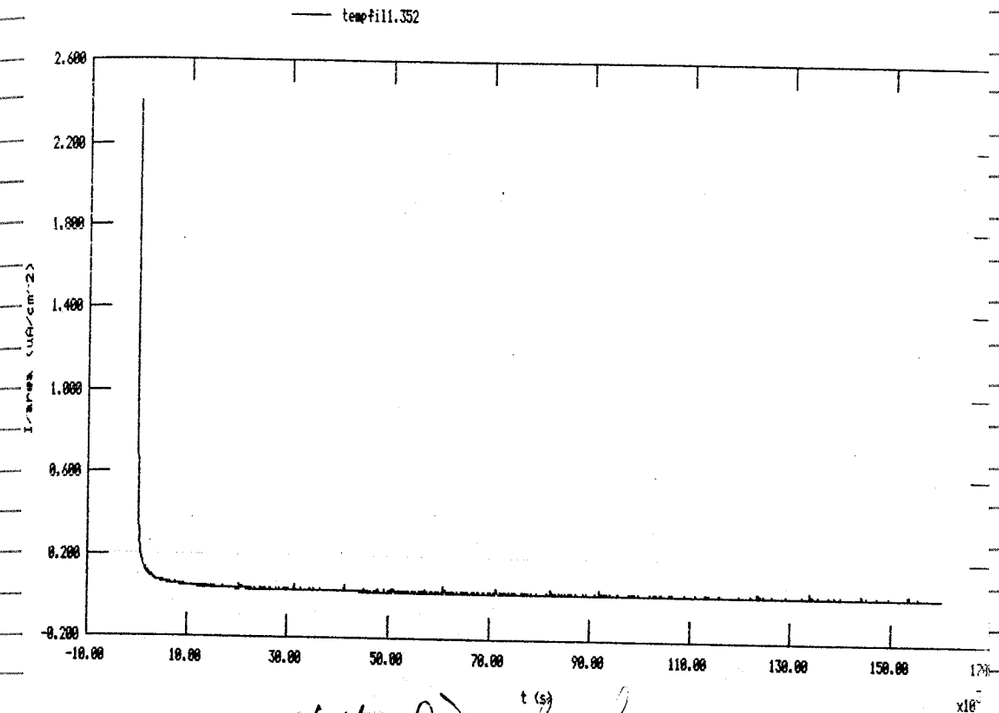
Start wt: 38.70579 g

data not saved

no localized corrosion

Walter J Machowski
9/22/99

Model 352/252 Corrosion Analysis Software, v. 2.30 Filename: c:\m352\temp fill.352 Pstat: VStat[] Ver 2
PS POTENTIOSTATIC File Status: NORMAL Date Run: 08-15-99 Time Run: 06:12:50
CP PASS vs. R CT PASS IP 0.200 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 2.000E+01 LS YES EW 0.000E+00 DEN 8.900E+00 AU NO
OC -0.423
Comment: Alloy C-22 2277-8-3235 welded 4M Cl pH 2.7 deaeratrd



Walter J Machowski 9/22/99

Model 352/252 Corrosion Analysis Software, v. 2.30
Filename: c:\m352\temp fill.352
Pstat: VStat[] Ver 2
PS POTENTIOSTATIC File Status: NORMAL
Date Run: 08-15-99 Time Run: 06:12:50

Cond. Time	CT	pass	s	Initial Pot.	IP	200.0E-3	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	20.00	cm^2	Equiv. Wt.	EW	0.0000	g
Density	DE	8.900	g/ml	AUX A/D	AU	no	
Open Circuit	OC	-423.0E-3	V				

Comment: Alloy C-22 2277-8-3235 welded 4M Cl pH 2.7 deaeratrd

Walter J Machowski 9/22/99

Walter J Machowski
9/22/99

Repassivation Potential C-22

Specimen: Alloy C-22 WELDED
Same material as p. 4
polished to 600 grit
PTFE crevice washers @ 50 in-oz
BASE ALLOY 2277-8-3235 FILLER XX1045BG11 DD 10/31/99
Start wt. 39.43325 g
end wt. 31.69280
assembly ultrasonic in test solution prior to assembly

Solution: Sat'd NaCl 55 ppm HCO_3^-
20 ppm $SO_4^=$ 10 ppm NO_3^- 2 ppm F^-
718 g NaCl Lot # 972274
0.23610 g $NaHCO_3$ Lot # 897789
40 ml $SO_4^=$
20 ml NO_3^- } 9/99
4 ml F^-
+ DI water to 2000 mL

Start pH 6.483 end pH 7.508
104°C de-aerated w/ N_2 (99.999%)

E_{corr} -695 Keithley 614 S/N 704934
E_{pt} -328

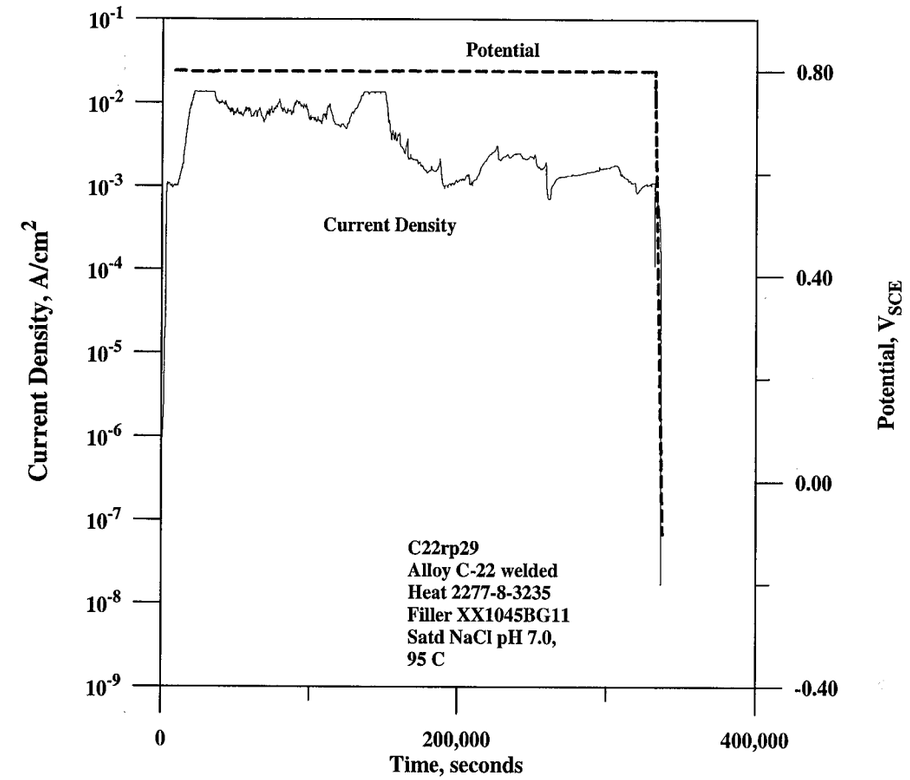
Started @ 1:10PM 9/24/99
held for 4 days @ +800 mV

started downscan @ 9:30AM 9/28/99

Specimen badly corroded, especially in filler material (weld zone) localized corrosion all around, much green corrosion product

saved as C22RP29.DAT

Daniel D. 10/31/99



$i < 10^{-5}$ A/cm² @ 92 mV$_{SCE}$
$i < 10^{-6}$ A/cm² @ 90 mV$_{SCE}$
$i < 0$ @ 89 mV$_{SCE}$

Daniel D. 10/31/99

C-22 Passive Current Density

Specimen: Same as p.26 (contamination)

Solution: Same as p.26

Conditions: Same as p.26

E_{cor} -450 Keithly 614 s/n 463394

E_{Pt} +108

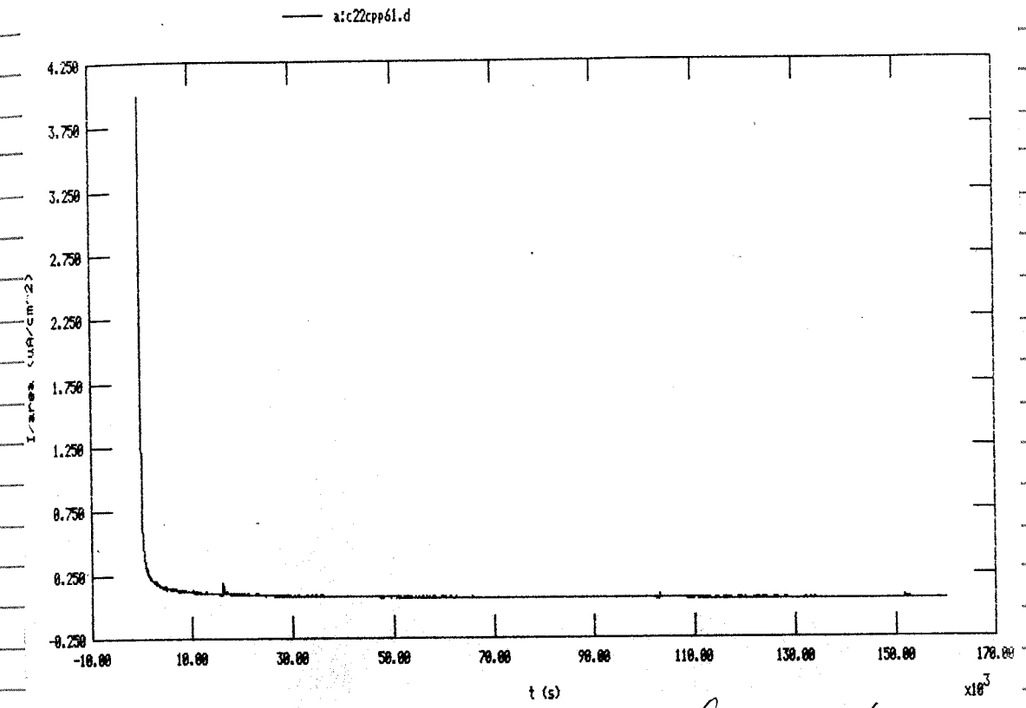
$E_{applied}$ +400 mV

passive C.D. 0.06 – 0.07 μA/cm²

no localized corrosion

Walter J Machowski 9/24/99

Model 352/252 Corrosion Analysis Software, v. 2.30
PS POTENTIOSTATIC File Status: NORMAL Date Run: 08-19-99 Filename: a:c22cpp61.dat Pstat: VStat[] Ver 2
CP- PASS vs. R CT PASS IP 0.400 vs. R Time Run: 07:36:23
CR AUTO NP 3000 SO Pass ID 5 S TP 5.333E+01 T1 1.600E+05
REF 0.24150 SCE WRK SOLID AR 2.000E+01 IR NONE FL I 5.3Hz RT HIGH STABILITY
OC -0.450 LS YES EW 0.000E+00 DEN 8.900E+00 AU NO
Comment: Alloy C-22 2277-8-3235 welded 4M Cl pH 2.7 deaeratrd



Walter J Machowski 9/24/99

Model 352/252 Corrosion Analysis Software, v. 2.30
Filename: a:c22cpp61.dat
Pstat: VStat[] Ver 2
PS POTENTIOSTATIC File Status: NORMAL
Date Run: 08-19-99 Time Run: 07:36:23

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	20.00	cm^2	Equiv. Wt.	EW	0.0000	g
Density	DE	8.900	g/ml	AUX A/D	AU	no	
Open Circuit	OC	-450.0E-3	V				

Comment: Alloy C-22 2277-8-3235 welded 4M Cl pH 2.7 deaeratrd

Walter J Machowski 9/24/99

Walter J Machowski 9/24/99

C-22 Passive Current Density

Specimen: Same as p.26 (continuation)

Solution: Same as p.26

Conditions: Same as p.26

E_{corr} -56 Keithly 614 S/N 467884

E_{pt} +203

$E_{applied}$ +600mV

end wt. 38.6811 g

data saved as C22CPP62.DAT

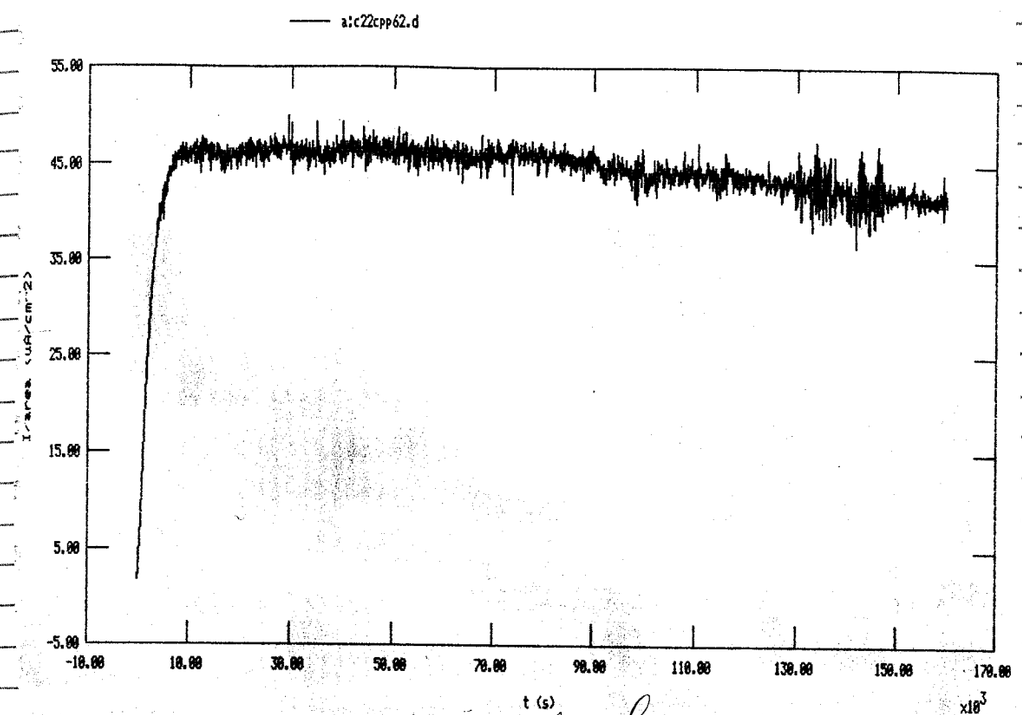
passive C.D. ~~D.~~ 43-47 μA/cm²

9/30/99
WJ Machowski

coved w/ golden film - no localized corrosion

Walter J Machowski
9/30/99

Model 352/252 Corrosion Analysis Software, v. 2.30 Filename: a:c22cpp62.dat Pstat: VStat[] Ver 2
PS POTENTIOSTATIC File Status: NORMAL Date Run: 08-21-99 Time Run: 06:45:32
CP PASS vs. R CT PASS IP 0.600 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 2.000E+01 LS YES EW 0.000E+00 DEN 8.900E+00 AU NO
OC -0.083
Comment: Alloy C-22 2277-8-3235 welded 4M Cl pH 2.7 deaeratrd



Walter J Machowski 9/30/99

Model 352/252 Corrosion Analysis Software, v. 2.30
Filename: a:c22cpp62.dat
Pstat: VStat[] Ver 2
PS POTENTIOSTATIC File Status: NORMAL
Date Run: 08-21-99 Time Run: 06:45:32

Cond. Time	CT	pass	s	Initial Pot.	IP	600.0E-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	20.00	cm^2	Equiv. Wt.	EW	0.0000	g
Density	DE	8.900	g/ml	AUX A/D	AU	no	
Open Circuit	OC	-83.00E-3	V				

Comment: Alloy C-22 2277-8-3235 welded 4M Cl pH 2.7 deaeratrd

Walter J Machowski 9/30/99

Walter J Machowski
9/30/99

C-22 Passive Current Density

Specimen: Same as p.26 (continuation)

Solution: Same as p.26

Condition: Same as p.26

E_{cor} +347

E_{pt} +29

$E_{applied}$ +800 mV

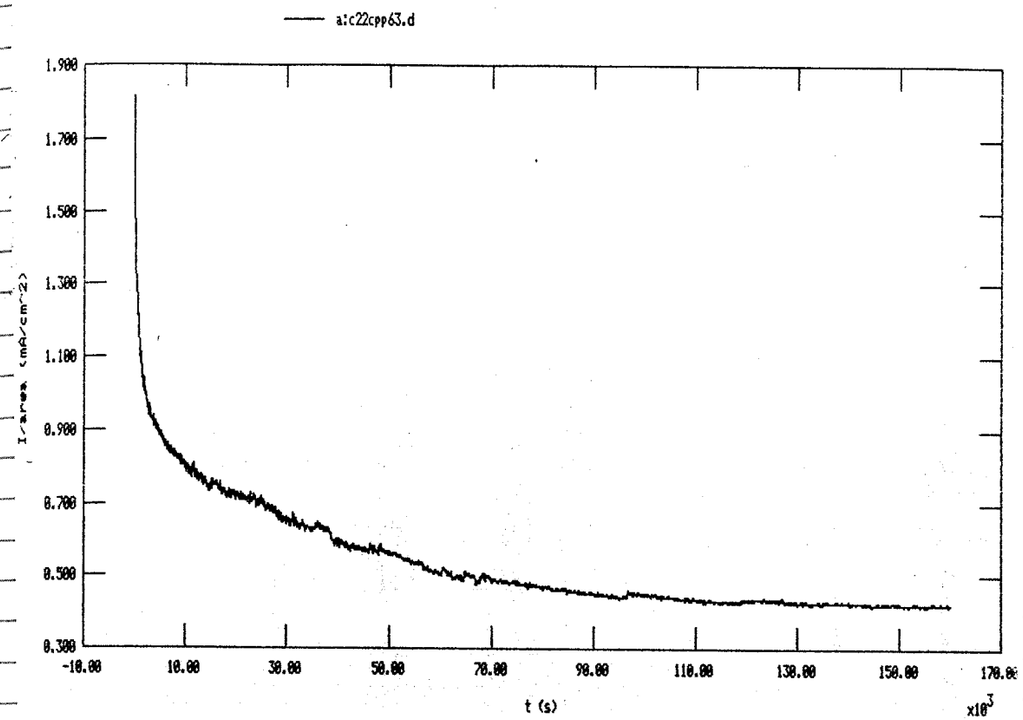
data saved as C22CPP63.DAT
passive C.D 0.42 – 0.55 mA/cm²

specimen dark brown
w/ localized corrosion

end pH 4.898

Daniel Dan 5/31/2000

Model 352/252 Corrosion Analysis Software, v. 2.30 Filename: a:c22cpp63.dat Pstat: VStat[] Ver 2
PS POTENTIOSTATIC File Status: NORMAL Date Run: 08-23-99 Time Run: 06:20:30
CP PASS vs. R CT PASS IP 0.800 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 2.000E+01 LS YES EW 0.000E+00 DEN 8.900E+00 AU NO
OC 0.344
Comment: Alloy C-22 2277-8-3235 welded 4M Cl pH 2.7 deaeratrd



Walter J Machowski 10/5/99

Model 352/252 Corrosion Analysis Software, v. 2.30
Filename: a:c22cpp63.dat
Pstat: VStat[] Ver 2
PS POTENTIOSTATIC File Status: NORMAL
Date Run: 08-23-99 Time Run: 06:20:30

Cond. Time	CT	pass	s	Initial Pot.	IP	800.0E-3	V
Cond. Pot.	CP	pass	V	Time Step 1	T1	168.0E3	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	20.00	cm^2	Equiv. Wt.	EW	0.0000	g
Density	DE	8.900	g/ml	AUX A/D	AU	no	
Open Circuit	OC	344.0E-3	V				

Comment: Alloy C-22 2277-8-3235 welded 4M Cl pH 2.7 deaeratrd

Walter J. Machowski 10/5/99

Walter J Machowski 10/5/99

Repassivation Potential C-22

Specimen: Alloy C-22 Lot # 2277-8-3175
polished to 600 grit
PTFE crevice blocks @ 50 in-oz
Start wt. 40.38139 g
End wt. 39.26224 g
assembly ultrasonic in test sol'n before assembly

Solution: Sat'd NaCl 85 ppm HCO_3^-
718 g NaCl Lot # 972274
0.23571 g $NaHCO_3$ " 923337A
40 ml $SO_4^=$
20 ml NO_3^- } 9/99
4 ml F^-
+ DI water to 2000 mL
Start pH 7.050 End pH 5.160

104°C deaerated w/ 99.999% N_2

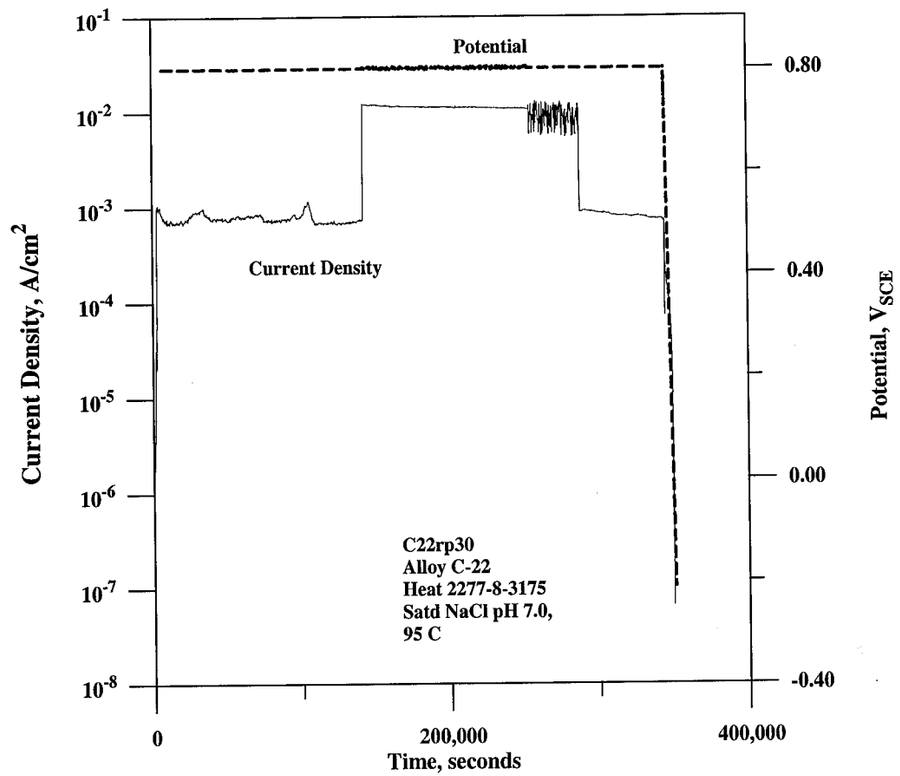
Potentiostat EG&G 273
E_{corr} -320 mV Keithly 614 S/N 704934
E_{pp} -308 " "

Start @ 9:20AM 10/1/99 to +800 mV
start down @ 9AM 10/5/99

Top of stem corroded (near the neoprene gasket)
no localized corrosion elsewhere
spec. covered w/ dark brown film, easily removed
after cleaning, saw one spot of local corrosion

Saved as C22RP30.DAT

MAY NOT BE VALID E_{pp} MEASUREMENT FOR ALLOY C-22
CORROSION OF STAINLESS STEEL SAMPLE ROD MAY HAVE
OCCURRED [signature] 10/31/99



$i < 10^{-5}$ A/cm² @ 27 mV SCE
$i < 10^{-6}$ A/cm² @ 7 mV SCE
$i < 0$ A/cm² @ 5 mV SCE

[signature] 10/31/99

C-22 Passive current density

SPECIMEN ALLOY 22 WELDED HEAT 2277-8-3235
600 GRIT FINISH
FILLER XX 1045BG11 DD 6/19/2000
SOLUTION 4M Cl^- 20 PPM SO_4^- 10 PPM NO_3^- 2 PPM F^-
pH 11.0 ADJUSTED W NaOH
SOLUTION DEAERATED W/ N_2
T = 95 °C N_2 THERMO C-96-783

POTENTIOSTAT ECG/G VERSASTAT SN 20104

REFERENCE FISHER SCE 13-620-51 SN 8131146

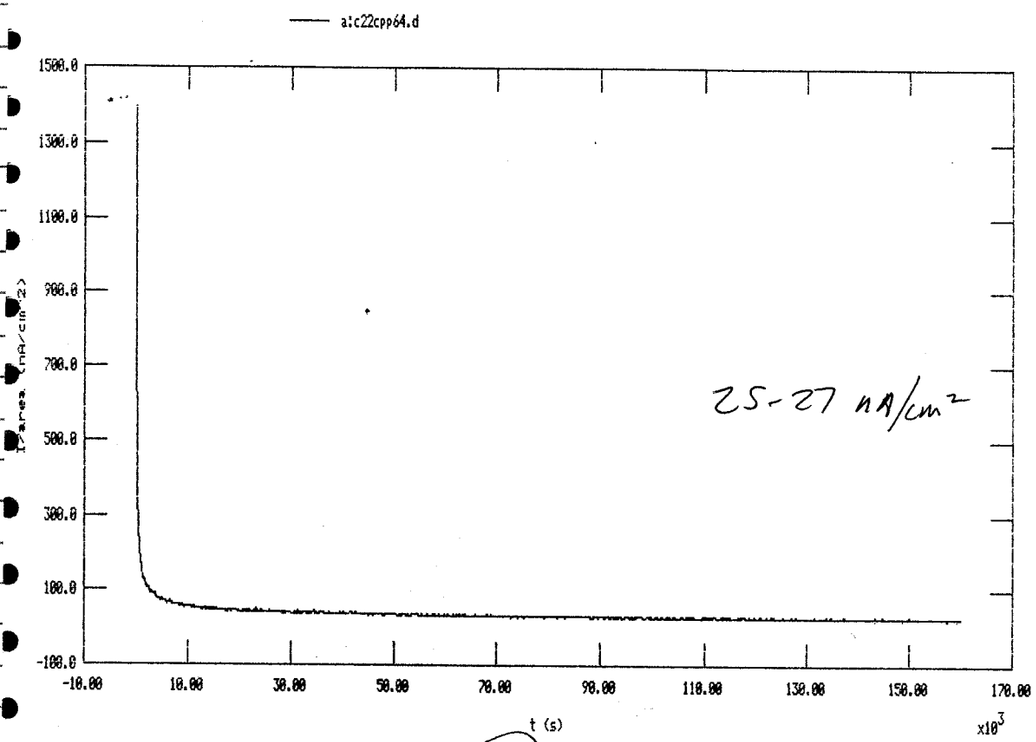
E APPLIED −200 mV_{SCE} TO 800 mV_{SCE}

C22 CPP 64 −200 mV_{SCE} p 49
C22 CPP 65 0 mV_{SCE} p 50
C22 CPP 66 200 mV_{SCE} p 51
C22 CPP 67 400 mV_{SCE} p 52
C22 CPP 68 600 mV_{SCE} p 53
C22 CPP 69 800 mV_{SCE} p 54

* Specimen Not Saved
Specimen Repolished 9-4-01 for further Testing
9-5-01

5/31/2000

Model 352/252 Corrosion Analysis Software, v. 2.30 Filename: a:c22cpp64.dat Pstat: VStat[] Ver 2
PS POTENTIOSTATIC File Status: NORMAL Date Run: 08-27-99 Time Run: 10:04:25
CP PASS vs. R CT PASS IP -0.200 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 2.000E+01 LS YES EW 0.000E+00 DEN 8.900E+00 AU NO
OC -0.564
Comment: Alloy C-22 2277-8-3235 welded 4M Cl pH 11.0 deaerated



10/21/99

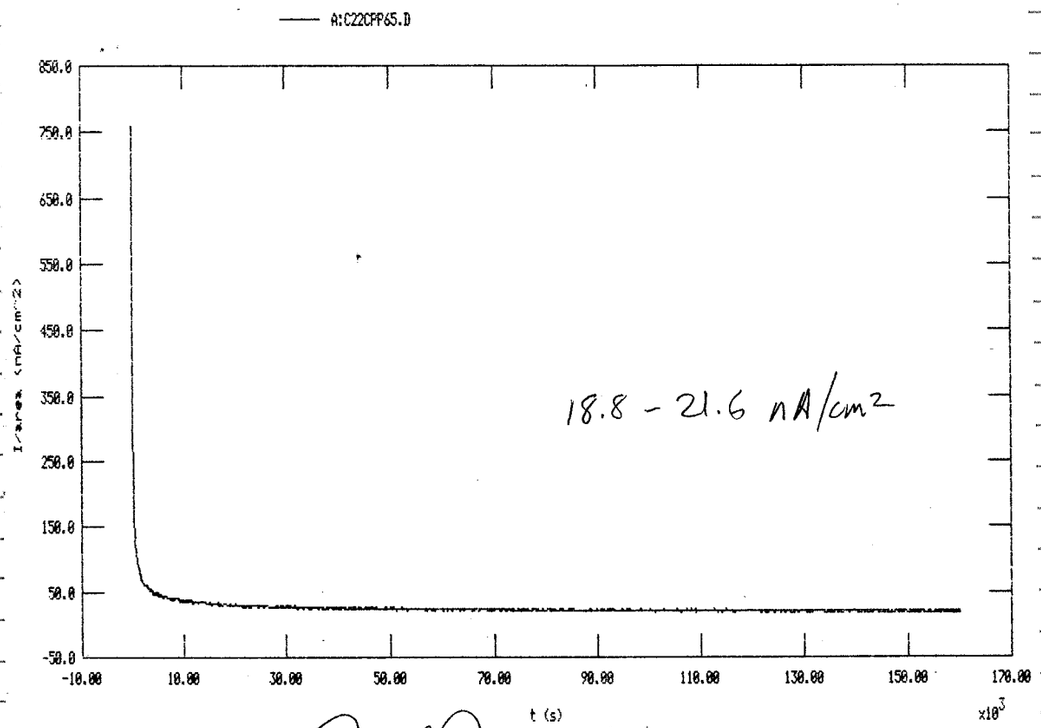
Model 352/252 Corrosion Analysis Software, v. 2.30
Filename: a:c22cpp64.dat
Pstat: VStat[] Ver 2
PS POTENTIOSTATIC File Status: NORMAL
Date Run: 08-27-99 Time Run: 10:04:25

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	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	20.00	cm^2	Equiv. Wt.	EW	0.0000	g
Density	DE	8.900	g/ml	AUX A/D	AU	no	
Open Circuit	OC	-564.0E-3	V				

Comment: Alloy C-22 2277-8-3235 welded 4M Cl pH 11.0 deaerated

10/21/99

Model 352/252 Corrosion Analysis Software, v. 2.30 Filename: A:C22CPP65.DAT Pstat: VStat[] Ver 2
PS POTENTIOSTATIC File Status: NORMAL Date Run: 08-31-99 Time Run: 09:48:49
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 2.000E+01 LS YES EW 0.000E+00 DEN 8.900E+00 AU NO
OC -0.560
Comment: Alloy C-22 2277-8-3235 welded 4M Cl pH 11.0 deaerated



10/21/99

Model 352/252 Corrosion Analysis Software, v. 2.30
Filename: A:C22CPP65.DAT
Pstat: VStat[] Ver 2
PS POTENTIOSTATIC File Status: NORMAL
Date Run: 08-31-99 Time Run: 09:48:49

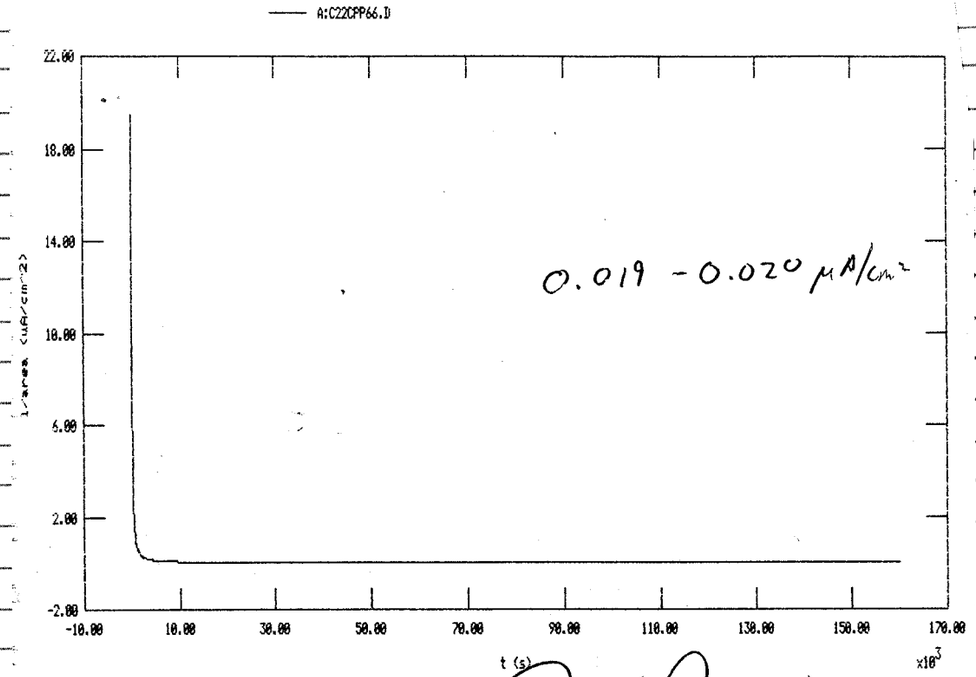
Cond. Time	CT	pass	s	Initial Pot.	IP	0.0000	V
Cond. Pot.	CP	pass	V	Time Step 1	TI	160.0E3	s
Initial Delay	ID	5	s	Stop On	SO	Pass	
Time/Pt.	TP	53.33	s	Curr. Range	CR	Auto	
No. of Points	NP	3000					
Line Sync.	LS	yes		IR Mode	IR	none	
Rise Time	RT	high stability		Filter	FL	I 5.3Hz	
Working Elec.	WE	Solid		Ref. Elec.	RE	SCE 241.5E-3V	
Sample Area	AR	20.00	cm^2	Equiv. Wt.	EW	0.0000	g
Density	DE	8.900	g/ml	AUX A/D	AU	no	
Open Circuit	OC	-560.0E-3	V				

Comment: Alloy C-22 2277-8-3235 welded 4M Cl pH 11.0 deaerated

10/21/99

PCP W6LP60 C-22 200mV

Model 352/252 Corrosion Analysis Software, v. 2.30 Filename: A:C22CPP66.DAT Pstat: VStat[] Ver 2
PS POTENTIOSTATIC File Status: NORMAL Date Run: 09-03-99 Time Run: 08:01:51
CP PASS vs. R CT PASS IP 0.200 vs. R ID 5 S TP 5.333E+01 TI 1.600E+05
CR AUTO NP 3000 SO Pass IR NONE FL I 5.3Hz RT HIGH STABILITY
REF 0.24150 SCE WRK SOLID AR 2.000E+01 LS YES EW 0.000E+00 DEN 8.900E+00 AU NO
OC -0.622
Comment: Alloy 22 2277-8-3235 welded 4M Cl 95 C pH 11 deaerated



10/27/99

Model 352/252 Corrosion Analysis Software, v. 2.30
Filename: A:C22CPP66.DAT
Pstat: VStat[] Ver 2
PS POTENTIOSTATIC File Status: NORMAL
Date Run: 09-03-99 Time Run: 08:01:51

Cond. Time	CT	pass	s	Initial Pot.	IP	200.0E-3	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	20.00	cm^2	Equiv. Wt.	EW	0.0000	g
Density	DE	8.900	g/ml	AUX A/D	AU	no	
Open Circuit	OC	-622.0E-3	V				

Comment: Alloy 22 2277-8-3235 welded 4M Cl 95 C pH 11 deaerated

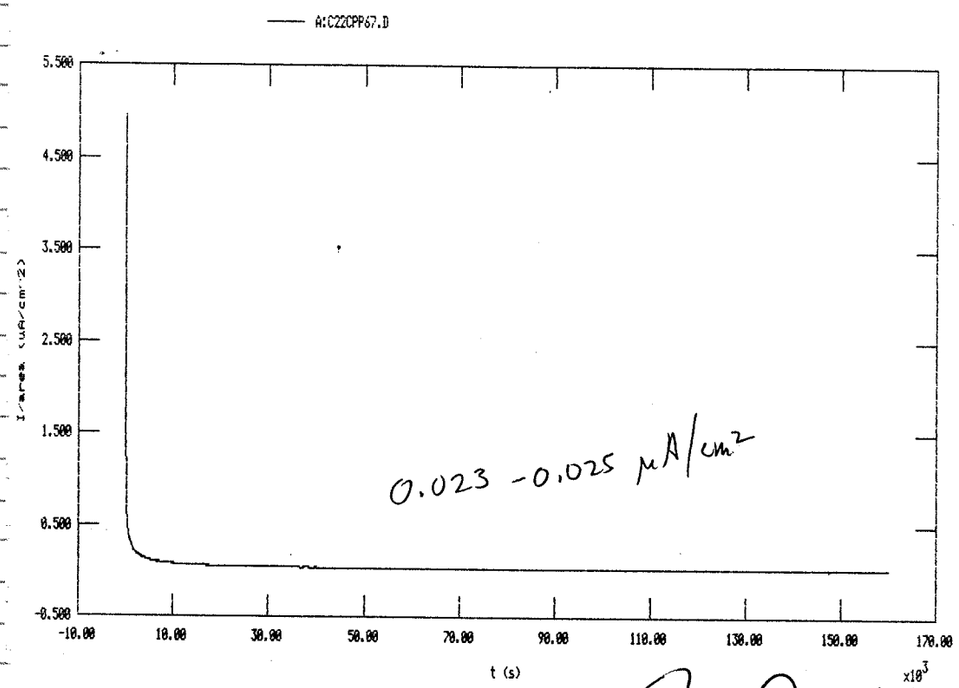
10/27/99

400 mV

Model 352/252 Corrosion Analysis Software, v. 2.30
PS POTENTIOSTATIC File Status: NORMAL Date Run: 09-05-99
CP PASS vs. R CT PASS IP 0.400 vs. R
CR AUTO NP 3000 SO Pass
REF 0.24150 SCE WRK SOLID AR 2.000E+01
OC -0.664
Comment: Alloy 22 2277-8-3235 welded 4M Cl 95 C pH 11 deaerated

Filename: A:C22CPP67.DAT
Time Run: 19:07:47
ID 5 S TP 5.333E+01
IR NONE FL I 5.3Hz
LS YES EW 0.000E+00

Pstat: VStat[] Ver 2
T1 1.600E+05
RT HIGH STABILITY
DEN 8.900E+00 AU NO



10/27/99

Model 352/252 Corrosion Analysis Software, v. 2.30
Filename: A:C22CPP67.DAT
Pstat: VStat[] Ver 2
PS POTENTIOSTATIC File Status: NORMAL
Date Run: 09-05-99 Time Run: 19:07:47

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	20.00	cm^2	Equiv. Wt.	EW	0.0000	g
Density	DE	8.900	g/ml	AUX A/D	AU	no	
Open Circuit	OC	-664.0E-3	V				

Comment: Alloy 22 2277-8-3235 welded 4M Cl 95 C pH 11 deaerated

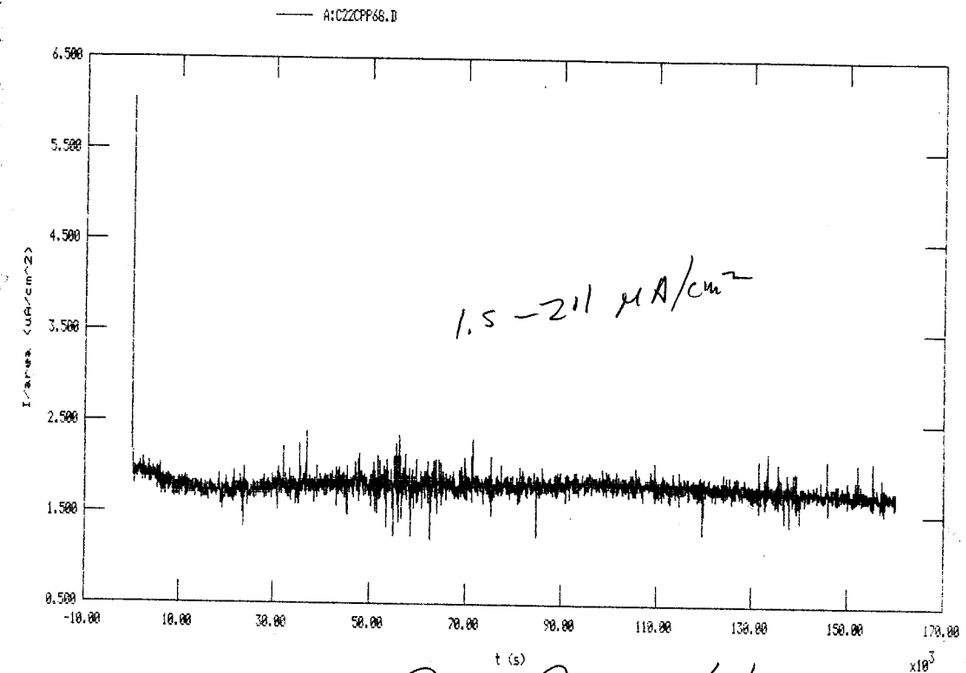
10/27/99

600 mV

Model 352/252 Corrosion Analysis Software, v. 2.30
PS POTENTIOSTATIC File Status: NORMAL Date Run: 09-07-99
CP PASS vs. R CT PASS IP 0.600 vs. R
CR AUTO NP 3000 SO Pass
REF 0.24150 SCE WRK SOLID AR 2.000E+01
OC -0.575
Comment: Alloy 22 2277-8-3235 welded 4M Cl 95 C pH 11 deaerated

Filename: A:C22CPP68.DAT
Time Run: 05:59:41
ID 5 S TP 5.333E+01
IR NONE FL I 5.3Hz
LS YES EW 0.000E+00

Pstat: VStat[] Ver 2
T1 1.600E+05
RT HIGH STABILITY
DEN 8.900E+00 AU NO



10/31/99

Model 352/252 Corrosion Analysis Software, v. 2.30
Filename: A:C22CPP68.DAT
Pstat: VStat[] Ver 2
PS POTENTIOSTATIC File Status: NORMAL
Date Run: 09-07-99 Time Run: 05:59:41

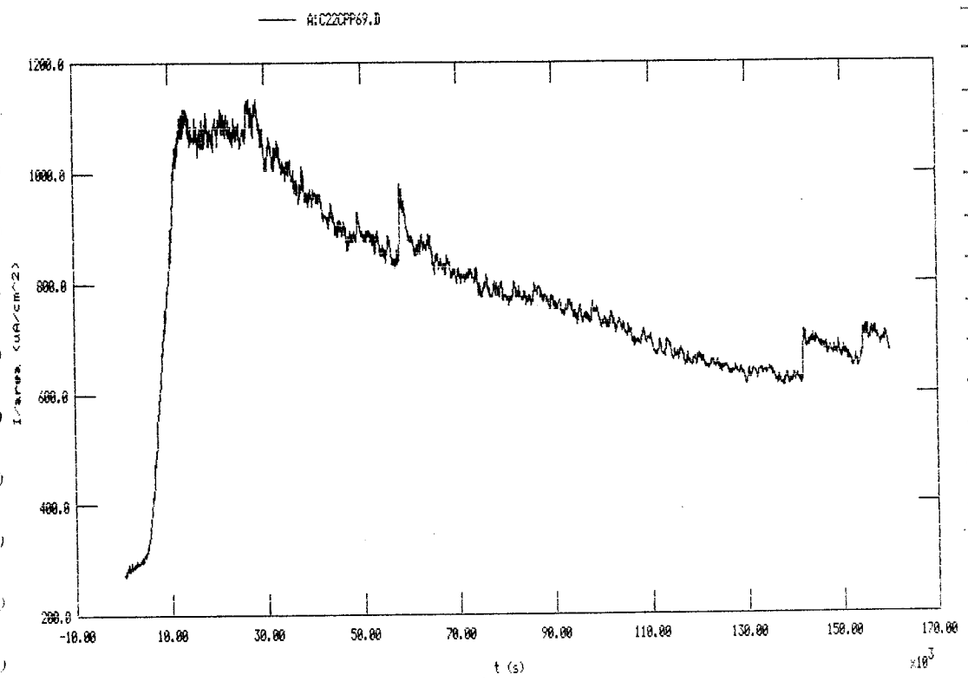
Cond. Time	CT	pass	s	Initial Pot.	IP	600.0E-3	V
Cond. Pot.	CP	pass	V	Time Step 1	T1	160.0E3	s
Initial Delay	ID	5	s	Stop On	SO	Pass	
Time/Pt.	TP	53.33	s	Curr. Range	CR	Auto	
No. of Points	NP	3000					
Line Sync.	LS	yes		IR Mode	IR	none	
Rise Time	RT	high stability		Filter	FL	I 5.3Hz	
Working Elec.	WE	Solid		Ref. Elec.	RE	SCE 241.5E-3V	
Sample Area	AR	20.00	cm^2	Equiv. Wt.	EW	0.0000	g
Density	DE	8.900	g/ml	AUX A/D	AU	no	
Open Circuit	OC	-575.0E-3	V				

Comment: Alloy 22 2277-8-3235 welded 4M Cl 95 C pH 11 deaerated

10/31/99

800 mV

Model 352/252 Corrosion Analysis Software, v. 2.30 Filename: A:C22CPP69.DAT Pstat: VStat[] Ver 2
PS POTENTIOSTATIC File Status: NORMAL Date Run: 09-08-99 Time Run: 14:27:35
CP PASS vs. R CT PASS IP 0.000 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 2.000E+01 LS YES EW 0.000E+00 DEN 8.900E+00 AU NO
OC -0.058
Comment: Alloy 22 2277-8-3235 welded 4M Cl 95 C pH 11 deaerated



Darrell Dan 10/31/99

Model 352/252 Corrosion Analysis Software, v. 2.30
Filename: A:C22CPP69.DAT
Pstat: VStat[] Ver 2
PS POTENTIOSTATIC File Status: NORMAL
Date Run: 09-08-99 Time Run: 14:27:35

Cond. Time	CT	pass	s	Initial Pot.	IP	800.0E-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	20.00	cm^2	Equiv. Wt.	EW	0.0000	g
Density	DE	8.900	g/ml	AUX A/D	AU	no	
Open Circuit	OC	-58.00E-3	V				

Comment: Alloy 22 2277-8-3235 welded 4M Cl 95 C pH 11 deaerated

Darrell Dan 10/31/99

Darrell Dan 5/31/2000

REPASSIVATION POTENTIAL

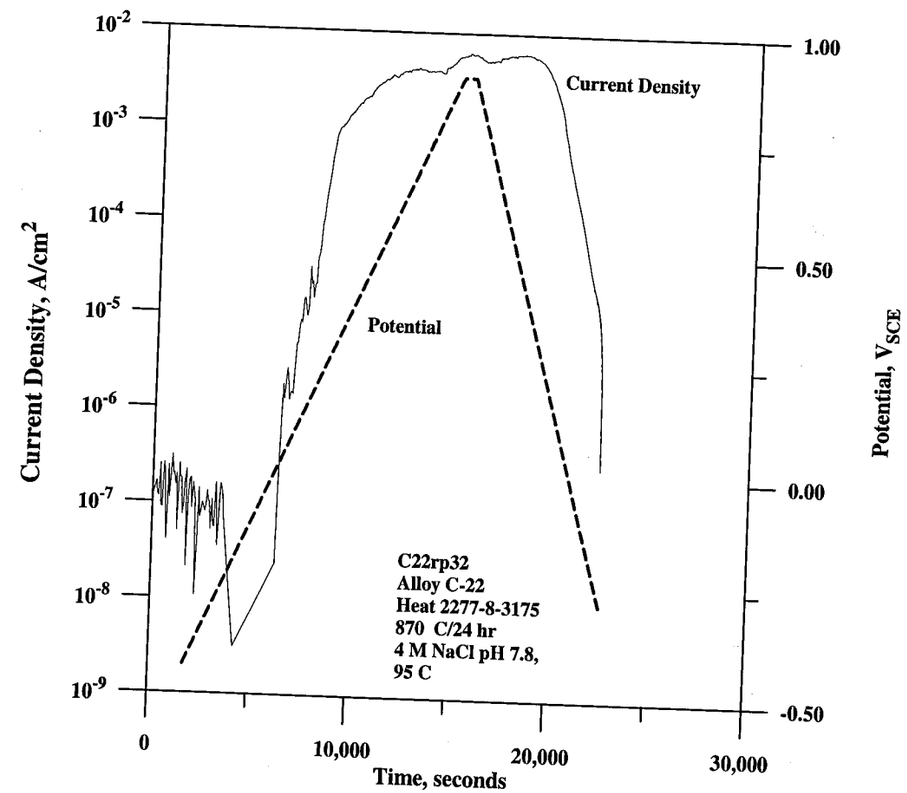
SPECIMEN ALLOY C-22 2277-8-3175
800 °C 24 hr
START WT 47.21567 g
END WT 46.98180 g
600 GRIT FINISH PTFE CREVICE WASHERS

SOLUTION 4 m Cl^- 85 PPM HCO_3 20 PPM $SO_4^=$ 10 PPM NO_3^-
2 PPM F^-
467.5 g NaCl LOT 972274
0.248 g $NaHCO_3$ LOT 923337A
40 mL SO_4 - 9/99 STOCK SOLUTION
20 mL NO_3 - 9/99
4 mL F - 9/99
START pH 7.82
END pH 8.73
DEAERATED W/ N_2
POTENTIOSTAT EG&G 273 SN 41108
T = 95 °C N_2 THERMOMETER C98-106
E_{corr} − 327 mV SCE KEITHLEY 614 SN 764934
E_{pt} −109 mV SCE KEITHLEY 614 SN 764934
REFERENCE FISHER SCE 13-620-51 SN 3106337
TEST PARAMETERS
START POTENTIAL −600 mV SCE
SCAN RATE 0.1 mV/s
HOLD AT 900 mV SCE
REVERSE SCAN RATE 0.17 mV/SEC

DATA SAVED AS. C22RP32.DAT

EXTENSIVE DAMAGE CREVICE CORROSION ON 22 OF 24 SITES
DEEP INTERGRANULAR PENETRATION

10/28/99



$i < 10^{-5}$ A/cm² @ −228 mV SCE

$i < 10^{-6}$ A/cm² @ −259 mV SCE

$i < 0$ @ −262 mV SCE

10/28/99

REPASSIVATION POTENTIAL

SPECIMEN ALLOY C-22 2277-8-3175
CREVICE SPECIMEN W/ CREVICE BLOCKS @ 50 IN-OZ
870°C 4 HOURS 600 GRIT FINISH
START WT 30.74128 g
END WT 30.56050 g

SOLUTION 4 M Cl^- 85 PPM HCO_3 20 PPM SO_4^- 10 PPM NO_3^-
2 PPM F^- 2000 mL AS FOLLOWS
467.5 g NaCl LOT 972274
0.249 g $NaHCO_3$ LOT 923337A
40 mL SO_4^- 9/99 STOCK SOLUTION
20 mL NO_3 - 9/99 "
4 mL F - 9/99 "
START pH 7.65
END pH 8.67
DEAERATED W/ N_2

POTENTIOSTAT EG&G 273 SN 41108
T = 95°C N_2 THERMOMETER C98-106

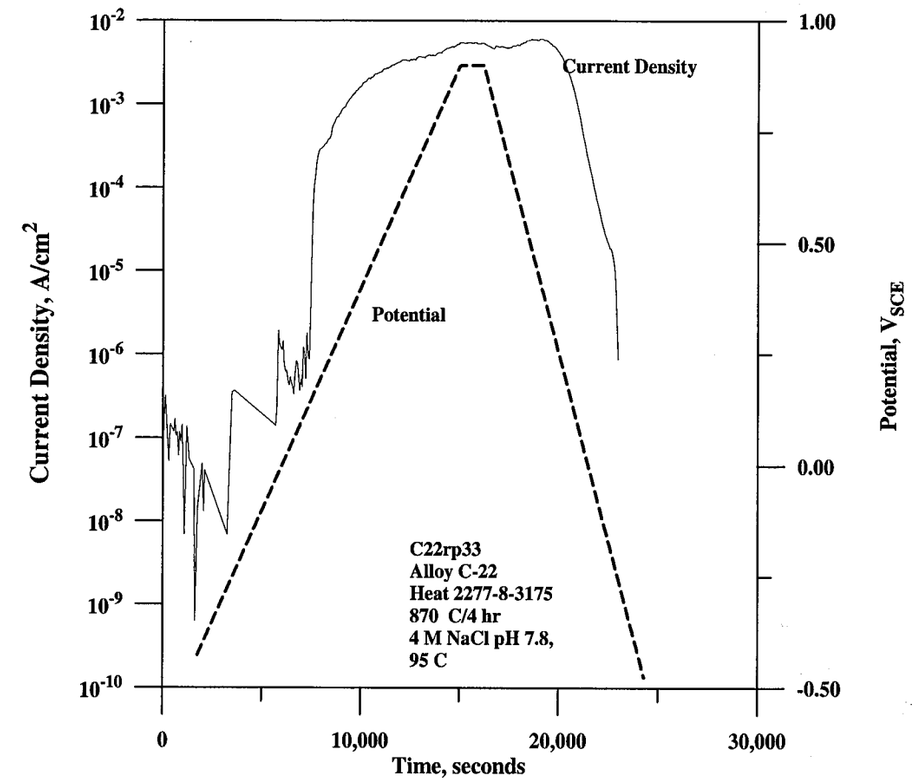
E_{corr} - 505 mV SCE
E_{pt} - 289 mV SCE

TEST PARAMETERS
START POTENTIAL -600 mV SCE
SCAN RATE 0.1 mV/s
HOLD AT 900 mV
REVERSE SCAN RATE 0.17 mV/s

DATA SAVED AS C22RP33.DAT

EXTENSIVE DAMAGE CREVICE CORROSION ON 24/of 24 SITES
200 μM + PENETRATION INTERGRANULAR ATTACK

10/28/99



$i < 10^{-5}$ A/cm² @ -231 mV SCE
$i < 10^{-6}$ A/cm² @ -252 mV SCE
i_{co} @ -262 mV SCE

10/28/99

REPASSIVATION POTENTIAL

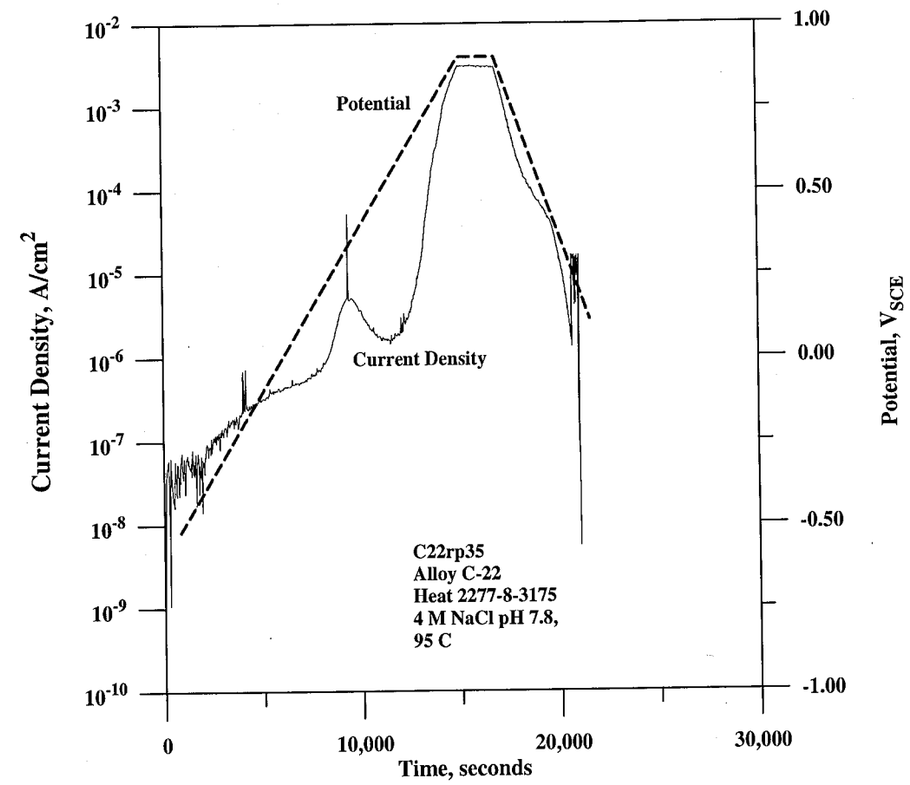
ALLOY C-22 2277-8.3175
CREVICE SPECIMEN W/ CREVICE BLOCKS AT 50 IN-OZ
600 GRIT FINISH
START WT 46.91879g
END WT 46.88889g

SOLUTION 4mCl⁻ 85PPM HCO_3 20PPM $SO_4^=$
10PPM NO_3^- 2PPM F^- 2000 mL AS FOLLOWS
467.5 g NaCl LOT
0.248 g $NaHCO_3$ LOT 923337*
40 mL SO_4 - 10/99 STOCK SOLUTION
20 mL NO_3 10/99 "
4 mL F - 10/99 "
+ DI WATER TO 2000 mL
START pH 7.781
END pH 8.640
T = 95°C Hg THERMOMETER C98-10C
POTENTIOSTAT EG&G 273 SN 41108
REFERENCE ELECTRODE FISHER 13-620-51 SN 3166337

Ecorr -536 mV KEITHLEY 614 SN 704934
Epr -042 mV "

TEST PARAMETERS
START POTENTIAL -600 mV
SCAN RATE 0.1 mV/s
HOLD AT 900 mV
REVERSE SCAN 0.167 mV/s

Specimen is gold color No clear indication of localized Corrosion.
* Note: Specimen Repolished for Reuse



$i < 10^{-5}$ A/cm² 337 mV SCE

$i < 0$ 258 mV SCE

11/3/99

REPASSIVATION POTENTIAL C-22

SPECIMEN ALLOY C-22 2277-8-3175
CREVICE SPECIMEN W CREVICE BLOCKS AT 50 IN-OZ
870°C FOR 30 min 600 GRIT FINISH
START WT 37.51496g
END WT 37.43675g

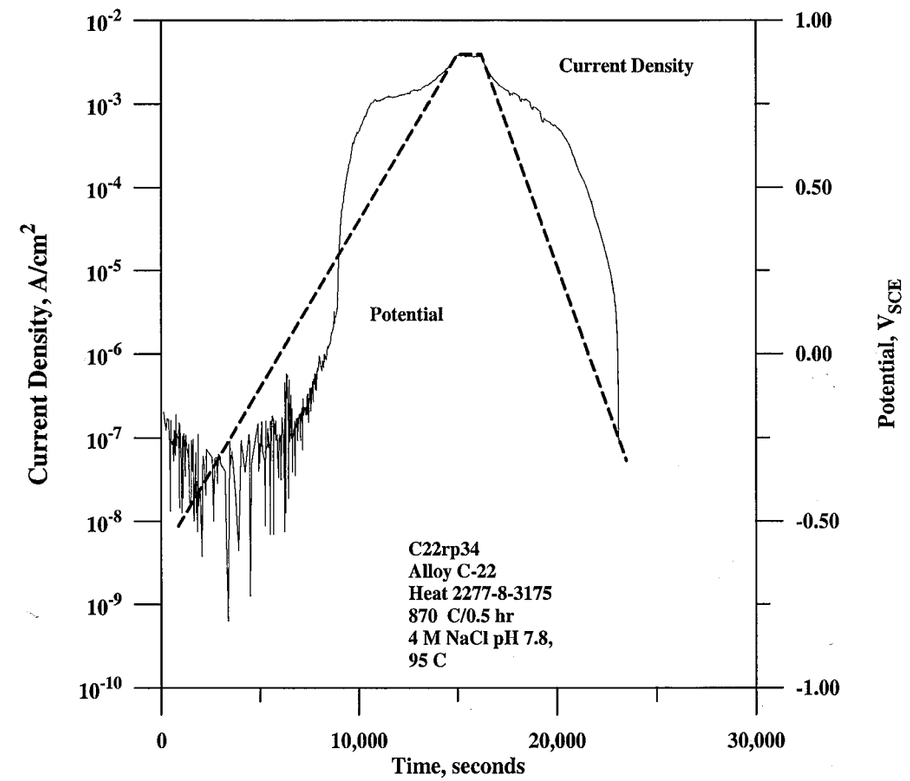
SOLUTION 4 mCl⁻ 85 PPM $NaCO_3$ 20 PPM SO_4 10 PPM NO_3 2 PPM F⁻
2000 mL AS FOLLOWS
467.5g NaCl LOT
0.248 g $NaHCO_3$ LOT 923337*
40 mL SO_4 - 10/99
20 mL NO_3 10/99
4 mL F - 10/99
+ DI WATER TO 2000 mL
START pH 7.57
END pH 8.63
DEAERATED w/ N_2
T = 95°C Hg THERMOMETER C98-106
POTENTIOSTAT EG&G 273 SN 41108
REFERENCE FISHER SCE 13-620-51 SN 3106337

E_{corr} -506 mV KEITHLEY 614 SN 704934
E_{pt} -353 mV

TEST PARAMETERS
START POTENTIAL -600 mV_{SCE}
SCAN RATE 0.1 mV/s
HOLD AT 900 mV_{SCE}
RELEASE SCAN 0.167 mV/s

DATA SAVED AS C22RP34.DAT

CREVICE ATTACK ON 12 OF 24 LOCATIONS
INTERGRANULAR CORROSION [signature] 10/29/99



$i < 10^{-5}$ A/cm² @ -179 mV_{SCE}

$i < 10^{-6}$ A/cm² @ -246 mV_{SCE}

$i < 0$ @ -258 mV_{SCE}

[signature] 10/31/99

STOCK SOLUTIONS 10/99

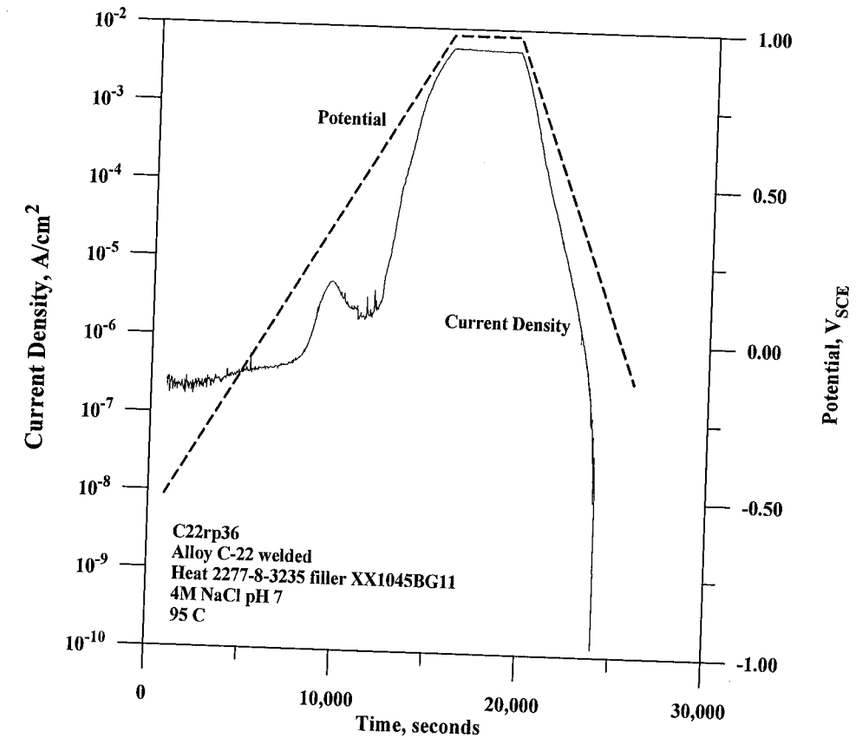
1000 ppm SO_4 - 10/99

1.147347 g Na_2SO_4 LOT 901213
PREP 10/27/99 EXP 11/27/99

1000 ppm NO_3 - 10/99
1.37339 g $NaNO_3$ LOT 961772A
PREP 10/27/99 EXP 11/27/99

1000 ppm F- 10/99
2.21528 g NaF LOT 896405
PREP 10/27/99 EXP 11/27/99

10/31/99



$i < 10^{-5}$ A/cm² @ 495 mV SCE
$i < 10^{-6}$ A/cm² @ 336 mV SCE
$i < 0$ A/cm² @ 219 mV SCE

5/31/2000

REPASSIVATION POTENTIAL

SPECIMEN ALLOY C22 WELDED
HEAT 2277-8-3235
FILLER 622 HEAT XX1045BG11
600 GRIT FINISH
START WT 39.55453 g
END WT 39.46098 g

SOLUTION 4 M NaCl 85 PPM NCO_3 20PPM SO_4 10PPM NO_3
2PPM F- 2000 mL MADE AS FOLLOWS
467.5 g NaCl LOT 995718
0.248 g $NaHCO_3$ LOT 897789
40 mL SO_4 - 10/99 STOCK SOLUTION
20 mL NO_3 10/99 "
10 mL F 10/99 "
+ DI WATER TO 2000 mL

START pH 7.532
END pH 8.472
TEMP = 95°C Hg THERMOMETER C98-106

POTENTIOSTAT EG&G 273 SN 41108
REFERENCE FISHER SCE 13-620-51 SN 3106337

Ecorr -698 KEITHLEY 614 SN 704934
Ept -47 mV "

TEST PARAMETERS
START POTENTIAL -600 mV_{SCE}
SCAN RATE 0.1 mV/s
HOLD AT 900 mV_{SCE}
REVERSE SCAN 0.167 mV/s

DATA SAVED AS C22RP36.DAT
no localized corrosion, light yellow film
spec. repolished for use in next test

Walter MacDonald
11/30/99

LT825PSAE

SPECIMEN ALLOY 825 HEAT 4371FG
START WT 39.07482 g
END WT 39.07469 g
2 PTFE CREVICE WASHERS AT 50 IN·OZ

SOLUTION 1000 ppm Cl^- 85PPM NCO_3^- 20PPM $SO_4^=$
10 PPM NO_3 2 PPM F^-
3.29621 g NaCl LOT
0.24827 g $NaHCO_3$ LOT
40 mL SO_4 - 10/99
20 mL NO_3 10/99
4 mL F- 10/99
+ DI WATER TO 2000 mL

START pH 8.283
END pH

T = 95°C Hg THERMOMETER E98-191
POTENTIOSTAT ESC 440 #1 CHANNEL #1
CE pt FLAG
REF FISHER SCE 13-620-51 SN 813114L

Ecorr -63 mV KEITHLEY 614 SN 467374
Ept +116 mV "
E APPLIED + 100 mV_{SCE}
TEST STARTED 11/23/99 4:20 PM
DATA FILE L825PSAE.DAT

5/31/2000

C22L6A

SPECIMEN ALLOY C-22 2277-8-3175
START WT 46.35059
END WT 46.34635 g
2 PTFE CREVICE WASHERS AT 50 oz·in

SOLUTION 4 mCl⁻ 85 PPM NCO_3 20 PPM SO_4
10 PPM NO_3 2 PPM F⁻
467.5 g NaCl LOT
0.248 g $NaHCO_3$ LOT
40 mL SO_4⁻ 10/99
20 mL NO_3 10/99
2 mL F⁻ 10/99
+ DI WATER TO 2000 mL

START pH 7.508
END pH

T=95 °C Hg THERMOMETER H96-1090

DD 11/21/99

POTENTIOSTAT ESC 440 #1 CHANNEL ~~#2~~ 3 NZM 12/1/99
CE PT FLAG
REFERENCE FISHER SCE 13-620-51 SN ~~8238320~~ 8205236

E_{corr} -313 mV_{SCE} KEITHLEY 614 SN 467374
E_{pt} +225 mV_{SCE} "
$E_{APPLIED}$ ~~+300 mV SCE~~ DD 11/23/99 +300 mV_{SCE}
TEST STARTED 11/23/99 4:20 PM
DATAFILE C22L6A.DAT

Donald Dan 5/31/2000

C22L7A

SPECIMEN ALLOY C-22 WELDED
BASE METAL 2277-8-3235
FILLER 622 XX1045BG11
START WT 38.31627 g
END WT NOT RECORDED
2 PTFE CREVICE WASHERS AT 50 IN·OZ

SOLUTION 4 m Cl⁻ 85 PPM NCO_3 20 PPM SO_4
10 PPM NO_3 2 PPM F⁻
g NaCl LOT
g $NaHCO_3$ LOT
40 mL SO_4 -10/99
20 mL NO_3 10/99
4 mL F⁻ 10/99
+ DI WATER TO 2000 mL

START pH 7.567
END pH

T = 95 °C Hg THERMOMETER

DD 11/21/99

POTENTIOSTAT ESC 440 #1 CHANNEL ~~#3~~ 2
CE PT FLAG
REFERENCE FISHER SCE 13-620-51 SN 8238320

E_{corr} - 298 mV_{SCE} KEITHLEY 614 SN 467374
E_{pt} +225 mV_{SCE} "
$E_{APPLIED}$ +400 mV_{SCE}
TEST STARTED 11/23/99 4:20 PM
DATAFILE ~~C22L7~~ DD 11/21/99 C22L7A.DAT

Donald Dan 5/31/2000

C22L3D

SPECIMEN C-22 HEAT 2277-8-3175
START WT 47.21857
END WT 47.21504 g
2 PTFE CREVICE WASHERS AT 50 IN.OZ

SOLUTION 4 M Cl⁻ 85 PPM HCO_3 20 PPM SO_4
10 PPM NO_3 2 PPM F⁻
467.5 g NaCl LOT
0.248 g $NaHCO_3$ LOT
40 mL SO_4 - 10/99
20 mL NO_3 10/99
4 mL F 10/99
+ DI WATER TO 2000 mL

START pH 7.506
END pH

T = 95 °C Hg THERMOMETER

POTENTIOSTAT ESC 440 #1 CHANNEL #4
CE pt FLAG
REFERENCE FISHER SCE 13-620-51 SN

Ecorr - 193 mV SCE KEITHLEY 614 SN 467374
Ept + 196 mV SCE "
E APPLIED O.C.
TEST STARTED 11/23/99 4:20 PM
DATA FILE C22L3D.DAT

Daniel D 5/31/2000

0825C1AB

SPECIMEN ALLOY 825 HEAT 4371F6
START WT 39.29057 g
END WT 39.29006 g
2 PTFE CREVICE WASHERS AT 50 IN·OZ

SOLUTION 1000 PPM Cl⁻ 85 PPM HCO_3 20 PPM $SO_4^{=}$
10 PPM NO_3^- 2 PPM F⁻
3.29644 g NaCl LOT
0.24819 g $NaHCO_3$ LOT
40 mL SO_4 - 10/99
20 mL NO_3 10/99
4 mL F⁻ 10/99
+ DI WATER TO 2000 mL

START pH 8.179
END pH

T = 95 °C Hg THERMOMETER

POTENTIOSTAT ESC 440 #1 CHANNEL #5
CE ~~AD~~ DD 11/21/99 pt FLAG
REFERENCE FISHER SCE 13-620-51 SN

Ecorr - 123 mV SCE KEITHLEY 614 SN ~~47~~ 467374 DD 11/23/99
Ept + 130 mV SCE
E APPLIED O.C
TEST STARTED 11/23/99 4:20 PM
DATA FILE 0825C1AB.DAT

Daniel D 5/31/2000

5/31/2000

Repassivation Potential

Specimen: Alloy C-22 Welded (same specimen as p.66)
Heat 2277-8-3235
Filler 622 NOMT XX1045 BA11
repolished to 600 grit finish, PTFE washers @50in-lb
Start wt. 38.85794 g End wt. 38.71232 g

Solution: 4M Cl^- 85 ppm HCO_3^-
20 ppm $SO_4^=$ 10 ppm NO_3^- 2 ppm F^-
467.5 g NaCl Lot # 995718
0.23617 g $NaHCO_3$ " 897789
40 ml $SO_4^=$
20 ml NO_3^- } Stock sol'n 10/99 (p.64)
4 ml F^-
+ DI water to 2000 mL

Start pH 7.270 End pH 6.874
deaerated w/ N_2
T = 95°C Hg thermometer C98-106

Potentiostat EG&G 273 S/N 41108
Ref: Fisher SCE 13-620-51 S/N 3106337

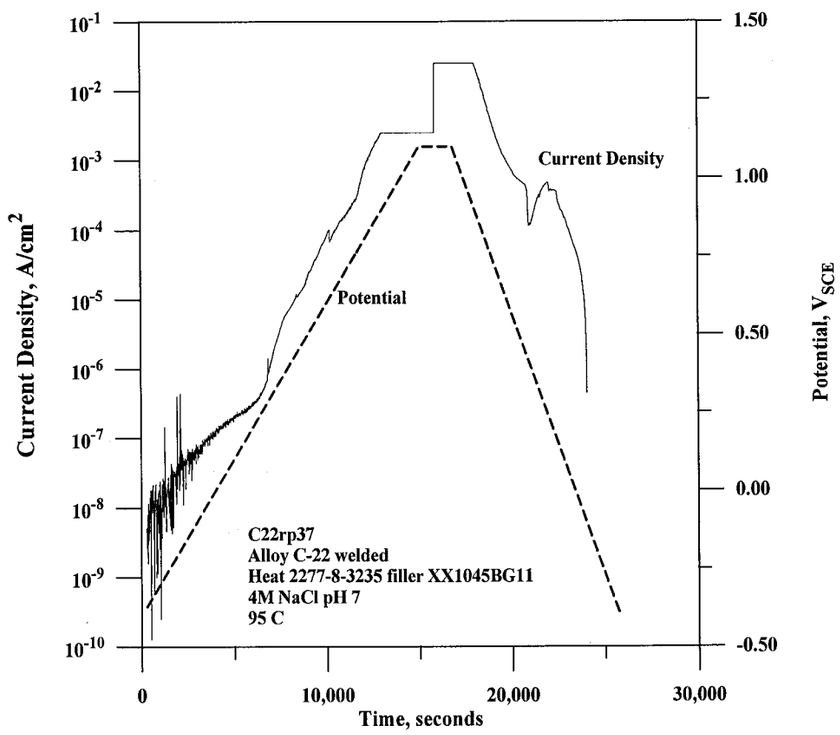
E_{corr}
E_{pt} for pt to measure Keithly 614 S/N ~~310~~ 704934 11/22/99 WJM

Run on 11/24/99 saved as C22RP37.DAT

Specimen a lite gold color; localized corrosion initiated in 2 areas under the crevice washer
specimen will be repolished + re-used

Start −400 mV SCE
rate 0.1 mV/sec
Hold 1100 mV SCE
Rev. 0.167 mV/sec

Walter J Mackerle
11/29/99



$i < 10^{-5}$ A/cm² −89 mV_SCE

$i < 10^{-6}$ A/cm² −101 mV_SCE

5/31/2000

Repassivation Potential

Specimen: Alloy C-22 Welded (same specimen as p. 73)
Heat 2277-8-3235 Filler: 622 ~~WELD~~ XX 104586-11
repolished to 600 grit; PTFE crevice washer @ 50 in-oz

Start WT. 37.01487 g End WT. 36.86033

Solution: 3M Cl⁻ 85 ppm NO_3^-
20 ppm $SO_4^=$ 10 ppm NO_3^- 2 ppm F^-
350.6 g NaCl Lot # 995718
0.23571 g $NaNO_3$ Lot # 897789
40 ml $SO_4^=$
20 ml NO_3^- } 10/99 p. 64
4 ml F^-
+ DI water to 2000 ml

Start pH 6.940 End pH 7.896
deaerated w/ N_2
T = 95°C Hg thermometer C98-106

Potentiostat EG&G 273 S/N 41108
Reference: Fisher SCE 13-620-51 S/N 3106337

E_{corr} −706 mV Keithly 614 S/N 704934
E_{pp} −547 mV " " "

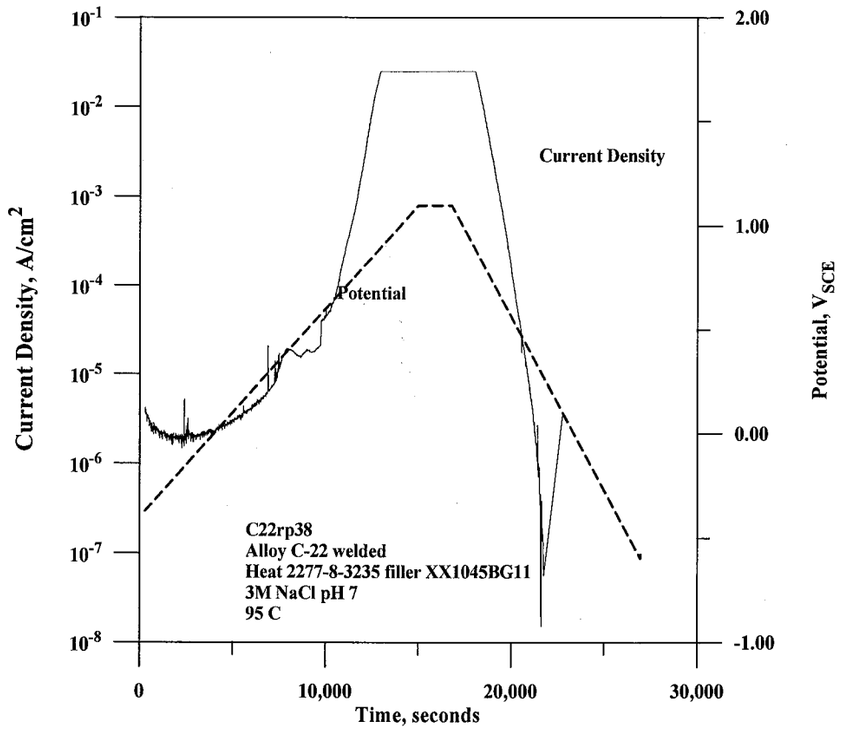
Test run 12/1/99 Start −400 mV SCE
rate 0.1 mV/sec
Hold 1100 mV SCE (1800 secs)
rev. 0.167 mV/sec

no visible localized corrosion

saved as C22RP38.DAT

specimen re-polished + reused

Walter J. Mochowski
12/2/99



$i < 10^{-5}$ A/cm^2 413 mV_{SCE}

$i < 10^{-6}$ A/cm^2 316 mV_{SCE}

$i < 0$ 300 mV_{SCE}

Darrell Dan 5/31/2000

Stock Solutions 12/99

1000 ppm $SO_4^{=}$ 12/99

1.4766 g Na_2SO_4

prep. 12/1/99 exp 1/1/00

1000 ppm NO_3^- 12/99

1.37233 g $NaNO_3$

prep. 12/1/99 exp 1/1/00

1000 ppm F^- 12/99

2.2146 8 g NaF

prep. 12/1/99 exp. 1/1/99

Walter J Mackowski

12/1/99

Darrell Dean 5/31/2000

Repassivation Potential

Specimen: Alloy C-22 not welded
HGAT 2277-8-3175
Start wt. 37.67294g End wt. 37.54194g
600 grit polished
2 PTFE crevice washers @ 50 in-oz

Solution: Sat'd NaCl 85 ppm HCO_3^-
20 ppm $SO_4^=$ 10 ppm NO_3^- 2 ppm F^-
sat'd @ 5M
650.0 g NaCl #985718
0.23327 g $NaHCO_3$ #897789
10 ml $SO_4^=$
20 ml NO_3^- } 12/99 Stock Sol'n p.27
4 ml F^-
+ DI Water to 2000 mL
Start pH 6.915 End pH 7.395
deaerated w/ N_2
T = 95°C Hg thermometer C98-106

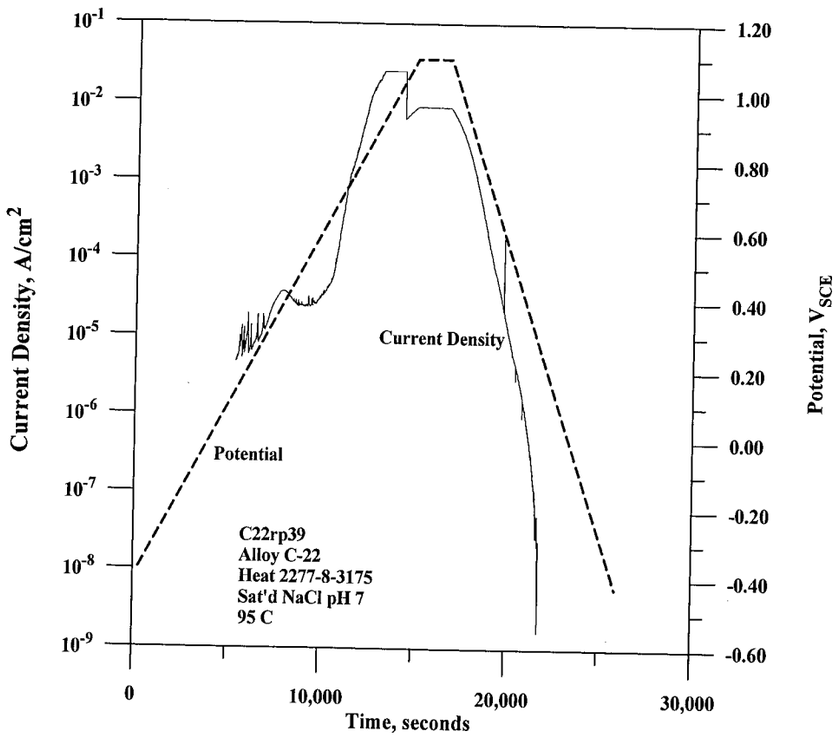
Potentiostat EG&G 273 S/N 41108
Reference Fisher SCE 13-620-51 S/N 3106337

E_{corr} -615 mV Keithley 614 S/N 704934
~~Epp~~ -593 mV " " "

rem 12/9/99 start -400 mV
rate up 0.1 mV/sec
Hold 1100 mV (1800 secs)
rate down 0.167 mV/sec

same as C22 RP39.DAT
no localized corrosion; transpassive dissolution, very light gold film

Walter J Mackowski
12/10/99



i < 10^{-5} A/cm² 550 mV$_{SCE}$

i < 10^{-6} A/cm² 395 mV$_{SCE}$

i < 0 292 mV$_{SCE}$

Russell Rowe
5/31/2000

Repassivation Potential

Specimen: Alloy C-22 Welded (same spec. as p.75)
Heat # 2277-8-3235 Filler: 622 Heat XX 1045 8011
repolished to 600 grit; PTFE crevice washers @ 50 in-oz

C22 RP 40.DAT
Start wt. 36.05194 g End Wt. 35.94158 g

Solution: Sat'd NaCl 85 ppm HCO_3^-
20 ppm $SO_4^=$ 10 ppm NO_3^- 2 ppm F^-

650.0 g NaCl # 995718
0.23562 g $NaHCO_3$ # 897789
40 ml $SO_4^=$
20 ml NO_3^- } 12/99 Stock Sol'n p. 77
4 ml F^-

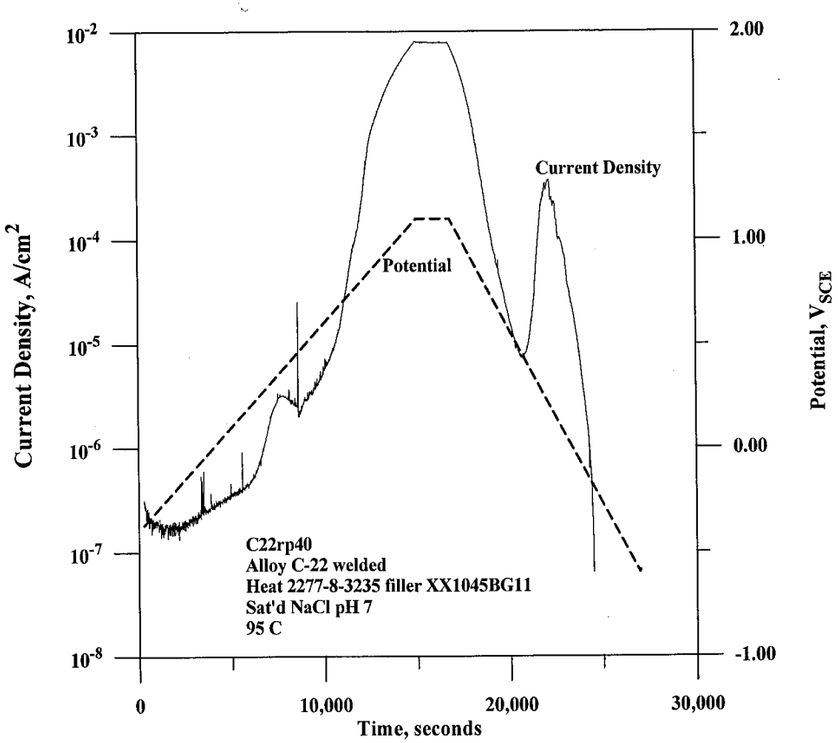
+ DI water to 2000 mL
Start pH 7.101 End pH 7.934
deaerated w/ N_2
T = 95°C Hg thermometer

Potentiostat EG&G 273 S/N 41108
Reference Fisher SCE 13-620-51 S/N 3106337

E_{corr} −684 mV$_{SCE}$ Keithly 614 S/N 704934
E_{pp} −590 mV$_{SCE}$ " " "
sm 12/13/99 same protocol as p.79

not much color on specimen, 3 areas of localized corrosion (2 major + 1 small spot), all in weld area, some transpassive dissolution elsewhere

Walter J Mazkowski
12/14/99



$i < 10^{-5}$ A/cm² — 55 mV SCE

$i < 10^{-6}$ A/cm² — 155 mV SCE

$i < 0$ — 187 mV SCE

5/31/2000

Repassivation Potential

Specimen: Alloy C-22 not welded
(repolished specimen from p. 79)
600 grit polished
2 PTFE crevice washers @ 50 in-oz
Start wt. 37.25423 End wt 34.71663 g

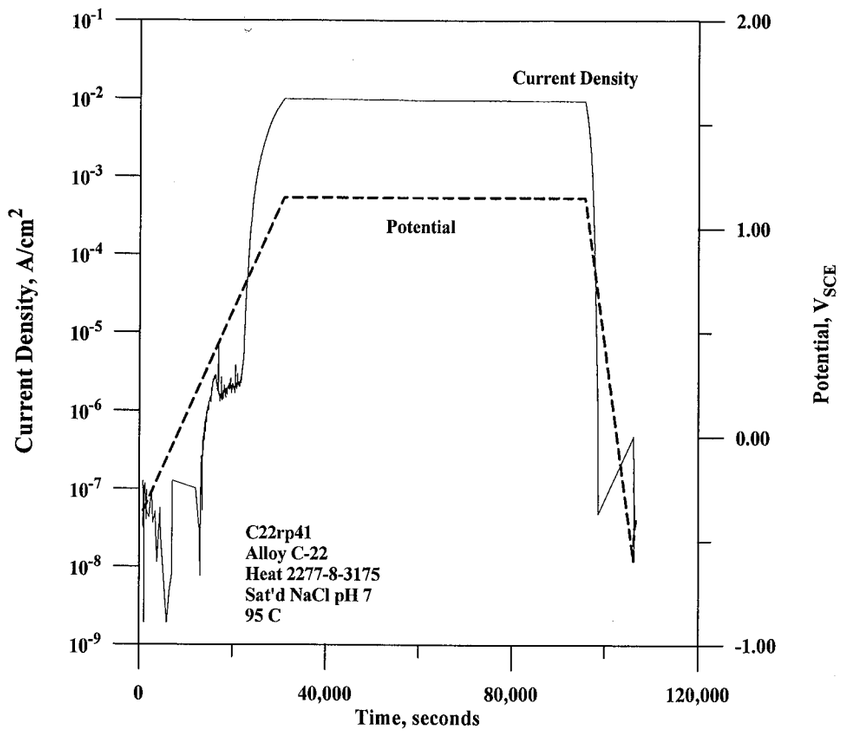
Solution: Sat'd NaCl 85 ppm HCO_3^-
20 ppm $SO_4^=$ 10 ppm NO_3^- 2 ppm F^-
650 g NaCl Lot # 995718
0.23601 g $NaHCO_3$ Lot # 897789
40 ml $SO_4^=$
20 ml NO_3^- } 12/99
4 ml F^-
+ DI water to 2000 mL
Start pH 7.087 End pH 5.431

deaerated w/ N_2
T = 95°C Hg Thermometer
(controller failure caused sol'n to boil prior to test
this was corrected before starting test)

Potentiostat EG&G 273 S/N 41108
Reference Fisher SCE 13-620-51 S/N 310633

E_{corr} -656 mV SCE Keithly 614 S/N 304934
E_{pp} -636 " " " "
run 12/16 - 12/17 -400 start
0.05 mV/s rate up
saved as C22RP41.DAT hold @ 1150 64,800 secs
no localized corrosion 0.167 mV/s rate down
much transpassive dissolution step -600 mV

Walter J Machowski
12/21/99



$i < 10^{-5}$ A/cm² 723 mV SCE

$i < 10^{-6}$ A/cm² 678 mV SCE

$i < 0$ 653 mV SCE

Darrell Dan 5/31/2000

STOCK SOLUTIONS 3/2000

1000 PPM SO_4 (SO_4 -3/2000)
1.46866 g Na_2SO_4 LOT 901213
+ DI WATER TO 1000 mL
PREP 3/6/2000 EXP 4/6/2020

1000 PPM NO_3 (NO_3 -3/2000)
1.37426 g $NaNO_3$ LOT 961772A
+ DI WATER TO 1000 mL
PREP 3/6/2000 EXP 4/6/2000

1000 PPM F^- (F -3/2000)
2.21154 g NaF LOT 896405
+ DI WATER TO 1000 mL
PREP 3/6/2000 EXP 4/6/2000

Darrell Dan 5/31/2000

LT825PSAF

SPECIMEN ALLOY 825 NH4371FG
START WT 39.07469g
END WT 39.07438g
2 PTFE CREVICE WASHERS ATTACHED AT 50 IN-OZ
USING PROTO 6103
SOLUTION
1000 ppm Cl⁻ 85ppm HCO_3 20ppm SO_4^-
10ppm NO_3^- 2ppm F^- 2000 mL AS FOLLOWS
3.29603g NaCl LOT 995007
0.24336g $NaHCO_3$ LOT 923337A
40mL SO_4 - 3/2000
20 mL NO_3 -3/2000
4 mL F -3/2000
+ DI WATER TO 2000mL

START pH 8.206 FISHER ACCUMET 950 SN 3340
END pH 8.749
T = 95 °C Hg THERMOMETER H96-1640

E_{corr} -48 mV KEITHLEY 614 SN 555368
E_{pt} +115 mV
E APPLIED 100 mV SCE

POTENTIOSTAT ESC 440 #1 CHANNEL #1
REFERENCE FISHER 13-620-51 SN 8127010

TEST STARTED 3/10/2000 5:00PM

4/26/02

C22L8A

SPECIMEN ALLOY C-22 WELDED
BASE METAL 2277-8-3235
FILLER XX1045BG11
START WT 38.99325g
END WT 38.97429g
2 PTFE CREVICE WASHERS ATTACHED AT 50 IN-OZ
SOLUTION 8/25/2000
4mCl⁻ 85ppm HCO_3 ~~20ppm NO~~ 20ppm SO_4^-
10ppm NO_3^- 2ppm F^-
467.5g NaCl LOT 995007
0.24133g $NaHCO_3$ LOT 923337A
40 mL SO_4- 3/2000
20 mL NO_3 - 3/2000
4 mL F - 3/2000
+ DI WATER TO 2000 mL

START pH = 7.613 FISHER ACCUMET 950 SN 3340
END pH 8.589

T=95 °C Hg THERMOMETER C96-784

E_{corr} -300 mVSCE KEITHLEY 614 SN 555368
E_{pt} +205mV "
E APPLIED 300 mVSCE

POTENTIOSTAT ESC 440 #1 CHANNEL #2
REFERENCE FISHER 13-620-51 SN 9214083

TEST STARTED 3/10/2000 5:00 PM

Crevice Corrosion in two areas

~~C22L7B~~ DP 3/1/2000 C22L6B

SPECIMEN ALLOY C-22 2277-8-3175
START WT ~~43.34635g~~ DP 3/10/2000 46.34635
END WT 46.34550
2 PTFE CREVICE WASHERS ATTACHED AT 50IN-OZ
SOLUTION
4mCl⁻ 85PPM HCO_3 20PPM $SO_4^=$ 10PPM NO_3^-
2PPM F⁻ 2000 mL MADE AS FOLLOWS
467.5 g NaCl LOT 995007
0.24043 g $NaHCO_3$ LOT 923337A
40 mL SO_4^- 3/2000
20 mL NO_3^- 3/2000
4 mL F⁻ 3/2000
+ DI WATER TO 2000 mL

START pH 7.738 FISHER ACCUMET 950 SN 3340
END pH 7.933
T=95°C Hg THERMOMETER H98-180

E_{corr} −219 mV SCE KEITHLEY 614 SN 555368
E_{pt} ~~−359 mV SCE~~ DP 3/10/2000 +237 mV SCE
$E_{APPLIED}$ 400 mV SCE

POTENTIOSTAT ESC 440 #1 CHANNEL #3
REFERENCE 13-620-51 SN 8131146

TEST STARTED 3/10/2000 5:00 PM

1 AREA OF CREVICE CORROSION

C22L3E

SPECIMEN C22 2277-8-3175
START WT 47.21504 g
END WT 47.22316 g
2 PTFE CREVICE WASHERS ATTACHED AT 50 IN-OZ
USING PROTO 6103

SOLUTION 4 mCl⁻ 85 PPM HCO_3 20PPM SO_4 10PPM NO_3
2PPM F⁻ 2000 mL AS FOLLOWS
467.5 g NaCl LOT 995007
0.24085 g $NaHCO_3$ LOT 923337A
40 mL SO_4 − 3/2000
20 mL NO_3 − 3/2000
4 mL F − 3/2000
+ DI WATER TO 2000 mL
BUBBLED W/ ZERO AIR
START pH 7.670 FISHER ACCUMET 950 SN 3340
END pH 8.594
T= 95°C Hg THERMOMETER E98-273

E_{corr} −120 mV SCE KEITHLEY 614 SN 555368
E_{pt} +114 mV SCE
$E_{APPLIED}$

POTENTIOSTAT ESC 440 #1 CHANNEL #4
REFERENCE 13-620-51 SN 8205236

TEST STARTED 3/10/2000 5:00 PM

©C825C1AC

SPECIMEN ALLOY 825 HN4371FG
START WT 39.29006 g
END WT 39.29036 g
2 PTFE CREVICE WASHERS ATTACHED AT 50 IN-OZ
USING PROTO 6103

SOLUTION 1000 PPM Cl⁻ 85 PPM NCO_3 20 PPM $SO_4^=$
10 PPM NO_3^- 2 PPM F⁻ 2000 mL AS FOLLOWS
3.29638 g NaCl LOT 995007
0.24113 g $NaHCO_3$ LOT 923937A
40 mL SO_4 -3/2000
20 mL NO_3 -3/2000
4 mL F⁻ 3/2000
+ DI WATER TO 2000 mL
BUBBLED W/ ZERO AIR
START pH 8.047 FISHER ACCUMET 950 SN 3340
END pH 9.008

T = 95°C Hg THERMOMETER C96-727

E_{corr} -134 mV KEITHLEY 614 SN 555368
E_{pt} +135 mV "
$E_{APPLIED}$

POTENTIOSTAT ESC 440 #1 CHANNEL #5
REFERENCE FISHER SCE 13-620-51 SN 8238320

TEST STARTED 3/10/2000 5:00 PM

Darrell Dean 4/26/02

Passive Current density Alloy 22

OBJECTIVE MEASURE PASSIVE CURRENT DENSITY OF ALLOY 22
SPECIMEN ALLOY 22 HEAT 2277-8-3175
0.250" DIA × 1.915" LONG
600 GRIT FINISH
START WT 12.23161 g
END WT 12.23157 g
SOLUTION 4 m Cl⁻ 85 PPM NCO_3 20 PPM $SO_4^=$ 10 PPM NO_3^-
2 PPM F⁻
446.8 g NaCl LOT 975121
0.243 g $NaHCO_3$ LOT 897789
40 mL SO_4 -5/2000 P. 93
20 mL NO_3 -5/2000 P. 93
4 mL F⁻ 5/2000 P. 93
+ DI WATER TO 2000 mL
SOLUTION DEAERATED WITH 99.999% N_2 PASSED THROUGH OXYGEN TRAP
START pH 7.734 FISHER ACCUMET 950 SN 3340
END pH 8.464 "

T = 95°C Hg THERMOMETER ~~C98~~ 5/4/2000 C96-816

E_{corr} -384 mV SCE KEITHLEY 614 SN 467374
E_{pt} -232 mV SCE "
$E_{APPLIED}$ -200 mV SCE " FOR 14 DAYS

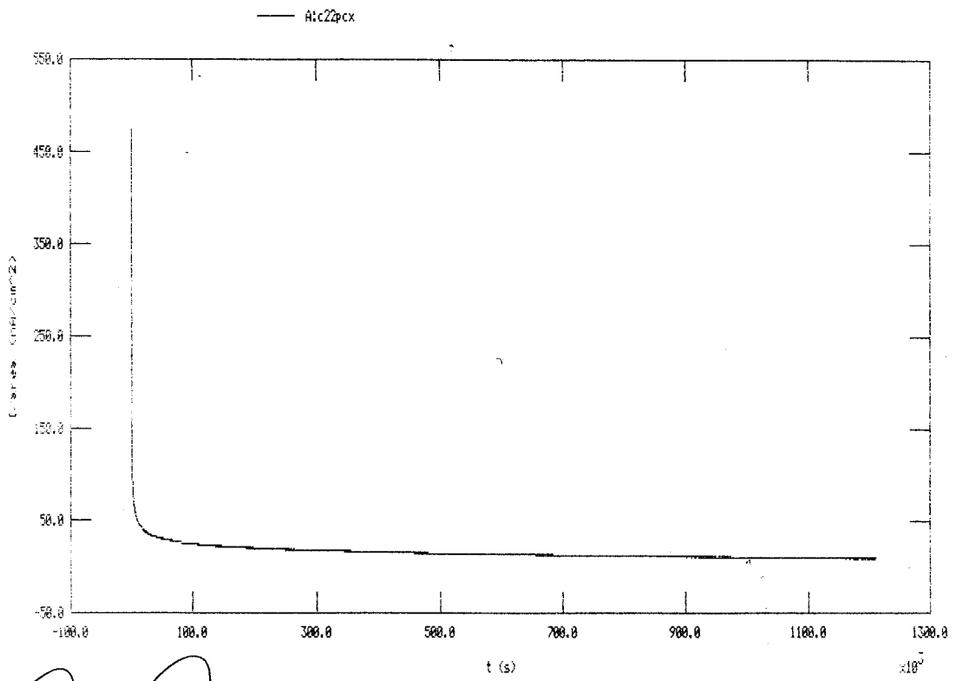
POTENTIOSTAT EG&G VERSASTAT SN 20104
REFERENCE FISHER SCE 13-620-51 SN 8238324

TEST STARTED 5/4/2000 3:30 PM
DATA FILE C22CPP70.DAT
PH ELECTRODE FISHER 13-620-296 SN 7064138
NO SIGN OF LOCALIZED CORROSION OR GENERAL ATTACK

Darrell Dean 5/23/2000

PASSIVE CURRENT DENSITY ALLOY 22

Model 352/252 Corrosion Analysis Software, v. 2.30 Filename: A:c22pcx Pstat: VStat[] Ver 2 PS POTENTIOSTATIC
File Status: NORMAL Date Run: 03-26-00 Time Run: 14:29:19
CP PASS vs. R CT PASS IP -0.200 vs. R TP 4.032E+02 TI 1.210E+06
CR AUTO NP 3000 SO Pass IR NONE FL I 5.3Hz AT HIGH STABILITY
REF 0.24150 SCE WAK SOLID AR 8.000E+00 LS YES EW 0.000E+00 DEN 8.140E+00 AU NO
OC -0.385
Comment: Alloy 22 4M Cl pH=8 95 C



5/23/2000

9.625 - 10.50 nA/cm²

AFTER 1100 x 10³ SECONDS

Model 352/252 Corrosion Analysis Software, v. 2.30
Filename: A:c22pcx
Pstat: VStat[] Ver 2
PS POTENTIOSTATIC File Status: NORMAL
Date Run: 03-26-00 Time Run: 14:29:19

Cond. Time	CT	pass	s	Initial Pot.	IP	-200.0E-3	V
Cond. Pot.	CP	pass	V	Time Step 1	T1	1.210E6	s
Initial Delay	ID	5	s	Stop On	SO	Pass	
Time/Pt.	TP	403.2	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	8.140	g/ml	AUX A/D	AU	no	
Open Circuit	OC	-385.0E-3	V				

Comment: Alloy 22 4M Cl pH=8 95 C

5/23/2000

STOCK SOLUTIONS 5/2000

1000 PPM SO_4 - 5/2000
1.47131 g Na_2SO_4 LOT 901213
+ DI WATER TO 1000 mL
PREP 5/3/2000 EXP 6/3/2000

1000 PPM NO_3 - 5/2000 5/3/2000
1.37215 g $NaNO_3$ LOT 961773A
+ DI WATER TO 1000 mL
PREP 5/3/2000 EXP 6/3/2000

~~1000 PPM F-~~ 5/3/2000

1000 PPM F- 5/2000
2.21371 g NaF LOT 896405
5/3/2000 ~~PIPET 1000 mL~~ + DI WATER TO 1000 mL
PREP 5/3/2000 EXP 6/3/2000

4/28/02

Passive Current density Alloy 22

OBJECTIVE SAME AS P 91

SPECIMEN ALLOY 22 HEAT 2277-8-3175

SAME AS PAGE 91

START WT 12.23157 g

SOLUTION SAME AS P 91 4M Cl⁻

TEMP = 95°C Hg THERMOMETER C96-876

END PH 8.464

Ecorr -408 mV SCE KEITHLEY 614 SN 467374

Ept ~153 mV SCE "

EAPPLIED 0 mV SCE

POTENTIOSTAT GG&G VERSASTAT SN 20104

REFERENCE 13-620-51 SN 8238324 FISHER SCE

TEST STARTED 5/23/2000 4:33 PM.

Passive Current density 6.3 to 7.0 nA/cm²

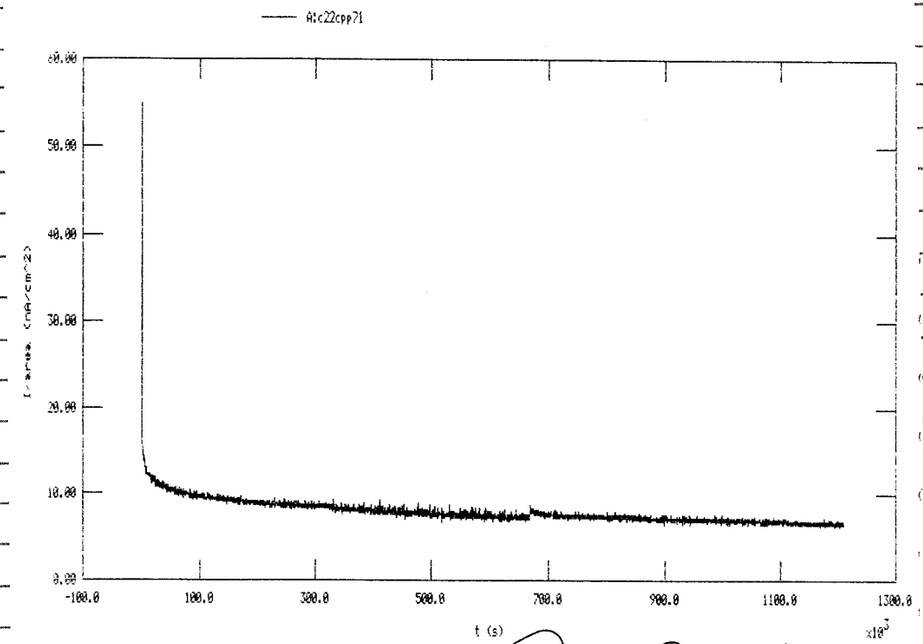
DATA FILE C22CPP71.DAT

END WT 12.23136 g SPECIMEN ABRADED TO REMOVE DEPOSITS.

6/8/2000

Passive current density alloy 22

Model 352/252 Corrosion Analysis Software, v. 2.38 Date: 03-29-00 Time Run: 12:40:59
Filename: A:c22cpp71 Pstat: VStat[] Ver 2 PS POTENTIOSTATIC
File Status: NORMAL
CP PASS vs. R CT PASS IP 0.000 vs. R ID 5 S TP 4.032E+02 T1 1.210E+06
CR AUTO NP 3000 SO Pass IR NONE FL I 5.3Hz RT HIGH STABILITY
REF 0.24150 SCE WRK SOLID AR 9.000E+00 LS YES EW 0.000E+00 DEN 8.140E+00 AU NO
OC -0.381
Comment: Alloy 22 4M Cl pH=8 95 C



6/8/2000

Model 352/252 Corrosion Analysis Software, v. 2.38
Filename: A:c22cpp71
Pstat: VStat[] Ver 2
PS POTENTIOSTATIC
Date Run: 03-29-00

File Status: NORMAL
Time Run: 12:40:59

Cond. Time	CT	pass	s	Initial Pot.	IP	0.0000	V
Cond. Pot.	CP	pass	V	Time Step 1	T1	1.210E6	s
Initial Delay	ID	5	s	Stop On	SO	Pass	
Time/Pt.	TP	403.2	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	8.140	g/ml	AUX A/D	AU	no	
Open Circuit	OC	-381.0E-3	V				

Comment: Alloy 22 4M Cl pH=8 95 C

6/8/2000

Repassivation Potential alloy 22

Objective measure E_{rp} of alloy 22

Specimen: Alloy 22 HEAT 2277-8-3175
CREVICE REPASSIVATION SPECIMEN w/ 0.375" HOLE
PTFE CREVICE BLOCKS TORQUED TO 50 IN-OZ
START WT 37.75172 g END WT 37.72016 g
SOLUTION 4 M Cl^- 85 PPM HCO_3 20 PPM $SO_4^=$ 10 PPM NO_3^-
2 PPM F^- 2000 mL AS FOLLOWS

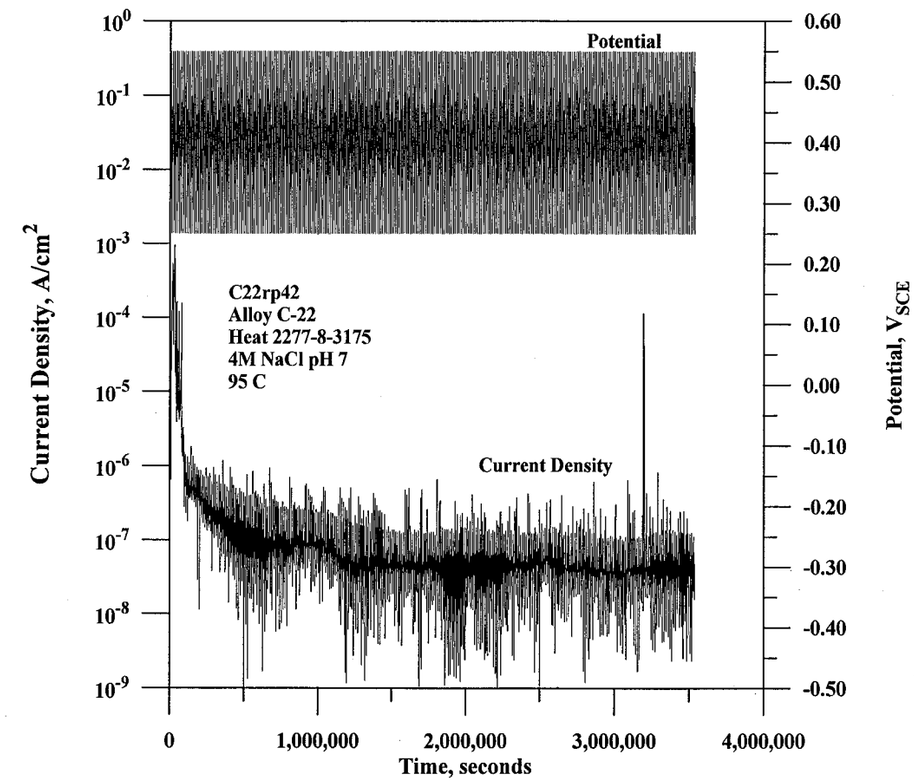
467.5 g NaCl LOT 000274
0.240 g $NaHCO_3$ LOT 897789
40 mL SO_4 - 5/2000
20 mL NO_3 - 5/2000
4 mL F - 5/2000
+ DI WATER TO 2000 mL
START pH 7.65
END pH 7.83
T = 95°C N_2 THERMOMETER N98-182
SOLUTION DEAERATED W/ N_2 (99.999%)

E_{corr} −134 mV SCE KEITHLEY 617 SN 537418
E_{pt} − 615 mV SCE "

TEST PARAMETERS DD 6/6/2000
START POTENTIAL ~~0.250 mV SCE~~ 0.250 V_{SCE}
RAMP TO 0.5500 ~~mV~~ V_{SCE} AT ~~0.05 mV/s~~ DD 6/6/2000
~~HOLD~~ DD 6/6/2000 0.05 mV/s HOLD AT
0.550 V_{SCE} FOR 600 s SCAN DOWN TO
0.250 V_{SCE} AT 0.05 mV/s AND REPEAT

DATA FILE C22RP42.DAT

Darrell Dunn 4/26/02



Darrell Dunn 7/19/2000

CHECK OF TEST SETUP

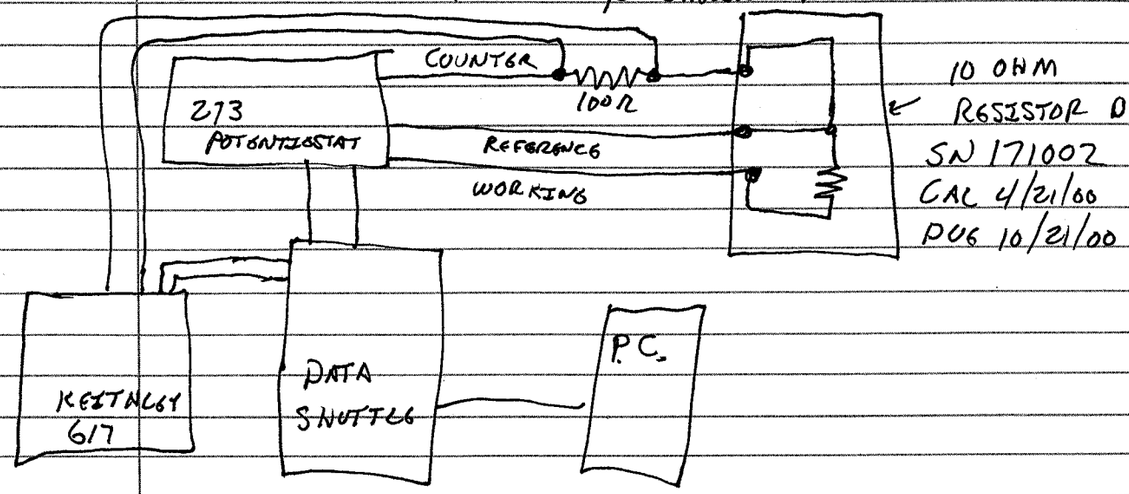
POTENTIOSTAT EG&G 273 SN 4108

DATA ACQUISITION SYSTEM STRAWBERRY TREE
DATA SHUTTLE WORK BENCH V 2.2.1

TEST SETUP POTENTIOSTAT CONNECTED TO
10 OHM RESISTOR AS A DUMMY LOAD
100 OHM RESISTOR USED TO MEASURE CURRENT
THROUGH COUNTER ELECTRODE CIRCUIT

R 100 Ω RESISTOR = 0.1012 KΩ KEITHLEY 617 SN 537418

SCHEMATIC OF TEST SETUP SHOWN BELOW



TEST PROCEDURE APPLY FIXED POTENTIAL
ACROSS TEST RESISTOR AND MEASURE
CURRENT BY MEASURING VOLTAGE DROP
ACROSS 100 Ω RESISTOR.

Darrell Du 4/26/02

CHECK OF TEST SETUP

TESTS W/ 10 OHM RESISTOR SN 171002
273 ON 100 mA SCALE (R = 10 OHMS)

POTENTIAL	273 CURRENT (273)	273 CURRENT (WB)	100 Ω V
100 mV	9.3 – 9.6 mA	9.45×10^{-3} A	0.957 V
200 mV	18.6 – 18.9 mA	1.9×10^{-2} A	1.904 V
500 mV	47.1 mA	4.75×10^{-2} A	4.73 V
1.0 V	93.9 mA	6.8×10^{-1} A	9.48 V
CURRENT TOO HIGH			
0.7 V	65.6 mA	6.8×10^{-1}	6.64 V

TESTS W/ 1000 Ω RESISTOR SN 171001

100 mV	0.1 mA	1.027×10^{-4} A	10.29 mV
200 mV	0.1 mA	2.040×10^{-4} A	20.4 mV
500 mV	0.4 mA	5.08×10^{-4} A	50.8 mV
1.0 V	0.9 mA	1.015×10^{-3} A	101.5 mV

TESTS W 100 KΩ RESISTOR SN 7243

10 mV	0.1 mA	3.2×10^{-7} A	0.05 mV
100 mV	0.1 mA	1.2×10^{-6} A	0.14 mV
200 mV	0.1 mA	2.2×10^{-6} A	0.23 mV
500 mV	0.1 mA	5.2×10^{-6} A	0.55 mV
1.0 V	0.1 mA	1.038×10^{-5} A	1.06 mV

Darrell Du 4/26/02

Initial Scientific notebook entry for passive current density with metal ion concentration measurements

Title: Passive film chemistry

Tests Preformed by: Darrell S. Dunn, Sean Brossia

Objectives: Determine the effect of potential and environment on the passive corrosion of candidate container materials.

Equipment: Keithley 614/617. EG&G Versastat Model Potentiostat serial number 20104 or equivalent, EG&G model 352c software or equivalent, Electrochemical test cell with small volume (250 mL) with ability to extract solution for analyses, Waters Capillary Ion Analyzer Model Code CIA serial number H99CIA 17P.

Materials: Alloy C-22, heat 2277-8-3175. Other materials and heats to be added and identified prior to testing.

Specimen specifications: Defined in each test.

Measurement Parameters: Potential and Current of specimen during test. Concentration of metal ions in test electrolyte as a result of corrosion of the specimen.

Required level of accuracy: Potentials $\pm$ 1mV, Current $\pm$ 0.01 microamp. Minimum detectable concentrations of metal ions dependent on test method and determined using standards.

Uncertainty and Sources of Error: Minimum detectable concentrations of metal ions in the electrolyte may not be the same for all alloying additions. Precipitation of corrosion products will interfere with metal ion concentration measurements.

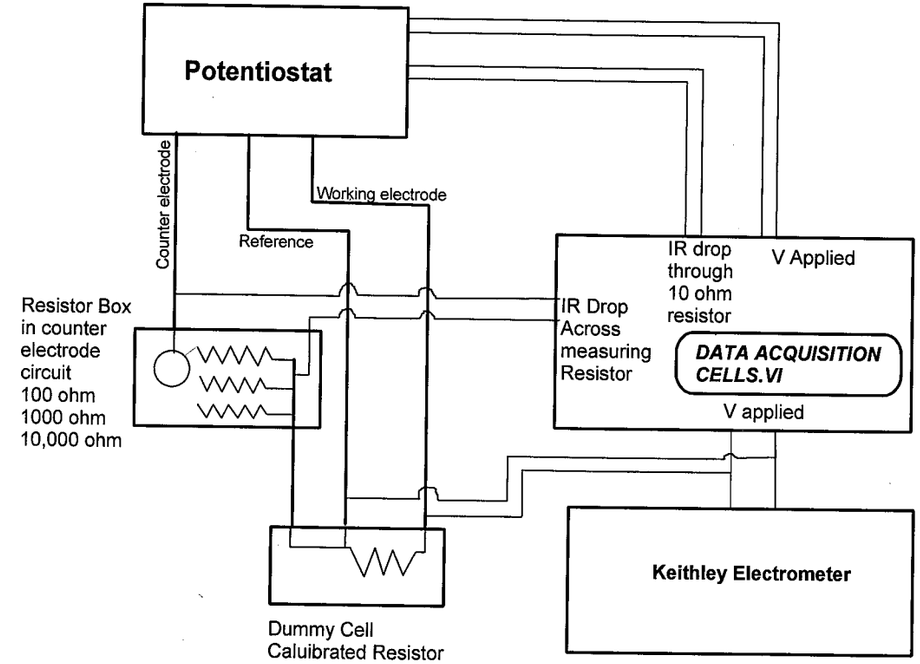
Darrell Dunn 6/15/2000

POTENTIOSTAT CHECK

POTENTIOSTAT ESC 440 #1
USED FOR LONG TERM TESTS
DATA ACQUISITION SYSTEM NATIONAL INSTRUMENTS
CELLS.VI DAQ PROGRAM

OVERVIEW OF SYSTEM
POTENTIOSTAT USED TO CONTROL POTENTIAL
OF SPECIMENS DURING TESTS

CURRENT MEASURED THROUGH 10 Ω RESISTOR
ON EACH POTENTIOSTAT CHANNEL AND THROUGH
RESISTOR BOX INSERTED IN COUNTERELECTRODE
CIRCUIT SCHEMATIC SHOWN BELOW



Darrell Dunn 6/15/00

POTENTIOSTAT CHECK

CHANNEL #1
DUMMY CELL = 1000 Ω SWRI 171001

V APPLIED 440 PSTAT	V MEASURED KEITHLEY 614 SN 555368	I 440 PSTAT 10 Ω	I RESISTOR BOX DD 6/15/2000 100 Ω ~~1000 Ω~~ ~~10 KΩ~~
100 mV	101.2 mV	1.3×10^{-4} to 1.5×10^{-4} A	1.02×10^{-4} to 1.05×10^{-4} A
20 mV	23 mV	4.8×10^{-5} A to 7.3×10^{-5} A	2.5×10^{-5} A 2.8×10^{-5} A
800 mV	DD 6/15/2000 ~~800~~ 803.9 mV	8.2×10^{-4} A to 8.4×10^{-4} A	8.05×10^{-4} A to 8.07×10^{-4} A
−200 mV	−196 mV	-1.7×10^{-4} to -1.55×10^{-4} A	-1.92×10^{-4} A to -1.89×10^{-4} A
0 mV	+ 3 mV	3.06×10^{-5} A 5×10^{-5} A	5×10^{-6} A 7×10^{-6} A

SAME AS ABOVE w/ 1000 Ω RESISTOR BOX

V APPLIED	I RESISTOR BOX 1000 Ω
100 mV	~~3.7 to 4.15×10⁻⁶ A~~ DD 6/15/2000 1.00×10^{-4} A to 1.01×10^{-4} A
20 mV	2.32×10^{-5} to 2.35×10^{-5} A
800 mV	7.99×10^{-4} A to 8.00×10^{-4} A
−200 mV	-1.94×10^{-4} A to -1.95×10^{-4} A
0 mV	3.7×10^{-6} to 4.15×10^{-6} A

[signature] 6/16/2000

CHANNEL #1
DUMMY CELL 100 KOHM SWRI 7243

V APPLIED	V KEITHLEY	I 440 PSTAT	I R 100	I R 1000	I R 10 KΩ
			DD 6/15/2000		
100 mV	101.4 mV	2.5×10^{-5} A	~~2.4×10^{-6} A~~ 2.2×10^{-6} A to 4.5×10^{-6} A	1.3×10^{-6} to 1.5×10^{-6}	1.03×10^{-6} to 1.05×10^{-6}
20 mV	23 mV	2.5×10^{-5} A	1×10^{-6} A to 4×10^{-6} A	5.1×10^{-7} to 7.2×10^{-7}	2.4×10^{-7} A 2.7×10^{-7} A
800 mV	805 mV	2×10^{-5} A 5×10^{-5} A	1.0×10^{-5} A 1.2×10^{-5} A	8.2×10^{-6} A to 8.4×10^{-6} A	8.05×10^{-6} to 8.08×10^{-6} A
−200 mV	−196 mV	2×10^{-5} A 5×10^{-5} A	-10^{-6} to $+10^{-6}$	-1.4×10^{-6} A to -1.7×10^{-6} A	-1.89×10^{-6} to -1.92×10^{-6} A
0.0 mV	+ 0.003 V	2×10^{-5} A 5×10^{-5} A	1×10^{-6} 5×10^{-6} A	2×10^{-7} A 5×10^{-7} A	6×10^{-8} to 8×10^{-8} A

ACTUAL CURRENTS
1000 Ω DUMMY CELL

V	I
100 mV	1×10^{-4} A
20 mV	~~8×10^{-4} A~~ DD 6/15/2000 2×10^{-5} A
800 mV	8×10^{-4} A
−200 mV	-2×10^{-4} A
0 mV	0

100 KOHM CELL

V	I
100	1×10^{-6} A
20	2×10^{-7} A
800	8×10^{-6} A
−200	-2×10^{-6} A

[signature] 6/16/2000

POTENTIOSTAT CHECK

CHANNEL #2 DUMMY CELL = 1000 Ω RESISTOR SWRI 171001

VAPPLIED	VMEASURED KEITHLEY 614	I 440 PSTAT 10 Ω	I RESISTOR BOX 100 Ω	1000 Ω	10,000 Ω
		1.1×10^{-4} – 1.3×10^{-4} A			
100	95.8 mV	~~2.2×10^{-5} – 4.6×10^{-5} A~~ DD 6/15/2000	9.7×10^{-5} to 1.0×10^{-4}	9.5×10^{-5} A	9.5×10^{-5} A
20	17.5 mV	4.5×10^{-5} – 5.1×10^{-5} A	1.98×10^{-5} to 2.1×10^{-5} A	~~7.97×10^{-4} A~~ DD 6/15/00 1.7×10^{-5} A	1.7×10^{-5} A
800	798 mV	8.2×10^{-4} to 8.3×10^{-4}	8.01×10^{-4} to 8.02×10^{-4} A	7.97×10^{-4} A	7.84×10^{-5} A
−200	−202 mV	-1.6×10^{-4} to -1.8×10^{-4} A	-1.97×10^{-4} A to -2.01×10^{-4} A	-2.01×10^{-4} A	-2.01×10^{-4}
0	−2.4 mV	1×10^{-5} to 3×10^{-5} A	-10^{-6} to $+10^{-6}$	-1.85×10^{-6} to -1.95×10^{-6} A	-2.1×10^{-6}

CHANNEL #2 DUMMY CELL = 100 K OHM RESISTOR 7243

VAPPLIED	VMEASURED KEITHLEY 614	I 440 PSTAT 10 Ω	I RESISTOR BOX 100 Ω	1000 Ω	10,000 Ω
100	95.8 mV	2.7×10^{-5} A to 4.5×10^{-5} A	9.7×10^{-5} A to 1.0×10^{-4}	1.1×10^{-6} 1.3×10^{-6}	9.7×10^{-7} A to 1.00×10^{-6} A
20	17.4	1×10^{-5} A to 4.5×10^{-5} A	1.8×10^{-5} A to 2.1×10^{-5} A	3×10^{-7} 6×10^{-7}	1.89×10^{-7} A to 2.16×10^{-7} A
800	799.1 mV	2×10^{-5} A to 5×10^{-5} A	7.99×10^{-4} A to 8.03×10^{-4} A	8.0×10^{-6} 8.3×10^{-6}	8.01×10^{-6} A to 8.03×10^{-6} A
−200	−202.6 mV	2×10^{-5} A to 5×10^{-5} A	-1.97×10^{-4} A to -2.00×10^{-4} A	-1.61×10^{-6} -1.82×10^{-6}	-1.97×10^{-6} A -2.00×10^{-6} A
0	−0.0024 V	2×10^{-5} A to 5×10^{-5} A	-10^{-6} to $+10^{-6}$ A	-10^{-7} to 3×10^{-7} A	-10^{-8} to $+10^{-8}$ A

DD 6/15/00

WRONG BOX SETTING
RESISTOR SET TO 10 K Ω

Darrell Dunn 6/16/2000

POTENTIOSTAT CHECK

CHANNEL #3 DUMMY CELL 1000 Ω RESISTOR SWRI 171001

VAPPLIED	VMEASURED KEITHLEY 614	I 440 PSTAT 10 Ω	I RESISTOR BOX 100 Ω	1000 Ω	10,000 Ω
		1.31×10^{-4} to 1.52×10^{-4}	9.97×10^{-5} to	9.63×10^{-5} to	9.62×10^{-5} A
100	96.6 mV	~~2.1×10^{-5} to 4.5×10^{-5} A~~ DD 6/15/2000	1.01×10^{-4} A	9.65×10^{-5} A	
~~800~~ 20 DD 6/16/2000	18.4 mV	5×10^{-5} to 7×10^{-5} A	2.04×10^{-5} 2.31×10^{-5}	1.83×10^{-5} to 1.86×10^{-5} A	1.81×10^{-5} to 1.82×10^{-5} A
DD ~~20~~ 800	800.1 mV	8.2×10^{-4} to 8.5×10^{-4} A	8.01×10^{-4} 8.06×10^{-4} A	7.96×10^{-4} A	7.97×10^{-4} A
−200	−202 mV	-1.6×10^{-4} to -1.8×10^{-4} A	-1.96×10^{-4} to -1.98×10^{-4} A	-2.00×10^{-4} A	-2.01×10^{-4} A
0	−1.6 mV	3×10^{-5} A 5×10^{-5} A	1×10^{-6} to 3×10^{-6} A	-9×10^{-7} to -1×10^{-6} A	-1.39×10^{-6} -1.42×10^{-6}

CHANNEL #3 DUMMY CELL = 100 K OHM RESISTOR SWRI 7243

VAPPLIED mV	VMEASURED	I 440 PSTAT 10 Ω	I RESISTOR BOX 100 Ω	1000 Ω	10,000 Ω
100 mV	−96.7 mV	1.8×10^{-5} to 5.2×10^{-5} A	2×10^{-6} 6×10^{-6} A	1.2×10^{-6} 1.5×10^{-6}	9.97×10^{-7} 1.01×10^{-6}
800 mV	800.2 mV	2×10^{-5} 5×10^{-5}	1.0×10^{-5} to 1.2×10^{-5} A	8.3×10^{-6} 8.4×10^{-6}	8.04×10^{-6} 8.06×10^{-6}
20	18.4 mV	1.1×10^{-5} 3×10^{-5}	2×10^{-6} A 5×10^{-6} A	3×10^{-7} 5×10^{-7}	2.0×10^{-7} 2.2×10^{-7}
−200	−202 mV	2×10^{-5} to 5×10^{-5}	9×10^{-7} A 2×10^{-6} A	-1.5×10^{-6} -1.9×10^{-6}	-1.96×10^{-6} -1.98×10^{-6}
0	−1.6	2×10^{-5} to 5×10^{-5} A	1×10^{-6} A 5×10^{-6} A	2×10^{-7} 5×10^{-7}	2×10^{-8} 3×10^{-8}

Darrell Dunn 6/16/2000

POTENTIOSTAT CHECK

CHANNEL #4 DUMMY CELL 1000 Ω RESISTOR SWRI 17100]

V APPLIED mV	V MEASURED KEITHLEY 614	I 440 PSTAT 10 Ω	I RESISTOR BOX 100 Ω	1000 Ω	10,000 Ω
100	96.2 mV	1.2×10^{-4}	9.94×10^{-5}	9.59×10^{-5}	9.54×10^{-5}
		1.5×10^{-4} A	1.01×10^{-4} A ND K	9.63×10^{-5}	
20	17.9 mV	2×10^{-5}	2.0×10^{-5}	1.79×10^{-5}	1.77×10^{-5}
		5×10^{-5} A	2.3×10^{-5} A K	1.82×10^{-5}	
800	.799 mV	8.2×10^{-4}	8.01×10^{-4}	7.96×10^{-4}	7.94×10^{-4}
		8.4×10^{-4}	8.03×10^{-4} A		
-200	-201.3 mV	-1.5×10^{-4}	-1.95×10^{-4}	-1.99×10^{-4}	-1.99×10^{-4}
		-1.7×10^{-4}	-1.98×10^{-4} K	-200×10^{-4}	
0	-2 mV	2×10^{-5}	1×10^{-6}	-1.3×10^{-4}	-1.75×10^{-6}
		5×10^{-5}	3×10^{-6} A	-1.5×10^{-6}	-1.80×10^{-6}

CHANNEL #4 DUMMY CELL = 100 KOHM RESISTOR SWRI 7243

V APPLIED	V MEASURED KEITHLEY 614	I 440 PSTAT 10 Ω	I RESISTOR BOX 100 Ω	1000 Ω	10,000 Ω
100	96.2	2×10^{-5}	2×10^{-6} to	1.2×10^{-6}	4.91×10^{-7}
		5×10^{-5}	6×10^{-6} A	1.4×10^{-6}	1.01×10^{-6}
~~800~~ DD 6/16/00					
20	17.9	2×10^{-5}	2×10^{-6}	4×10^{-7}	2.0×10^{-7}
		5×10^{-5}	5×10^{-6} A	7×10^{-7}	2.3×10^{-7}
800	799	2×10^{-5}	1.1×10^{-5}	8.2×10^{-6}	8.00×10^{-6}
		5×10^{-5}	1.3×10^{-5} A	8.5×10^{-6}	8.03×10^{-6}
-200	-201.3	2×10^{-5}	0 to	-1.5×10^{-6}	-1.95×10^{-6}
		5×10^{-5}	3×10^{-6}	-1.8×10^{-6}	-1.97×10^{-6}
0	-2 mV	2×10^{-5}	2×10^{-6}	2×10^{-7}	0 to
		5×10^{-5}	4×10^{-6}	5×10^{-7}	3×10^{-8}

Darrell Dunn 6/16/2000

POTENTIOSTAT CHECK

CHANNEL #5 DUMMY CELL = 1000 Ω RESISTOR BOX SWRI 17100]

V APPLIED	V MEASURED	I 440 PSTAT 10 Ω	I RESISTOR BOX 100 Ω	1000 Ω	10,000 Ω
100	96.1 mV	1.1×10^{-4}	9.97×10^{-5}	9.61×10^{-5}	9.55×10^{-5}
		1.4×10^{-4} A	1.01×10^{-4} A	9.62×10^{-5}	9.56×10^{-5}
20	17.8	3×10^{-5}	1.98×10^{-5}	1.79×10^{-5}	1.76×10^{-5}
		7×10^{-5} A	2.30×10^{-5} A	1.82×10^{-5}	1.78×10^{-5}
800	798.7	8.1×10^{-4}	8.00×10^{-4}	7.96×10^{-4}	7.94×10^{-4}
		8.5×10^{-4} A	8.02×10^{-4} A	7.97×10^{-4}	7.95×10^{-4}
-200	-202.1	-1.4×10^{-4}	-1.95×10^{-4}	-2.00×10^{-4}	-2.00×10^{-4}
		-1.8×10^{-4}	-1.99×10^{-4}	-2.01×10^{-4}	-2.01×10^{-4}
0	-2.1	1×10^{-5}	-1×10^{-7}	-1.4×10^{-5}	-1.83×10^{-7}
		5×10^{-5}	2×10^{-6}	-1.7×10^{-6}	-1.84×10^{-7}

CHANNEL #5 DUMMY CELL = 100 KOHM RESISTOR SWRI 7243

V APPLIED	V MEASURED	I 440 PSTAT 10 Ω	I RESISTOR BOX 100 Ω	1000 Ω	10,000 Ω
100	96.2 mV	2×10^{-5}	3×10^{-6}	1.0×10^{-6}	9.97×10^{-7}
		5×10^{-5}	5×10^{-6}	1.4×10^{-6}	1.01×10^{-6}
20	17.9	2×10^{-5}	2×10^{-6}	4×10^{-7}	1.8×10^{-7}
		5×10^{-5}	5×10^{-6}	6×10^{-7}	2.2×10^{-7}
800	798.9	2×10^{-5}	1.1×10^{-5}	8.0×10^{-6}	8.01×10^{-6}
		5×10^{-5}	1.3×10^{-5}	8.3×10^{-6}	8.04×10^{-6}
-200	-202.1	2×10^{-5}	9×10^{-7}	-1.5×10^{-6}	-1.96×10^{-6}
		5×10^{-5}	2×10^{-6}	-2.0×10^{-6}	-2.01×10^{-6}
0	-2.1	2×10^{-5}	1×10^{-6}	2×10^{-7}	0 to
		5×10^{-5}	5×10^{-6}	6×10^{-7}	3×10^{-8}

Darrell Dunn 6/16/2000

POTENTIOSTAT CHECK

MEASURING RESISTORS

10 Ω RESISTOR IN ESC 440 P. STAT
ABLE TO MEASURE CURRENTS ABOVE 1×10^{-4} A

100 Ω RESISTOR IN RESISTOR BOXES
CAN BE USED TO MEASURE ABOVE 5×10^{-5} A

1000 Ω RESISTOR IN RESISTOR BOXES
CAN ~~BE~~ DD 6/16/2000 BE USED TO MEASURE
ABOVE 5×10^{-6} A

10,000 Ω RESISTOR IN RESISTOR BOXES
CAN BE USED TO MEASURE ABOVE 2×10^{-7} A

RESOLUTION OF NATIONAL INSTRUMENTS DATA ACQUISITION
~~SYSTEM~~ DD 6/16/2000 SYSTEM SEEMS TO BE THE
MAJOR LIMITATION

POTENTIAL MEASUREMENTS AND POTENTIAL
CONTROL

THE 12 BIT ANALOG OUTPUT OF THE SYSTEM
ALLOWS POTENTIAL CONTROL ± 4 mV

ALL 5 POTENTIOSTAT CHANNELS APPEAR TO FUNCTION
CORRECTLY

Darrell Dunn 6/16/2000

LT82SP5AF

SPECIMEN ALLOY 825 HH4371FG SAME AS P 86
START WT 39.07438 g
END WT 39.07046 g
2 PTFE CREVICE WASHERS ATTACHED AT 50 in.oz
USING PROTO 6103

SOLUTION 1000 ppm Cl^- 85 PPM HCO_3 20 PPM $SO_4^=$
~~10 PPM NO_3^-~~ DD 6/16/2000 10 PPM NO_3^-
2 PPM F^- 2000 mL PREPARED AS FOLLOWS
3.297 g NaCl LOT 000274
0.240 g $NaHCO_3$ LOT 897784
40 mL SO_4 - S/2000 P93
20 mL NO_3 - S/2000 P93
4 mL F - S/2000 P93
+ DI WATER TO 2000 mL
START pH 7.977 FISHER ACCUMET 950 SN 3340 13-620-296 SN 7064138
END pH 9.356

T = 95 °C Hg THERMOMETER 115858
REFERENCE ELECTRODE 13-620-52 SN 8238320
E_{corr} −87 mV KEITHLEY 614 SN 555368
E_{pt} +111 mV " " " "
E APPLIED +100 mV SCE MEASURED 101.5 mV KEITHLEY 614

TEST STARTED 2:45 PM 6/16/2000

DATAFILE 825P5AF

Darrell Dunn 9/19/2000

C22L9A

SPECIMEN ALLOY C-22 WELDED
BASE METAL 2277-8-3235
FILLER METAL XX1045 BG11
START WT 38.60269 g
END WT 38.60234 g
2 PTFE CREVICE WASHERS ATTACHED AT 50 in-oz
USING PROTO 6103

SOLUTION 4 mCl⁻ 85PPM HCO_3 20PPM $SO_4^{=}$
10 PPM NO_3^- 2PPM F^-
2000 mL PREPARED AS FOLLOWS
467.5 g NaCl 000274
0.240 g $NaHCO_3$ 897789
40 mL SO_4 - 5/2000 P93
20 mL NO_3 - 5/2000 P.93
4 mL F^- 5/2000 P.93
+ DI WATER TO 2000 mL
START pH 7.953 FISHER 950 SN 3340 w/ 13-620-296 SN 7064138
END pH 8.758

T=95°C Hg THERMOMETER C48-101
REFERENCE ELECTRODE 13-620-52 SN 8205236
E_{corr} −297 mV_{SCE} KEITHLEY 614 SN 555368
E_{pt} ~~−503 mVSCE~~ 6/16/2000 " " " +205 mV_{SCE}
E APPLIED 200 mV_{SCE} MEASURED 198.6 mV KEITHLEY 614

TEST STARTED 2:45 pm 6/16/2000

DATAFILE C22L9A

SOME CORROSION PRODUCTS (GREEN COLOR) OBSERVED
IN SOLUTION SPECIMEN TO BE RETESTED
NO SIGN OF LOCALIZED CORROSION

9/19/2000

C22L10A

SPECIMEN ALLOY C22
HEAT 2277-8-3175
START WT 43.04549 g
END WT 9/9/2000 43.03946 g
2 PTFE CREVICE WASHERS ATTACHED AT 50 in-oz
USING PROTO 6103

SOLUTION 4 mCl⁻, 85 PPM HCO_3, 20PPM SO_4
10 PPM NO_3, 2PPM F^-
2000 mL MADE AS FOLLOWS
467.5 g NaCl LOT 000274
0.240 g $NaHCO_3$ LOT 897789
40 mL SO_4 - 5/2000 P. 93
20 mL NO_3 - 5/2000 P. 93
4 mL F - 5/2000 P. 93
+ DI WATER TO 2000 mL
START pH 7.548 FISHER 950 SN 3340 w/ 13-620-296 SN 7064138
END pH 8.649

T= 95°C Hg THERMOMETER H98-162

REFERENCE ELECTRODE 13-620-51 SN 8131146

E_{corr} −257 mV_{SCE} KEITHLEY 614 SN 555368
E_{pt} +229 mV_{SCE} " " " "
E APPLIED 300 mV_{SCE} MEASURED 297 mV_{SCE} KEITHLEY 614

TEST STARTED 2:45 pm 6/16/2000

DATAFILE C22L10A

1 AREA OF CREVICE CORROSION
CORROSION PRODUCTS OBSERVED IN SOLUTION

9/19/2000

C22L3F

SPECIMEN ALLOY C-22 SAME AS P 89
HEAT 2277-8-3175
START WT 47.22316 g
END WT 47.21957 g
2 PTFE CREVICE WASHERS ATTACHED AT ~~40~~ DD 6/16/2000
50 IN.OZ USING PROTO 6/03

SOLUTION 4M Cl^- 85 PPM HCO_3 20 PPM $SO_4^=$
10 PPM NO_3^- 2 PPM F^-
DD 6/16/00 2000 mL PREPARED AS FOLLOWS
~~47~~ 467.5 g NaCl
0.240 g $NaHCO_3$
40 mL SO_4 - S/2000 P. 93
20 mL NO_3 - S/2000 P. 93
4 mL F - S/2000 P. 93
+ DI WATER TO 2000 mL
START pH 7.550 FISHER 950 SN 3340 w/ 13-620-296 SN 7064138
END pH 9.058

T = 95 °C Hg THERMOMETER H98-187

SOLUTION BUBBLED w/ ZERO AIR DURING TEST

REFERENCE ELECTRODE 13-620-52 SN 9252111

E_{corr} − 191 mV SCE KEITHLEY 614 SN 555368
E_{pt} + 169 mV SCE " " " "
$E_{APPLIED}$ OPEN CIRCUIT

TEST STARTED ~~C22L3~~ DD 2:45 PM 6/16/2000

DATAFILE C22L3F
SPECIMEN TO BE RETESTED
NO SIGN OF LOCALIZED CORROSION SPECIMEN HAS DULL APPEARANCE [signature] 9/19/2000

OC825CIAD

SPECIMEN ALLOY 825 HH4371FG SAME AS P 90
START WT 39.29036 g
END WT 39.29018 g
2 PTFE CREVICE WASHERS ATTACHED AT
50 in·oz USING PROTO 6/03

SOLUTION 1000 PPM Cl^- 85 PPM HCO_3 20 PPM SO_4
10 PPM NO_3 2 PPM F^-
2000 mL MADE AS FOLLOWS
3.297 g NaCl
0.240 g $NaHCO_3$
40 mL SO_4 - S/2000 P. 93
20 mL NO_3 - S/2000 P. 93
4 mL F - S/2000 P. 93
+ DI WATER TO 2000 mL
START pH 8.036 FISHER 950 SN 3340 w/ 13-620-296 SN 7064138
END pH 9.434

T = 95 °C Hg THERMOMETER H98-170

SOLUTION BUBBLED w/ ZERO AIR DURING TEST

REFERENCE ELECTRODE 13-620-52 SN 8238333

E_{corr} − 99 mV SCE KEITHLEY 614 SN 555368
E_{pt} + 102 mV SCE
$E_{APPLIED}$ OPEN CIRCUIT

TEST STARTED 2:45 PM 6/16/2000

DATAFILE 825CIAD

SPECIMEN TO BE RETESTED
[signature] 9/19/2000

REFERENCE ELECTRODE CHECK

OBJECTIVE MEASURE REFERENCE ELECTRODE POTENTIALS VS LAB REFERENCE

SETUP KEITHLEY 614 SN 555368
MEASURE POTENTIALS OF ~~ONE REFER~~ DD 6/16/2000
ONE ELECTRODE VS. THE LAB REFERENCE

LAB REFERENCE FISHER SCE 13-620-52
SN 9250074

SOLUTION SAT'D KCL FISHER LOT 977007

POTENTIAL VS LAB REFERENCE SHOWN IN TABLE BELOW

	REFERENCE MODEL	SN	POTENTIAL
	13-620-52	8238320	0.00088 V
	13-620-52	8205236	-0.00022 V
*	13-620-51	8122010	0.00157 V
	13-620-51	8131146	-0.00059 V
*	13-620-51	9214083	0.00203 V
	13-620-52	9252111	0.00056 V
	13-620-52	8238333	0.00041 V
*	13-620-51	7079125	-0.00976 V

* ELECTRODES DISCARDED

[signature] 6/19/2000

PASSIVE FILM CHEMISTRY C22PFC1

SPECIMEN ALLOY C-22 2277-8-3175
1.915" LONG 0.250" DIA 600 GRIT FINISH
START WT 12.24064 g
END WT NOT RECORDED - SPECIMEN COVERED W/ SiO_2 DUE TO SOLUTION EVAPORATION
SOLUTION 1000 PPM Cl^- AS KCL
2.10237 g KCl LOT 901422
+ DI WATER TO 1000 mL
END pH 8.31 ORION EA940 SN 4274 + 13-620-246 SN 7064138 pH PROBE

TEST CONDITIONS
SOLUTION: 220 mL PLACED IN TEST CELL
EXPOSED AREA: 8 cm^2
TEMP 95°C
SOLUTION DEAERATED W/ N_2
E_{corr} -370 mV SCE KEITHLEY 614 SN 467374
E_{pt} -100 mV SCE "
$E_{APPLIED}$ 100 mV SCE CHECKED W/ KEITHLEY 614 SN 467374
TEST STARTED 6/15/2000 4:00PM
PASSIVE CURRENT DENSITY FILE C22PFC1
FINAL VOLUME OF SOLUTION 131.4 mL
ANALYSES OF SOLUTION

TEST SOLUTION - DETECTED K AND TRACE Na
TEST SOLUTION AFTER 24 hr AT ROOM TEMP
DETECTED K AND TRACE NA

TEST SOLUTION AFTER 22 HOURS AT 100 mV SCE
DETECTED TRACE Na AND K

TEST SOLUTION AFTER 3.396 E5 SECONDS 94.3 HOURS
AT 100 mV SCE NO TRANSITION METALS DETECTED

TEST SOLUTION AFTER 6.640 E5 SECONDS ≈184 HOURS
AT 100 mV SCE

[signature] 8/17/2000

C22PFC1

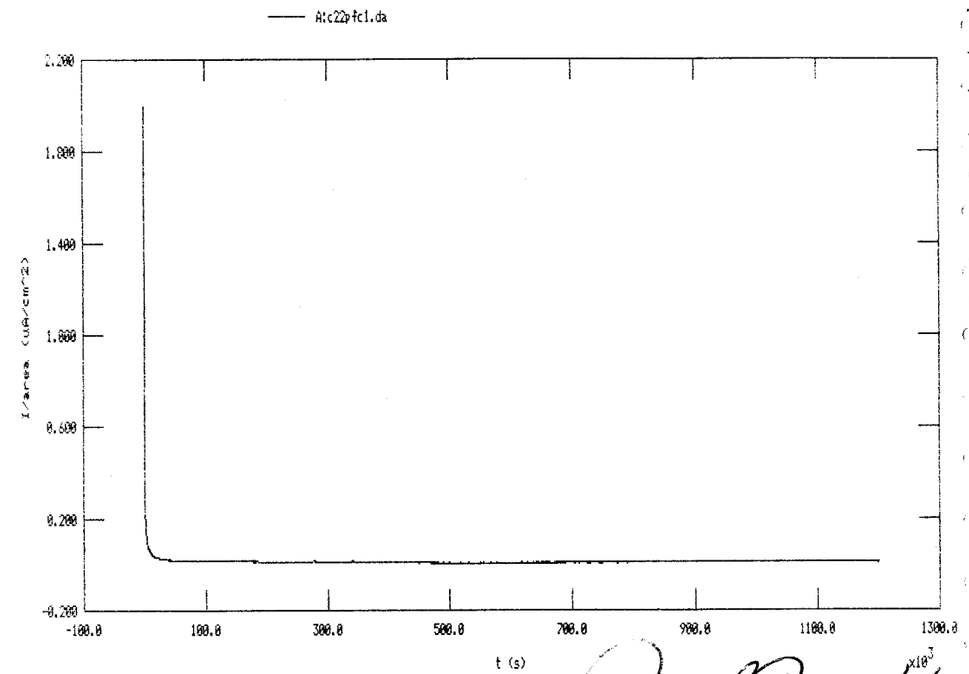
TEST SOLUTION AFTER 260 HOURS
NO TRANSITION METALS DETECTED

TEST SOLUTION AFTER 311 HOURS
NO TRANSITION METALS DETECTED

8/17/2000

C22PFC1

Model 352/252 Corrosion Analysis Software, v. 2.30 Filename: A:c22pfc1.dat Pstat: VStat[] Ver 2
PS POTENTIOSTATIC File Status: NORMAL Date Run: 04-03-00 Time Run: 15:01:28
CP PASS vs. R CT PASS IP 0.100 vs. R ID 5 S TP 4.000E+02 TI 1.200E+06
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 NO EW 0.000E+00 DEN 8.140E+00 AU NO
OC -0.370
Comment: C-22 1000 ppm Cl as KCl 95C



7/7/2000

Model 352/252 Corrosion Analysis Software, v. 2.30
Filename: A:c22pfc1.dat
Pstat: VStat[] Ver 2
PS POTENTIOSTATIC
Date Run: 04-03-00
File Status: NORMAL
Time Run: 15:01:28

Cond. Time	CT	pass	s	Initial Pot.	IP	100.0E-3	V
Cond. Pot.	CP	pass	V	Time Step 1	TI	1.200E6	s
Initial Delay	ID	5	s	Stop On	SO	Pass	
Time/Pt.	TP	400.0	s	Curr. Range	CR	Auto	
No. of Points	NP	3000					
Line Sync.	LS	no		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	8.140	g/ml	AUX A/D	AU	no	
Open Circuit	OC	-370.0E-3	V				

Comment: C-22 1000 ppm Cl as KCl 95C

0.0084–0.0090 MA/cm²
AFTER 1000 E 3 SEC

7/7/2000

C22 PFC2

SPECIMEN ALLOY 22 2277-8-3175
1.915" x 0.250" POLISHED TO 600 GRIT FINISH
START WT 12.20857
END WT
EXPOSED AREA = 8 cm^2
SOLUTION 1000 PPM Cl^- AS KCl
2.10237 g KCl LOT 901422
+ DI WATER TO 1000 mL
220 mL PLACED IN TEST CELL
FINAL VOLUME NOT RECORDED
END pH NOT RECORDED
TEMP = 95°C
SOLUTION DEAERATED W/ N_2

E_{corr} -422 mV KEITHLEY 614 467374
~~E_{pt} = 422 mV KEITHLEY 614 467374~~ DH 7/12/2000
$E_{APPLIED}$ 0.5V SCE
E_{pt} = +21 mV KEITHLEY 614 SN 467374
TEST STARTED
PASSIVE CURRENT DENSITY SAVED TO FILE C22PFC2.DAT
TEST STARTED 7/12/2000 10:13 AM

INITIAL SOLUTION CHEMISTRY PRIOR TO START OF TEST
7/12/2000 10:00 AM

SAMPLE OF SOLUTION EXTRACTED 7/13/2000 8:13 AM
22 hr (7.880 E4 SECONDS) SPECIMEN GOLD COLOR

SAMPLE OF SOLUTION EXTRACTED AT 46.5 hr

SAMPLE OF SOLUTION EXTRACTED AT 122.4 hr

SAMPLE OF SOLUTION EXTRACTED AT 144.1 hr

C22 PFC2

SAMPLE OF SOLUTION EXTRACTED AT 183.5 hr

SAMPLE OF SOLUTION EXTRACTED AT 214.8 hr

SAMPLE OF SOLUTION EXTRACTED AT 286.4 hr

SAMPLE OF SOLUTION EXTRACTED AT 333.3 hr

Daniel Dunn 8/17/2000

C22 PFC2

- DATA FROM SOLUTION ANALYSES AT 22 hr

CrO_4^{2-}	5.65 ppm	6.2 COULOMBS
MoO_4^{2-}	1.51 ppm	1.2 COUL
WO_4^{2-}	3.5 ppm	1.8 COUL
Ni^{2+}	0.28 ppm	~~0.3~~ DD 7/11/2000 0.20

- DATA FROM SOLUTION ANALYSES AT 46.5 hours

CrO_4^{2-}	8.2 ppm	9.0 COUL
WO_4^{2-} ~~MoO_4^{2-}~~ DD 7/18/00	4.5 ppm	2.3 COUL
MoO_4^{2-} ~~WO_4^{2-}~~ DD 7/18/00	2.7 PPM	2.2 COUL
Ni^{2+}	0.51 PPM	0.37

- DATA FROM SOLUTION ANALYSES AT 122.4 hours

CrO_4^{2-}	27.2 PPM	29.8 COUL
WO_4^{2-} ~~MoO_4^{2-}~~ DD 7/18/00	0.2 PPM	0.1 / 2.4
MoO_4^{2-} ~~WO_4^{2-}~~ DD 7/18/00	6.4 PPM	5.1
Ni^{2+}	1.5 PPM	1.1

Russell Dunn 8/17/2000

DATA FROM SOLUTION ANALYSES AT ~~122.4~~ 144.1 hr DD 7/18/00

CrO_4^{2-}	36.3 ppm	39.7 COULOMBS
MoO_4^{2-}	~~0~~ DD 7/18/00 8.1 ppm	6.5 COULOMBS
WO_4^{2-}	~~8.1 ppm~~ DD 7/18/00 0	~~6.5~~ DD 7/18/00 0
Ni^{2+}	0.8	

DATA FROM SOLUTION ANALYSES AT ~~144.1~~ 183.5 hr DD 7/28/00

CrO_4^{2-}	43.3 ppm	47.4 COULOMBS
MoO_4^{2-}	10.1 ppm	8.1 COULOMBS
WO_4^{2-}	0	0
Ni^{2+}	0.5 ppm	?

DATA FROM SOLUTION ANALYSES AT 214.8 hr

CrO_4^{2-}	57.7 ppm	63.1 COULOMBS
MoO_4^{2-}	13.7 ppm	11.0 COULOMBS
WO_4^{2-}	0	–
Ni^{2+}	0	–

Russell Dunn 8/17/2000

C22PFC2

DATA FROM SOLUTION ANALYSIS AT 286.4 hr

CrO_4^{2-}	72.3 ppm	79.1 COULOMBS
MoO_4^{2-}	23.1 ppm	18.5 COULOMBS
WO_4^{2-}	–	–
Ni^{2+}	–	–

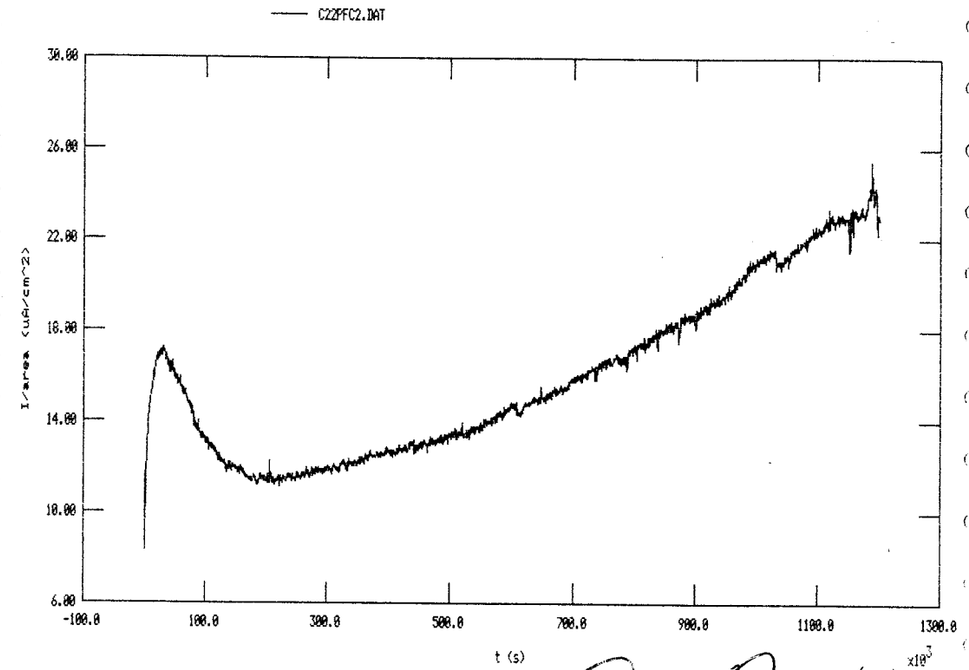
DATA FROM SOLUTION ANALYSIS AT 333.3 hr

CrO_4^{2-}	83.1 ppm	90.9 COULOMBS
MoO_4^{2-}	25.9 ppm	20.8 COULOMBS
WO_4^{2-}	–	–
Ni^{2+}	–	–

Darrell Dunn 8/17/2000

C22PFC2

Model 352/252 Corrosion Analysis Software, v. 2.30
PS POTENTIOSTATIC File Status: NORMAL Date Run: 04-08-00 Time Run: 09:09:18
CP PASS vs. R CT PASS IP 0.500 vs. R ID 5 S TP 4.000E+02 T1 1.200E+06
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 0.000E+00 DEN 8.140E+00 AU NO
OC -0.419
Comment: C-22 1000 ppm Cl as KCl 95C
Filename: A:\C22PFC2.DAT Pstat: VStat[] Ver 2



Darrell Dunn 8/17/2000

Model 352/252 Corrosion Analysis Software, v. 2.30
Filename: A:\C22PFC2.DAT
Pstat: VStat[] Ver 2
PS POTENTIOSTATIC File Status: NORMAL
Date Run: 04-08-00 Time Run: 09:09:18

Cond. Time	CT	pass	s	Initial Pot.	IP	500.0E-3	V
Cond. Pot.	CP	pass	V	Time Step 1	T1	1.200E6	s
Initial Delay	ID	0	s	Stop On	SO	Pass	
Time/Pt.	TP	400.0	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	8.140	g/ml	AUX A/D	AU	no	
Open Circuit	OC	-419.0E-3	V				

Comment: C-22 1000 ppm Cl as KCl 95C

Darrell Dunn 8/17/2000

Initial Scientific notebook entry for sensor tests

Title: Sensor tests

Tests Preformed by: Darrell S. Dunn

Objectives: design build and test sensors to detect corrosion and corrosive environments

Equipment: Keithley 614/617. Solartron potentiostat Model 1287, EG&G potentiostat model 273, Pine potentiostat model AFRDE5, Humidity chamber.

Materials: A516 carbon steel and Type 304L stainless steel. Other materials identified at the time of testing.

Specimen specifications: Identified in each test

Measurement Parameters: Potential, current, and resistance. Other parameters identified at time of test.

Required level of accuracy: Potentials $\pm$ 1mV, Current $\pm$ 0.1 microamp, Resistance 0.01 kohm to 10 Mohm

Uncertainty and Sources of Error: Response of sensors will be dependent on exposure conditions, deposited salts, and area of coverage. Variations in dimensions of the sensors during production may alter the response of sensors.

Darrell Dunn 7/21/00

INITIAL SENSOR TEST SPECIMENS

OBJECTIVE: PRODUCE SENSOR SIMILAR TO THOSE USED BY JAPANESE.

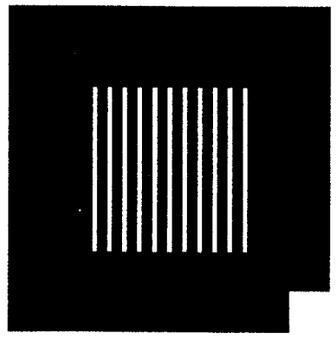
SENSOR DESIGNED AFTER THAT SHOWN IN FIGURE BELOW

Information potentially subject to copyright protection was redacted from this location. The redacted material is from the following reference:

Tadashi, S. S. Tsujikawa, S. Motoda, Y.Suzuki, W. Oshikawa S. Itomura, T. Fukushhima, and S. Izumo. "Evaluation of Corrosivity of Marine atmosphere by Atmospheric Corrosion Monitor) Type Sensor." Figure 1. Proceedings of the International Symposium on Plant Aging and Life Predictions of Corrodible Structures, Sapporo, Japan. Sapporo, Japan: Japan Society of Corrosion Engineering. 1995.

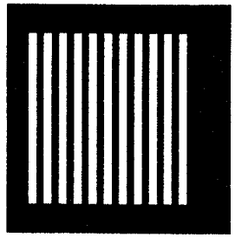
INITIAL SENSOR DESIGN

INSULATOR SCREEN PRINTED ON 2.0 IN x 2.0 IN SUBSTRATE



7/24/00

CONDUCTIVE Ag CONTAINING EPOXY SCREEN PRINTED OVER INSULATOR ON 2.0 IN x 2.0 IN SUBSTRATE.



7/24/00

TA002090

INITIAL SENSOR TEST

OBJECTIVE DETERMINE RESPONSE OF SENSORS SHOWN ON PAGE 126.

DP 7/24/00

TEST SETUP: 4 SENSORS TESTED ~~2 w/ TYPE~~
2 SENSORS USING TYPE 304L SUBSTRATE
2 SENSORS USING TYPE AISI STEEL SUBSTRATE.
1 OF EACH CONNECTED TO A POTENTIOSTAT AND POTENTIAL BETWEEN SUBSTRATE AND CONDUCTIVE Ag EPOXY SET TO 0mV. CURRENT RECORDED AS A FUNCTION OF TIME.
1 EACH SENSOR CONNECTED TO KEITHLEY 617 ELECTROMETER AND RESISTANCE BETWEEN SUBSTRATE AND Ag CONDUCTIVE EPOXY MEASURED

ALL SENSORS PLACED IN HUMIDITY CHAMBER BLUE-M VAPOR TEMP WET AND DRY BULB TEMP MEASURED USING RTD BLUE M RECORDER SN 91E34523 CAL 3/2/00 DUE 9/01/00 RELATIVE HUMIDITY CALCULATED USING WET AND DRY BULB TEMP. CHART ON PAGE 128

INITIAL TEST CONDUCTED BY VARYING RELATIVE HUMIDITY INSIDE TEST CHAMBER AND MONITORING RESPONSE OF SENSORS.

DATA FILE TSNST1.DAT
RESPONSE SUMMARIZED BELOW

304 ZRA SMALL CURRENT $1-3 \times 10^{-6}$ A
AS16 ZRA NEGATIVE CURRENT

304L RESISTANCE > 200 MΩ
AS16 RESISTANCE > 200 MΩ UNTIL RH > 80%
80 - 150 MΩ AT HIGH RH

8/17/2000

Information potentially subject to copyright protection was redacted from this location. The redacted material is from page 15-20 of the referenced handbook listed below.

15-20 [signature] 7/24/00

SOURCE CRC HANDBOOK OF CHEMISTRY AND PHYSICS 71ST EDITION 1990-1991

[signature] 7/24/00

SENSOR TEST #2

OBJECTIVE DETERMINE RESPONSE OF SENSORS SHOWN ON P/26

TEST SETUP SAME AS P127 SAME SENSORS AS P/27
304L ZRA
304L RESISTANCE
AS16 ZRA
AS16 RESISTANCE
ALL SENSORS IN RH CHAMBER
2.5 mL OF 1 PPM NaCl (LOT 000274) PLACED ON EACH SENSOR. SOLUTION ALLOWED TO EVAPORATE AT 39% RH T= 30°C 7/28/00 9:30AM

RELATIVE HUMIDITY VARIED FROM 39% TO 96%
OUTPUT OF SENSORS RECORDED AS A FUNCTION OF TIME DATA SAVED AS ~~TSNTS~~ DD 8/4/00
TSNST 2.DAT

SIMILAR RESULTS TO FIRST TEST
ONLY AS16 RESISTANCE HAD RESPONSE AS A FUNCTION OF RELATIVE HUMIDITY

RELATIVE HUMIDITY DECREASED TO 39% AT CONCLUSION OF TEST.

[signature] 8/4/2000

SENSOR TEST #3

OBJECTIVE DETERMINE RESPONSE OF SENSORS
ON P 126

TEST SETUP SAME AS TESTS 1 & 2
304 ZRA
AS16 ZRA
304 RESISTANCE
AS16 RESISTANCE

ALL SENSORS IN RH CHAMBER
2.5 mL 10 PPM CL PLACED ON SENSORS
AND ALLOWED TO EVAPORATE AT ~~39% RH~~ DD 8/4/2000
39% RH. SOLUTION APPLIED 4:00 PM 8/3/2000

RELATIVE HUMIDITY VARIED FROM 39% TO 99%
OUTPUT OF SENSORS RECORDED AS A FUNCTION
OF TIME

DATA SAVED AS TSNST 3.DAT

WATER CHILLER PUMP FAILED 8/8/2000
NO CONTROL OVER LOW/WET BULB TEMP
COULD NOT REDUCE RELATIVE HUMIDITY
OF CHAMBER FROM 99% AT END OF TEST

SYSTEM WAS SHUT DOWN AND TESTING STOPPED

Darrell Dean 8/8/2000

SENSOR TESTS

OBJECTIVE DETERMINE RESPONSE OF SENSORS
ON P126

TEST SETUP SAME AS PAGE 127
304 ZRA
AS16 ZRA
~~304 1~~ DD 8/25/2000
304 RESISTANCE
AS16 RESISTANCE
DD 8/25/2000 DD 8/25/2000
TEST ~~#4~~ #5 DATA SAVED AS ~~TSNST4.DAT~~ TSNST5.DAT
ALL SENSORS IN RH CHAMBER DRY BULB 30°C
WET BULB 20°C RH: 39%
2.5 mL OF 1 PPM Cl^- PLACED ON SENSORS
AND ALLOWED TO EVAPORATE
NOTE THAT SENSORS HAVE PREVIOUSLY BEEN
EXPOSED TO CHLORINE SOLUTIONS AS LISTED BELOW

TEST	Cl SOLUTION	
TSNST 1	NONE	RH 39-99%
TSNST 2	1 PPM Cl^- (2.5 mL)	RH 39-99%
TSNST 3	10 PPM Cl^- (2.5 mL)	RH 39-99%
TSNST 4	100 PPM Cl^- 2.5 mL	RH 39-99%

RESISTANCE RECORDED AFTER WETTING OF SENSORS
CURRENT MEASURED ON ZRA SENSORS

TEST #6 SAME AS TEST #5 SAME SENSORS
ADDED 2.5 mL 10 PPM Cl TO EACH SENSOR
DATA FILE TSNST 6.DAT

TEST #7 SAME AS TEST #5 & #6 SAME SENSORS
ADDED 2.5 mL 100 PPM Cl TO EACH SENSOR
DATA FILE TSNST 7.DAT

Darrell Dean 12/22/2000

SENSOR TEST

TEST #8 SAME AS 5, 6, & 7 SAME SENSORS
ADDED 2.5 mL 1000 ppm Cl TO EACH
SENSOR RH = 39% DATA FILE TSNST8.DAT
TEST CONDUCTED 8/28/2000

PROBLEMS WITH RH CHAMBER UNABLE TO
MAINTAIN HUMIDITY BELOW 40% SOLUTION
REMAINED ON SENSOR SURFACES FOR MUCH
LONGER THAN 8 hours

SOME ADDITIONAL CORROSION OF ~~316~~ DD 8/31/2000
304L RESISTANCE SENSOR RED CORROSION PRODUCTS
CLEARLY VISIBLE ON SURFACE.

TEST #9 SAME AS PREVIOUS TESTS SAME SENSORS
ADDED 2.5 mL 1000 PPM Cl TO EACH
SENSOR RH = 39% DATAFILE TSNST9.DAT
TEST CONDUCTED 8/31/2000

TEST #10 SAME AS PREVIOUS TESTS SAME SENSORS
VARIED RH FROM 39 TO 99%
DATA FILE TSNST10.DAT TEST CONDUCTED 9/1/2000

TEST #10 SAME TEST SAME SENSORS ADDED
2.5 mL 1000 ppm Cl^- TO EACH SENSOR
RH AT 39% ~~DAD~~ DD 9/5/2000 DATA
SAVED TO TSNST10.DAT TIMER RESET TO
ZERO PRIOR TO ADDITION OF Cl^- SOLUTION
RH INCORRECTLY SET TO 67% IN DATA
ACQ PROGRAM FOR FIRST 12,000 SECONDS

TEST #11 SAME SENSORS SAME SETUP
ADDED 2.5 mL 1000 PPM Cl^- TO
EACH SENSOR RH AT 39%
DATA SAVED AS TSNST11.DAT

TEST 12 SAME SENSORS SAME SETUP
ADDED 2.5 mL 1000 PPM Cl^- TO
EACH SENSOR RH AT 39%
DATA SAVED AS TSNST12.DAT

TEST 13 SAME SENSORS SAME SETUP
ADDED 2.5 mL 1000 PPM Cl^- TO
EACH SENSOR RH AT 39%
DATA SAVED AS TSNST13.DAT

TEST 14 SAME SENSORS SAME SETUP
ADDED 2.5 mL 1000 PPM Cl^- TO
EACH SENSOR RH AT 39%
DATA SAVED AS TSNST14.DAT 9/21/2000

TEST 15 SAME SENSORS SAME SETUP ATTEMPTED
TO MEASURE E_{corr} OF BOTH 304 ZRA
AND 304 RESISTANCE SENSORS WAS NOT
ABLE TO OBTAIN STABLE E_{corr} VALUE FOR
304 OHM SENSOR. E_{corr} FOR 304 ZRA SENSOR
SEEMS WHAT NOISY. 2.5 mL 1000 ppm Cl^-
ADDED TO EACH SENSOR
DATA SAVED AS TSNST15.DAT.
E_{corr} OF 304 OHM MEASURED AT 4400 SEC
E_{corr} = +80mV SCE USING KEITHLEY 614
E_{corr} = +34mV SCE AT 7400 S

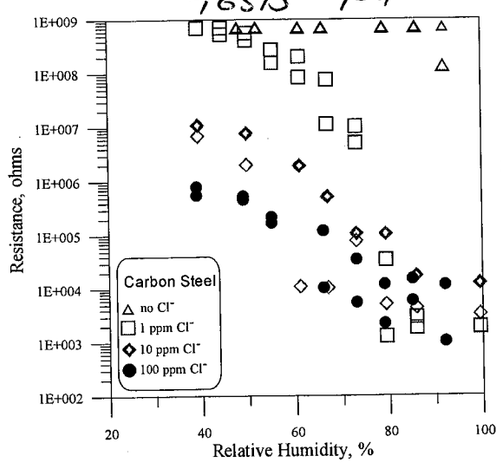
12/22/2000

SENSOR TEST RESULTS

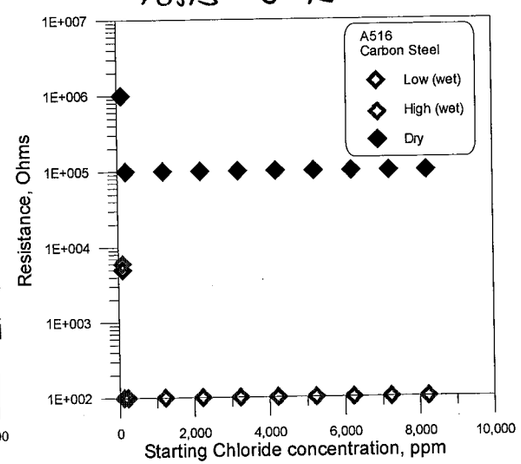
CARBON STEEL

RESISTANCE

TESTS 1-4



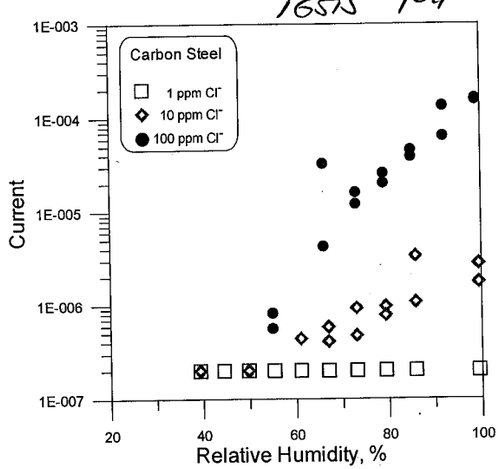
TESTS 5-15



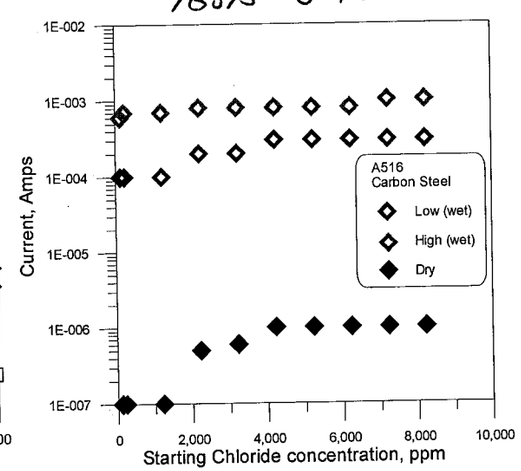
CARBON STEEL

CURRENT

TESTS 1-4



TESTS 5-15

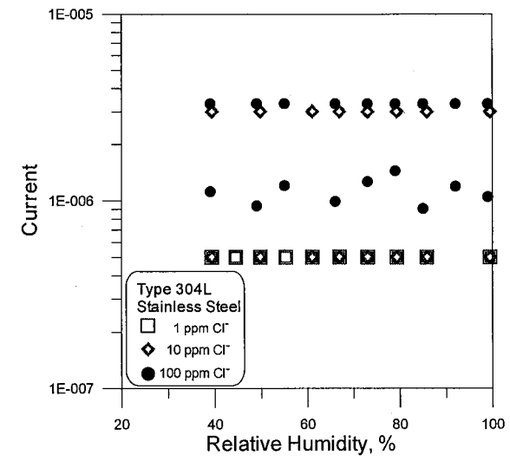


Darrell Dunn 4/26/02

SENSOR TEST RESULTS

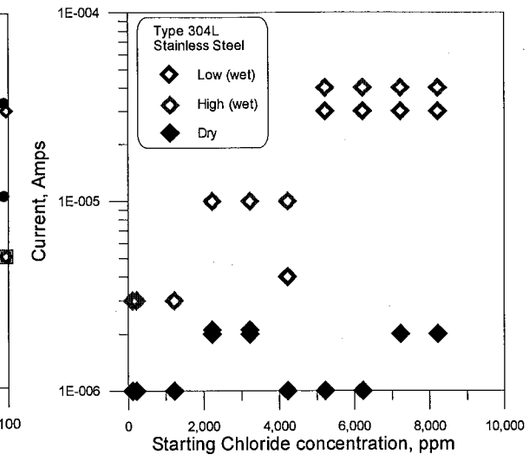
STAINLESS STEEL

CURRENT TESTS 1-4



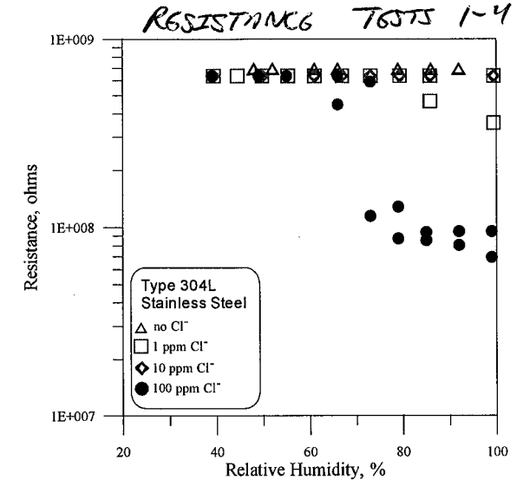
STAINLESS STEEL

CURRENT TESTS 5-15



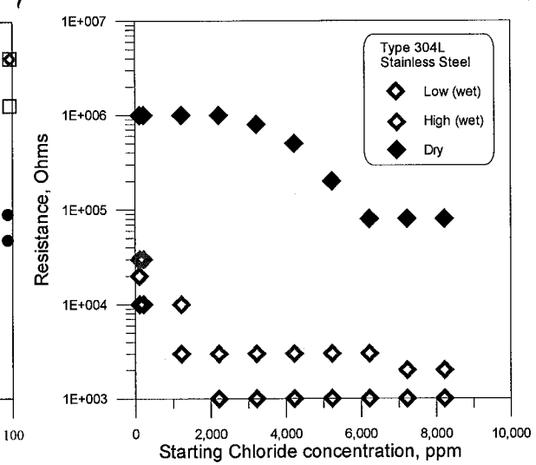
STAINLESS STEEL

RESISTANCE TESTS 1-4



STAINLESS STEEL

RESISTANCE TESTS 5-15



Darrell Dunn 4/26/02

PASSIVE FILM CHEMISTRY.. C22PFC3

SPECIMEN ALLOY 22 2277-8-3175 72 cm²
START WT NOT RECORDED >200g

SOLUTION 1000 PPM Cl⁻ ~~85~~ 8/31/2000 AS KCl
2.10237 g KCl LOT 901422
+ DI WATER TO 1000 mL
220 mL PLACED IN TEST CELL
TEMP = 95°C
SOLUTION DEAERATED W/ N_2

E_{corr} − 597 mV SCE KEITHLEY 614 SN 467374
$E_{APPLIED}$ 0 mV SCE

TEST RUN FOR 1.2×10^6 SECONDS

DATA SAVED AS C22PFC3.DAT PLOT P137

TEST RESTARTED AT END OF C22PFC3.DAT

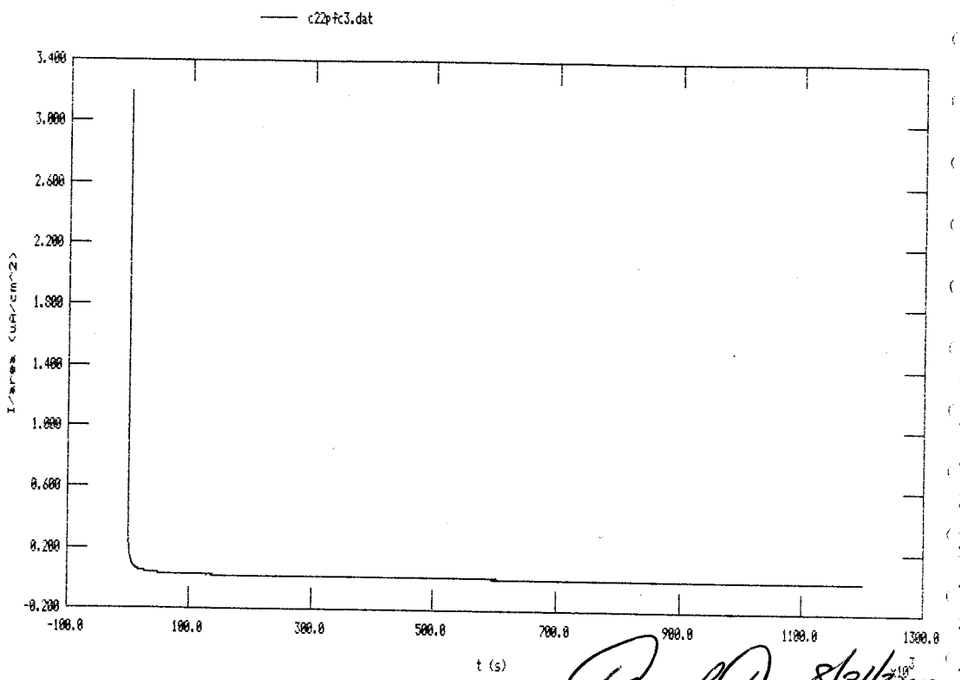
DATA SAVED AS C22PFC4.DAT

SAME TEST SPECIMEN AND SOLUTION

MULTIPLE WATER ADDITIONS NECESSARY TO MAINTAIN SOLUTION LEVEL AS A RESULT OF EVAPORATION

9/19/2000

Model 352/252 Corrosion Analysis Software, v. 2.30
PS POTENTIOSTATIC File Status: NORMAL Date Run: 04-16-00 Time Run: 07:26:23
CP PASS vs. R CT PASS IP 0.000 vs. R ID 5 S TP 4.000E+02 T1 1.200E+06
CR AUTO NP 3000 SO Pass IR NONE FL I 5.3Hz RT HIGH STABILITY
REF 0.24150 SCE WRK SOLID AR 7.200E+01 LS YES EW 2.604E+01 DEN 8.140E+00 AU NO
OC -0.597
Comment: alloy 22 2277-8-3175 0.028 M KCl 95 c N2 deaerated
Filename: A:\c22pfc3.dat
Pstat: VStat[] Ver 2



8/31/2000

Model 352/252 Corrosion Analysis Software, v. 2.30
Filename: A:\c22pfc3.dat
Pstat: VStat[] Ver 2
PS POTENTIOSTATIC File Status: NORMAL
Date Run: 04-16-00 Time Run: 07:26:23

Cond. Time	CT	pass	s	Initial Pot.	IP	0.0000	V
Cond. Pot.	CP	pass	V	Time Step 1	T1	1.200E6	s
Initial Delay	ID	5	s	Stop On	SO	Pass	
Time/Pt.	TP	400.0	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	72.00	cm^2	Equiv. Wt.	EW	26.04	g
Density	DE	8.140	g/ml	AUX A/D	AU	no	
Open Circuit	OC	-597.0E-3	V				

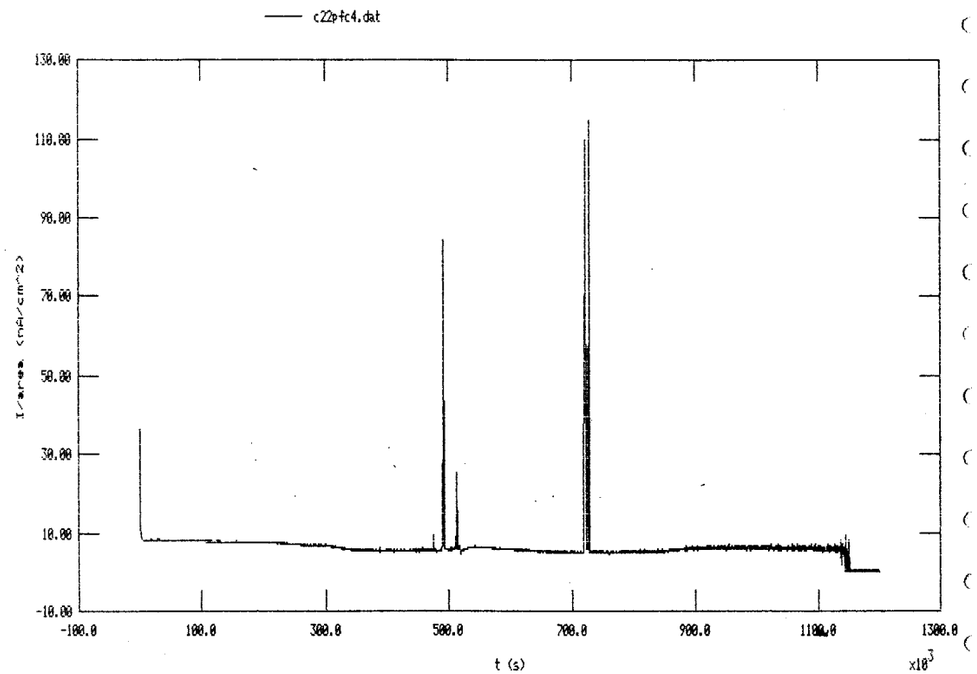
Comment: alloy 22 2277-8-3175 0.028 M KCl 95 c N2 deaerated

8/31/2000

Model 352/252 Corrosion Analysis Software, v. 2.30 Filename: A:\c22pfc4.dat Pstat: VStat[] Ver 2
PS POTENTIOSTATIC File Status: NORMAL Date Run: 04-18-00 Time Run: 07:28:34

CP	PASS vs. R	CT	PASS	IP	0.000 vs. R	ID	5 S	TP	4.000E+02	T1	1.200E+06
CR	AUTO	NP	3000	SO	Pass	IR	NONE	FL	1 5.3Hz	RT	HIGH STABILITY
REF	0.24150 SCE	WRK	SOLID	AR	7.200E+01	LS	YES	EW	2.604E+01	DEN	8.140E+00 AU NO
OC	-0.228										

Comment: alloy 22 2277-8-3175 0.028 M KCl 95 c N2 deaerated second run



Daniel Dunn 9/19/00

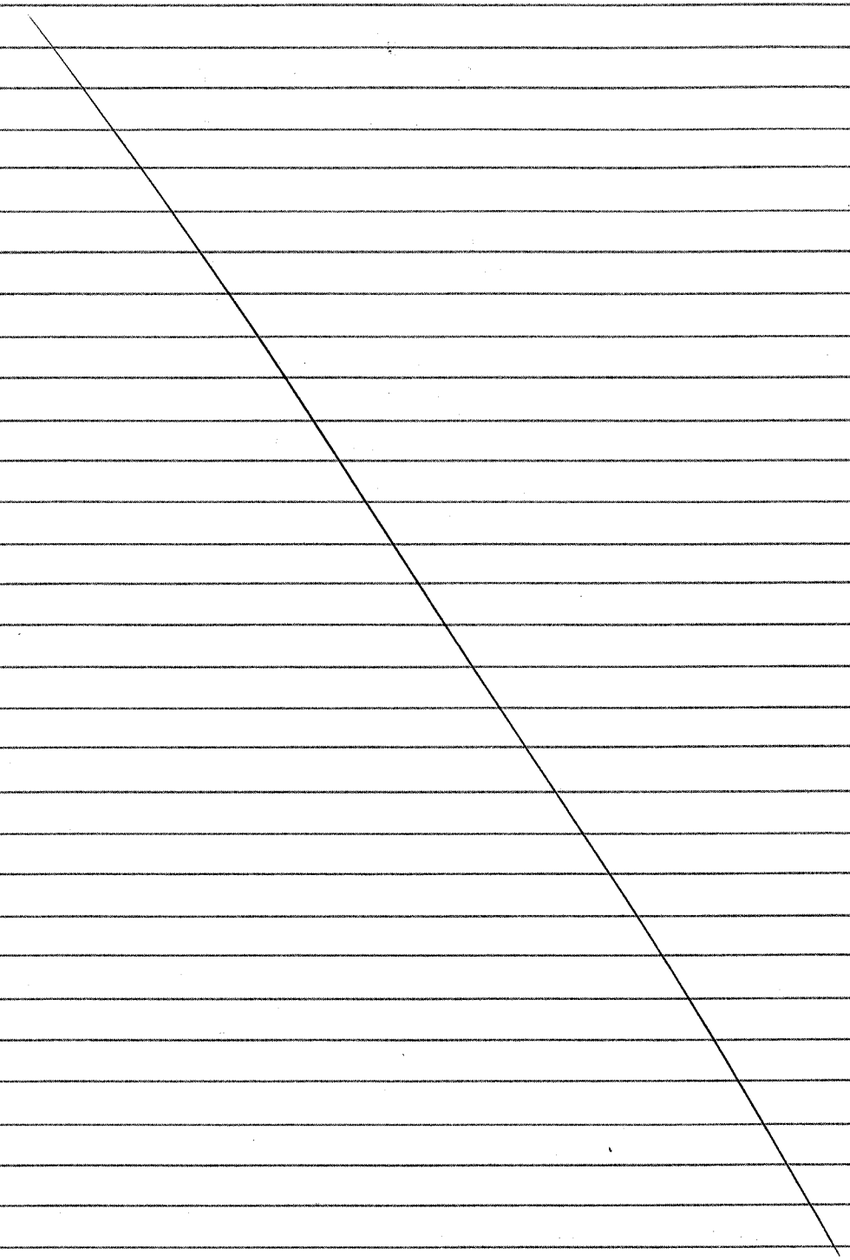
Model 352/252 Corrosion Analysis Software, v. 2.30
Filename: A:\c22pfc4.dat
Pstat: VStat[] Ver 2
PS POTENTIOSTATIC File Status: NORMAL
Date Run: 04-18-00 Time Run: 07:28:34

Cond. Time	CT	pass	s	Initial Pot.	IP	0.0000	V
Cond. Pot.	CP	pass	V	Time Step 1	T1	1.200E6	s
Initial Delay	ID	5	s	Stop On	SO	Pass	
Time/Pt.	TP	400.0	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	1 5.3Hz	
Working Elec.	WE	Solid		Ref. Elec.	RE	SCE 241.5E-3V	
Sample Area	AR	72.00	cm^2	Equiv. Wt.	EW	26.04	g
Density	DE	8.140	g/ml	AUX A/D	AU	no	
Open Circuit	OC	-228.0E-3	V				

Comment: alloy 22 2277-8-3175 0.028 M KCl 95 c N2 deaerated second run

Daniel Dunn 9/19/2000

SOLUTION ANALYSES



Daniel Dunn 9/21/02

LT825PSAG

SPECIMEN ALLOY 825 SAME AS p 109 (HH4371FG)
START WT 39.07046
END WT 39.07417 1-31-01 [signature] Sartorius RC210 SN 10704379
2 PTFE CREVICE WASHERS ATTACHED AT 50 in-oz
USING PROTO 6103

SOLUTION 1000 PPM Cl^- 85PPM HCO_3 20 PPM $SO_4^=$
10PPM NO_3 2PPM F^- 2000 mL AS FOLLOWS

3.29733 g NaCl LOT 000274
0.24016 g $NaHCO_3$ LOT 897789
40 mL SO_4 -9/2000 STOCK SOLUTION p 145
20 mL NO_3 -9/2000 " "
4 mL F-9/2000 " "
+ DI WATER TO 2000 mL
START pH 8.513
END pH 9.18 1-30-01 [signature]

T= 95°C Hg THERMOMETER 115858
REFERENCE FISHER SCE 13-620-52 SN 8238320

E_{corr} -83 mV SCE KEITHLEY 614 SN 555368
E_{pt} +116 mV SCE " " " "
$E_{APPLIED}$ +100 mV SCE " " " "

TEST STARTED 9/18/2000
COMPUTER LOCK UP 9/25/2000 TEST RESTARTED
LT825PSAH
LT825PSAH2

TEST STOPPED 12/22/2000

[signature] 4/26/02

C22L9B

SPECIMEN ALLOY C-22 WELDED SAME A p 110
BASE METAL 2277-8-3235
FILLER XX1045BG11
START WT 38.60234
END WT 38.56633 1-31-01 [signature] Sartorius RC210 SN 10704379
2 PTFE CREVICE WASHERS ATTACHED AT 50 IN-OZ
USING PROTO 6103

SOLUTION 4m Cl^- 85PPM HCO_3 20 PPM $SO_4^=$ 10PPM NO_3^-
2PPM F^- 2000 mL PREPARED AS FOLLOWS

467.5 g NaCl LOT 000274
0.24035 g $NaHCO_3$ LOT 897789
40 mL SO_4 -9/2000 STOCK SOLUTION P 145
20 mL NO_3 -9/2000 " "
4 mL F-9/2000 " "
+ DI WATER TO 2000 mL
START pH 7.98
END pH 8.53 1-30-01 [signature]

T= 95°C Hg THERMOMETER C98-101
REFERENCE FISHER SCE 13-620-52 SN 8205236

E_{corr} -299 mV SCE KEITHLEY 614 SN 555368
E_{pt} +187 mV SCE " " " "
$E_{APPLIED}$ 200 mV SCE " " " "

TEST STARTED 9/18/2000
COMPUTER LOCKUP 9/25/2000 TEST RESTARTED
C22L9C
C22L9C2

TEST STOPPED 12/22/2000 Specimen Examination
Test Specimen Showed Deep Corrosion on 1 foot Replaced
Test Specimen with New C-22 Alloy [signature] 02/01/2001

C22L11A

SPECIMEN ALLOY C-22 2277-8-3175
START WT 31.45020 g
END WT 31.45013 g 1-31-01 B. [illegible] Sartorius RC210 SN 10704379
2 PTFE CREVICE WASHERS ATTACHED USING
PROTO 6103 50 in.oz

SOLUTION 4m Cl^- 85 ppm NCO_3 20 ppm $SO_4^=$ 10 ppm NO_3
2 ppm F^-

467.5 g NaCl LOT 000274
0.24037 g $NaNCO_3$ LOT 897789
40 mL SO_4 -9/2000 STOCK SOLUTION p 145
20 mL NO_3 -9/2000 " "
4 mL F -9/2000 " "
+ DI WATER TO 2000 mL
START pH 7.74
END pH 8.53 1-30-01 B. [illegible]

T= 95°C Hg THERMOMETER C98-162
REFERENCE SCE FISHER 13-620-52 SN 9252111

E_{corr} -243 mV SCE KEITHLEY 614 SN 555368
E_{pt} +237 mV SCE " " " "
$E_{APPLIED}$ +250 mV SCE " " " "

TEST STARTED 9/18/2000
COMPUTER LOCKUP 9/25/2000 TEST RESTARTED
C22L11B
C22L11B2

TEST STOPPED 12/22/2000

[signature] 4/26/02

C22L3G

SPECIMEN ALLOY C22 2277-8-3175 SAME AS P 112
START WT 47.21957 g
END WT 47.22436 g 1-31-01 B. [illegible] Sartorius RC210 SN 10704379
2 PTFE CREVICE WASHERS ATTACHED USING
PROTO 6103 50 in.oz

SOLUTION 4m Cl^- 85 ppm NCO_3^- 20 ppm $SO_4^=$ 10 ppm NO_3^-
2 ppm F^- 2000 mL MADE AS FOLLOWS

467.5 g NaCl LOT 000274
0.24026 g $NaNCO_3$ LOT 897789
40 mL SO_4 -9/2000 STOCK SOLUTION p 145
20 mL NO_3 -9/2000 STOCK SOLUTION p
4 mL F -9/2000 " "
+ DI WATER TO 2000 mL
START pH 7.96
END pH 8.73 1-30-01 B. [illegible]
SOLUTION BUBBLED w/ ZERO AIR
T=95°C Hg THERMOMETER H 98-197
REFERENCE FISHER SCE 13-620-52 SN 8238333

E_{corr} -160 mV SCE KEITHLEY 614 SN 555368
E_{pt} +131 mV SCE " " " "
$E_{APPLIED}$ OPEN CIRCUIT " " " "

TEST STARTED 9/18/2000
COMPUTER LOCKUP 9/25/2000 TEST RESTARTED
C22L3H
C22L3H2

TEST STOPPED 12/22/2000

[signature] 4/26/02

~~OC825CIAA~~ DD 9/18/2000 OC825CIAE

SPECIMEN ALLOY 825 HN4371FG SAME AS PAGE 113
START WT 39.29018 g
END WT 39.29055 g 1-31-01 B-Day Sartorius RC210 SN 10704379
2 PTFE CREVICE WASHERS ATTACHED USING
PROTO 6103 50 in-oz

SOLUTION 1000 ppm Cl^- 85 ppm HCO_3 20 ppm $SO_4^=$ 10 ppm NO_3
2 ppm F^- 2000 mL MADE AS FOLLOWS

3.29711 g NaCl LOT 000274
~~0.24 DD 9/18/2000 g $NaHCO_3$~~ 0.24083 g $NaHCO_3$ LOT 897789
40 mL SO_4 - 9/2000 STOCK SOLUTION
20 mL NO_3 - 9/2000 " " "
4 mL F - 9/2000 " " "
+ DI WATER TO 2000 mL

START pH 8.18
END pH 9.36 1-30-01 B-Day

SOLUTION BUBBLED W/ ZERO AIR

T = 95°C Hg THERMOMETER H98-170
REFERENCE FISHER SCE 13-620-51 SN 8131146

E_{corr} - 79 mV_{SCE} KEITHLEY 614 SN 555368
E_{pc} + 93 mV_{SCE}
$E_{APPLIED}$ OPEN CIRCUIT

TEST STARTED 9/18/2000
COMPUTER LOCKUP 9/28/2000 TEST RESTARTED
OC825CIAF
OC825CIAF2

TEST STOPPED 12/22/2000

STOCK SOLUTIONS 9-2000

SO_4 - 9/2000
1000 ppm $SO_4^=$ AS Na_2SO_4
1.47018 g Na_2SO_4 LOT 901213
+ DI WATER TO 1000 mL
PREP 9/8/2000 EXP 10/8/2000

NO_3 9/2000
1000 ppm NO_3 AS $NaNO_3$
1.37289 g $NaNO_3$ LOT 961772A
+ DI WATER TO 1000 mL
PREP 9/8/2000 EXP 10/8/2000

F - 9/2000
1000 ppm F AS NaF
2.21008 g NaF LOT 991559
+ DI WATER TO 1000 mL
PREP 9/8/2000 EXP 10/8/2000

PASSIVE FILM CHEMISTRY

OBJECTIVE MEASURE PASSIVE DISSOLUTION AND
CORROSION PRODUCT CONCENTRATIONS

SPECIMEN ALLOY C-22 2277-8-3175

SOLUTION 1000 ppm Cl AS KCl + HCl TO pH 2.5
2.13036 g KCl LOT 901422
2.5 mL HCl SOLUTION ADDED TO REACH pH 2.5
HCl SOLUTION 4 mL 37.5% HCl + DI WATER TO 20 mL
HCl ADDED (4)(0.375) 1.19 g/mL = 1.785 g HCl
1.785 g HCl / 20 mL = 0.0893 g HCl/mL
(0.0893 g HCl/mL)(2.5 mL) / 36.45 g/mol
0.0062 mol HCl LOT 002560
TOTAL [Cl⁻] 0.028 mol Cl⁻ FROM KCl
0.0062 mol Cl⁻ FROM HCl
~~0.00~~ 9/22/2000
0.0342 mol Cl⁻

TEMP = 60°C
SOLUTION DEAERATED w/ N_2

E_{corr} +48 mV
E_{pt} +221 mV
$E_{APPLIED}$ 200 mV / vs SCE

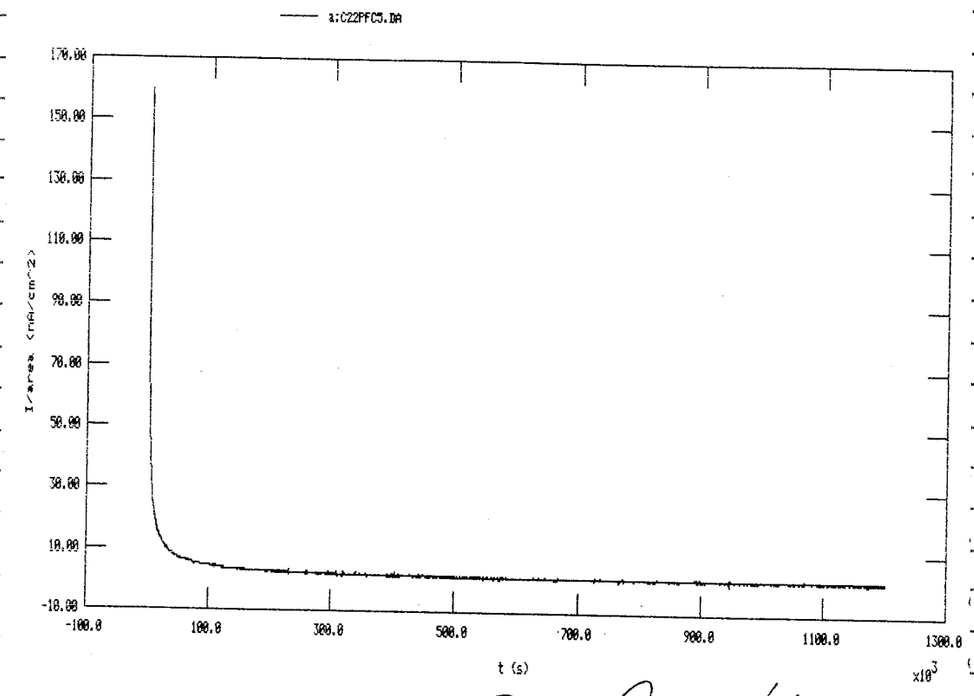
TEST STARTED 8:50 AM 9/22/2000

PASSIVE CURRENT DENSITY ~~0.0~~ 10/6/2000 0.7 TO 1.2 nA/cm²

SOLUTION EXTRACTED PRIOR TO START OF TEST AND
AFTER 318 HOURS

DATA SAVED AS C22PFC5.DAT
TEST RESTARTED USING SAME CONDITIONS C22PFC6.DAT
10/6/2000 SOLUTION EXTRACTED 666 hr

Model 352/252 Corrosion Analysis Software, v. 2.30
PS POTENTIOSTATIC File Status: NORMAL Date Run: 04-22-00 Filename: a:C22PFC5.DAT Time Run: 07:43:12 Pstat: VStat[] Ver 2
CP PASS vs. R CT PASS IP 0.200 vs. R ID 5 S TP 4.000E+02 TI 1.200E+06
CR AUTO NP 3000 SO Pass IR NONE FL I 5.3Hz RT HIGH STABILITY
REF 0.24150 SCE MPK SOLID AR 7.200E+01 LS YES EW 2.604E+01 DEN 8.690E+00 AU NO
OC 0.046
Comment: alloy 22 2277-8-3175 0.035 M KCl pH 2.5 95 c N2 deaerated



10/6/2000

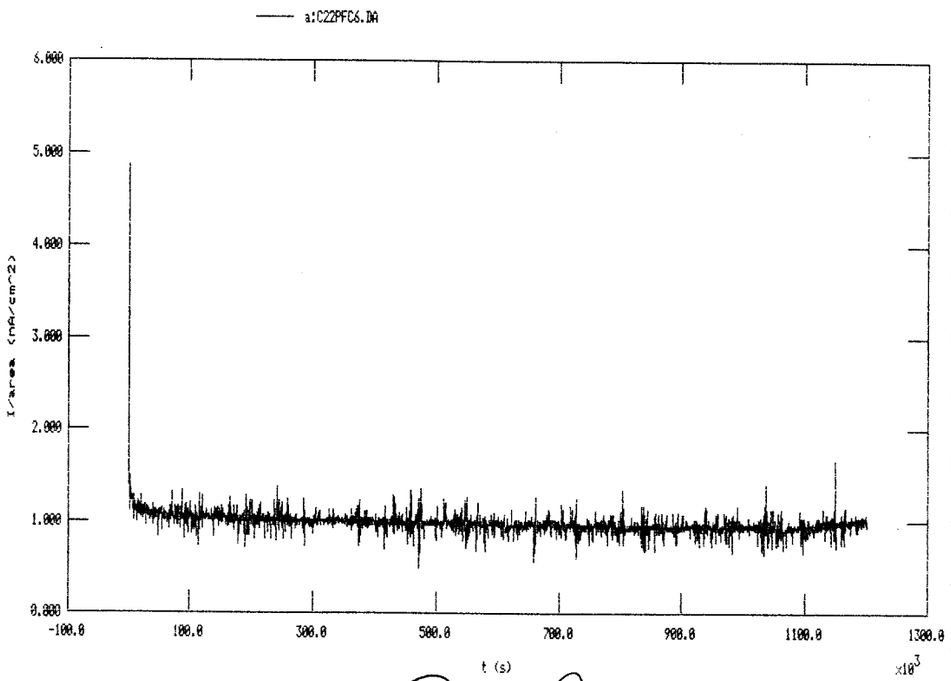
Model 352/252 Corrosion Analysis Software, v. 2.30
Filename: a:C22PFC5.DAT
Pstat: VStat[] Ver 2
PS POTENTIOSTATIC File Status: NORMAL
Date Run: 04-22-00 Time Run: 07:43:12

Cond. Time	CT	pass	s	Initial Pot.	IP	200.0E-3	V
Cond. Pot.	CP	pass	V	Time Step 1	T1	1.200E6	s
Initial Delay	ID	5	s	Stop On	SO	Pass	
Time/Pt.	TP	400.0	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	72.00	cm^2	Equiv. Wt.	EW	26.04	g
Density	DE	8.690	g/ml	AUX A/D	AU	no	
Open Circuit	OC	46.00E-3	V				

Comment: alloy 22 2277-8-3175 0.035 M KCl pH 2.5 95 c N2 deaerated

10/6/2000

Model 352/252 Corrosion Analysis Software, v. 2.30 Filename: a:C22PFC6.DAT Pstat: VStat[] Ver 2
PS POTENTIOSTATIC File Status: NORMAL Date Run: 04-25-00 Time Run: 14:22:02
CP PASS vs. R CT PASS IP 0.200 vs. R ID 5 S TP 4.000E+02 T1 1.200E+06
CR AUTO NP 3000 SO Pass IR NONE FL I 5.3Hz RT HIGH STABILITY
OCP 0.2[illegible] OCE MAX COLID AR 7.200E+01 LS YES EW 2.604E+01 DEN 0.690E+00 AU NO
OC 0.181
Comment: alloy 22 2277-8-3175 0.035 M KCl pH 2.5 95 c N2 deaerated



10/23/2000

Model 352/252 Corrosion Analysis Software, v. 2.30
Filename: a:C22PFC6.DAT
Pstat: VStat[] Ver 2
PS POTENTIOSTATIC File Status: NORMAL
Date Run: 04-25-00 Time Run: 14:22:02

Cond. Time	CT	pass	s	Initial Pot.	IP	200.0E-3	V
Cond. Pot.	CP	pass	V	Time Step 1	T1	1.200E6	s
Initial Delay	ID	5	s	Stop On	SO	Pass	
Time/Pt.	TP	400.0	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	72.00	cm^2	Equiv. Wt.	EW	26.04	g
Density	DE	8.690	g/ml	AUX A/D	AU	no	
Open Circuit	OC	101.0E-3	V				

Comment: alloy 22 2277-8-3175 0.035 M KCl pH 2.5 95 c N2 deaerated

10/23/2000

PASSIVE FILM CHEMISTRY.

OBJECTIVE MEASURE PASSIVE CORROSION RATE AND CORROSION PRODUCT CONCENTRATION

SPECIMEN ALLOY C-22 2277-8-3175 72 cm²
SAME AS C22PFC5 P 146

SOLUTION 0.0342 M Cl⁻ SAME AS P 146

T = 60°C
SOLUTION DEAERATED w/ N2

Ecorr + 118 mV SCE
EAppliED 200 mV SCE

REFERENCE SCE 13-620-52 8205245

TEST STARTED 10/23/2000

DATA SAVED AS C22PFC7.DAT SOLUTION EXTRACTED 999 hr

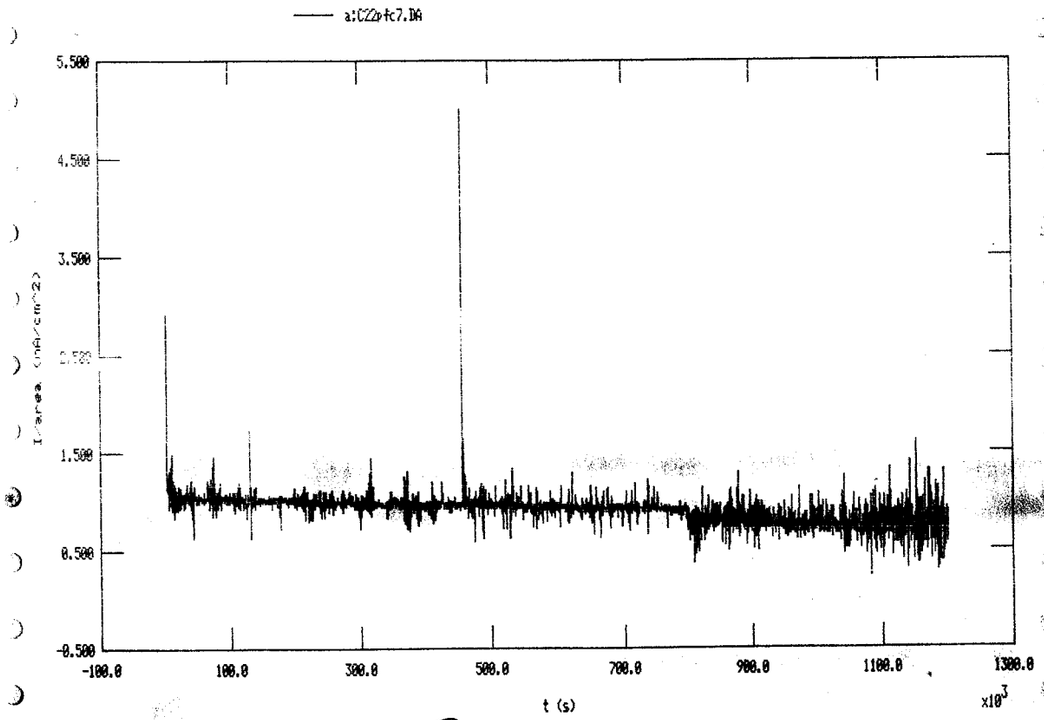
TEST RESTARTED AFTER ADDING 25 mL DI WATER
SAME TEST CONDITIONS AS ABOVE
TEST RESTARTED 11/7/2000 10:00 AM

DATA SAVED AS C22PFC8.DAT
NO SOLUTION EXTRACTED

ADDED 20 mL DI WATER 11/22/2000
TEST RESTARTED
DATA SAVED AS C22PFC9.DAT
SOLUTION EXTRACTED

12/22/2000

Model 352/252 Corrosion Analysis Software, v. 2.30 Filename: a:C22p+c7.DAT Pstat: VStat[] Ver 2
PS POTENTIOSTATIC File Status: NORMAL Date Run: 04-27-00 Time Run: 10:12:14
CP PASS vs. R CT PASS IP 0.200 vs. R ID 5 S TP 4.000E+02 T1 1.200E+06
CR AUTO NP 3000 SQ Pass IR NONE FL I 5.3Hz RT HIGH STABILITY
REF 0.24150 SCE WRK SOLID AR 7.200E-01 LS YES EW 2.684E+01 DEN 8.698E+00 AU NO
OC 0.112
Comment: alloy 22 2277-8-3175 0.035 M KCl pH 2.5 95 c N2 deaerated



12/22/2000

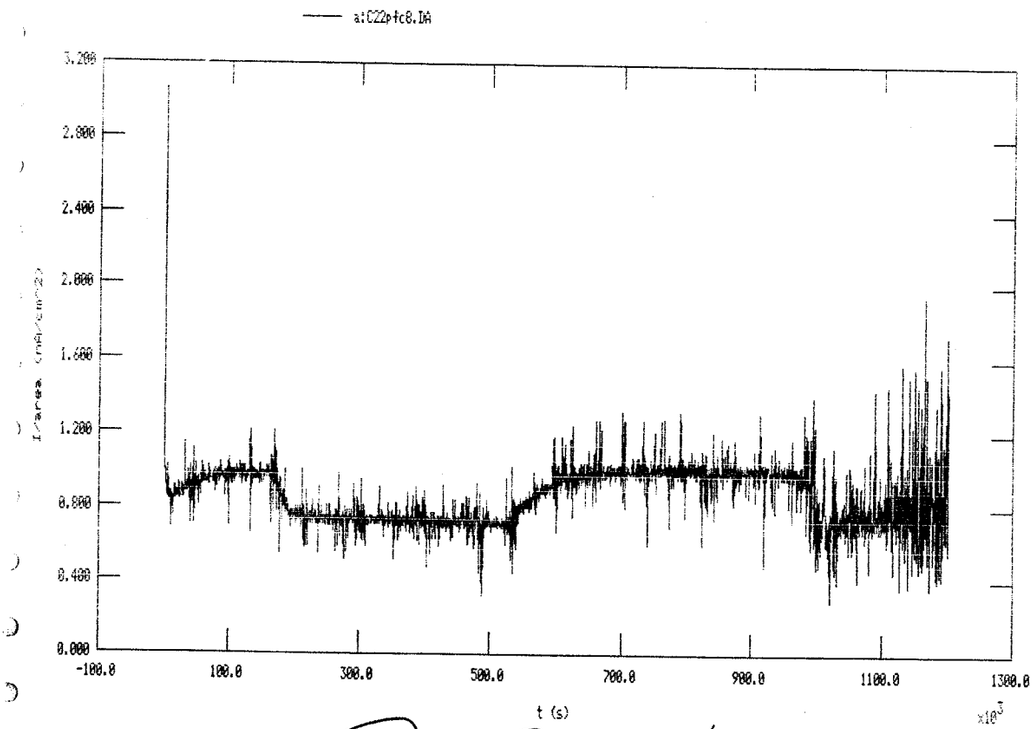
Model 352/252 Corrosion Analysis Software, v. 2.30
Filename: a:C22p+c7.DAT
Pstat: VStat[] Ver 2
PS POTENTIOSTATIC File Status: NORMAL
Date Run: 04-27-00 Time Run: 10:12:14

Cond. Time	CT	pass	s	Initial Pot.	IP	200.0E-3	V
Cond. Pot.	CP	pass	V	Time Step 1	T1	1.200E6	s
Initial Delay	ID	5	s	Stop On	SQ	Pass	
Time/Pt.	TP	400.0	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	72.00	cm^2	Equiv. Wt.	EW	26.04	g
Density	DE	8.698	g/ml	AUX A/D	AU	no	
Open Circuit	OC	112.0E-3	V				

Comment: alloy 22 2277-8-3175 0.035 M KCl pH 2.5 95 c N2 deaerated

12/22/2000

Model 352/252 Corrosion Analysis Software, v. 2.30 Filename: a:C22p+c8.DAT Pstat: VStat[] Ver 2
PS POTENTIOSTATIC File Status: NORMAL Date Run: 04-29-00 Time Run: 09:51:56
CP PASS vs. R CT PASS IP 0.200 vs. R ID 5 S TP 4.000E+02 T1 1.200E+06
CR AUTO NP 3000 SQ Pass IR NONE FL I 5.3Hz RT HIGH STABILITY
REF 0.24150 SCE WRK SOLID AR 7.200E-01 LS YES EW 2.684E+01 DEN 8.698E+00 AU NO
OC 0.118
Comment: alloy 22 2277-8-3175 0.035 M KCl pH 2.5 95 c N2 deaerated



12/22/2000

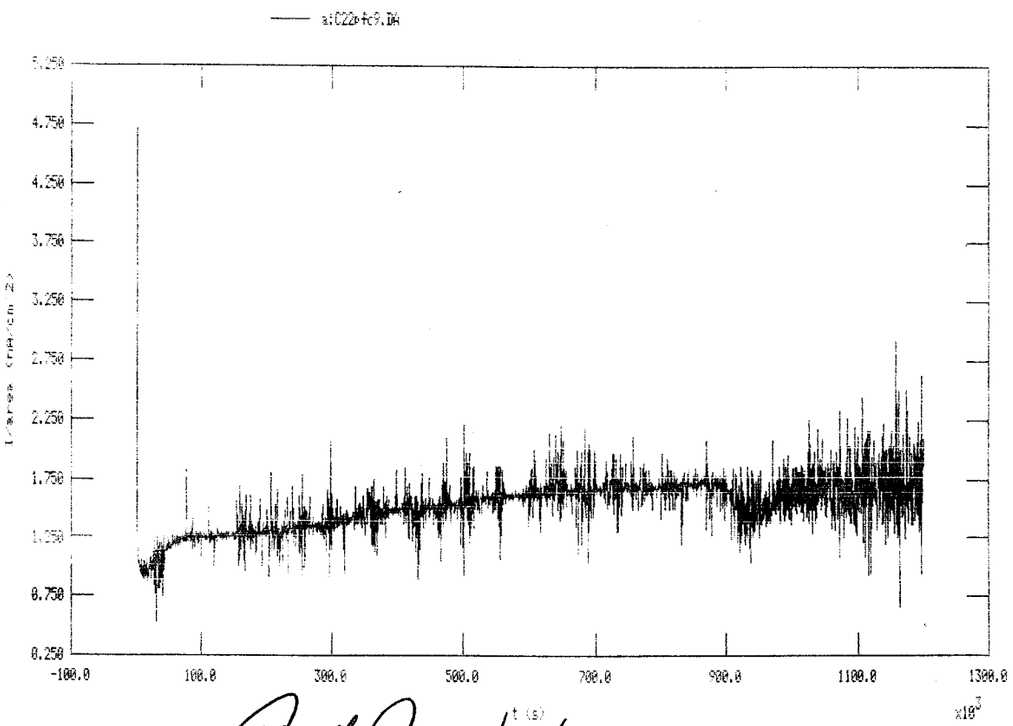
Model 352/252 Corrosion Analysis Software, v. 2.30
Filename: a:C22p+c8.DAT
Pstat: VStat[] Ver 2
PS POTENTIOSTATIC File Status: NORMAL
Date Run: 04-29-00 Time Run: 09:51:56

Cond. Time	CT	pass	s	Initial Pot.	IP	200.0E-3	V
Cond. Pot.	CP	pass	V	Time Step 1	T1	1.200E6	s
Initial Delay	ID	5	s	Stop On	SQ	Pass	
Time/Pt.	TP	400.0	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	72.00	cm^2	Equiv. Wt.	EW	26.04	g
Density	DE	8.698	g/ml	AUX A/D	AU	no	
Open Circuit	OC	118.0E-3	V				

Comment: alloy 22 2277-8-3175 0.035 M KCl pH 2.5 95 c N2 deaerated

12/22/2000

Model 352/252 Corrosion Analysis Software, v. 2.30 Filename: a:C22p+c9.DAT Pstat: VStat[] Ver 2
PS POTENTIOSTATIC File status: NORMAL Date Run: 05-01-00 Time Run: 13:28:44
CP PASS vs. R CT PASS IP 0.200 vs. R ID 5 S TP 4.000E+02 T1 1.200E+06
CR AUTO NP 3000 SO Pass IR NONE FL I 5.3Hz RT HIGH STABILITY
REF 0.24150 SCE WRK SOLID AR 7.200E+01 LS YES EW 2.604E+01 DEN 8.690E+00 AU NO
OC 0.102
Comment: alloy 22 2277-8-3175 0.035 M KCl pH 2.5 95 c N2 deaerated



12/20/2000

Model 352/252 Corrosion Analysis Software, v. 2.30
Filename: a:C22p+c9.DAT
Pstat: VStat[] Ver 2
PS POTENTIOSTATIC File Status: NORMAL
Date Run: 05-01-00 Time Run: 13:28:44

Cond. Time	CT	pass	s	Initial Pot.	IP	200.0E-3	V
Cond. Pot.	CP	pass	V	Time Step 1	T1	1.200E6	s
Initial Delay	ID	5	s	Stop On	SO	Pass	
Time/Pt.	TP	400.0	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	72.00	cm^2	Equiv. Wt.	EW	26.04	g
Density	DE	8.690	g/ml	AUX A/D	AU	no	
Open Circuit	OC	102.0E-3	V				

Comment: alloy 22 2277-8-3175 0.035 M KCl pH 2.5 95 c N2 deaerated

12/20/2000

Sensor evaluation

Objective: measure electrical resistance of corrosion sensors shown on p 124-126

QA Reference: NCR No. 2001-02

Materials: TYPE 304L SS NT T0954
EPO-TEK H20E ELECTROCALLY CONDUCTIVE EPOXY – Ag DOPED
EPO TEK H54 INSULATING EPOXY

Tests to evaluate sensor and epoxy properties

Measure resistance between electrically conductive epoxy and 304L SS substrate. These layers are separated by a layer of the H54 insulating epoxy. The measured resistance should be high (R > 1 MΩ).

Measured resistance > 200 GΩ
KEITHLEY 614 ELECTROMETER SN 704934
CALIBRATED 3/18/2000 CAL DUE 3/16/2001

Measure resistance of conductive epoxy by measuring resistance from end of lead wire attached to the Ag epoxy layer to the corner of the Ag epoxy located at the greatest distance ~~for~~ DD 1/22/01 from the lead wire. This is a measure of the resistance of the lead wire + the entire width of the Ag epoxy layer.

Measured resistance 0.012 KΩ
KEITHLEY 614 SN 704934

1/25/2001

DD 2/5/2001
~~LT 825 PSAG~~ LT825PSAI DD. 2/5/2001

Specimen Alloy 825 Same As pg. 109 (HH4371FG)
Start wt. 39.07417 Sartorius RC210 SN# 10704579
End wt. 39.4587 g Mettler AE240 SN# 101237 cal 03/02/01
2 PTFE Crevice Washers Attached At 50 in-oz
Using Proto 6104 SN 314047

Solution 1000 ppm Cl^- 85 ppm HCO_3 20 ppm $SO_4^=$
10 ppm NO_3 2 ppm F^- 2000 ml As Follows

3.29738 g NACl Lot # 000274
0.24019 g $NaHCO_3$ Lot # 92337A
40 ml SO_4 - 02/01/2001 Stock Solution pg. 145
20 ml NO_3 - 02/01/2001 " "
4 ml F^- - 02/01/2001 " "
+ DI water To 2000 ml
Start PH 9.102 Fishner Scientific Accumet 950 SN 3340
End PH 9.638

Temp. 95°C Hg Thermometer 115858
Reference Fisher SCE 13-620-52 SN# 8238320

Econn -116 mv Keithley 614 SN# 555368
Ept +126 mV " " " "
E Applied +100 mV " " " "

Test Started 02/05/2001
Test Ended 03/27/2001

02/05/01 [signature]

DD 2/5/2001
~~C22L9C C22L4A~~ C22L12A
New Specimen - See Specimen Examination Pg 141
Specimen Alloy C-22 WG6PCD
Base Metal 2277-8-3235
Filler XX 1045 BG11
Start wt. 39.41936 g Sartorius RC210 SN# 10704379
End wt. 39.4212 g Mettler AE240 SN# 101237 cal 03/02/01
2 PTFE Crevice Washers Attached At 50 in-oz
Using Proto 6104 SN# 314047

Solution 4 m Cl^- 85 ppm HCO_3 20 ppm $SO_4^=$
10 ppm NO_3^- 2 ppm F^- 2000 ml Prepared As Follows

467.5 g NACl Lot # 000274
0.24032 g $NaHCO_3$ Lot # 92337A
40 mls SO_4 - 02/01/2001 Stock Solution Pg. 145
20 mls NO_3 - 02/01/2001 " "
4 mls F^- - 02/01/2001 " "
+ DI water To 2000 ml
Start PH 7.548 Fisher Scientific Accumet 950 SN# 3340
End PH 8.347
T = 95°C Hg Thermometer C98-101 - Reference Fisher SCE 13-620-52 SN 8205226
Ecorr -256 mv Keithley 614 SN 555368
Ept +200 mv " " " "
E Applied +150 mv " " " "

Test Started 02/05/2001
Test Ended 03/27/2001

02/05/01 [signature]

QD 2/5/2001
~~C22L11A~~ ~~C22L11B~~ C22L11C

Specimen Alloy C-22 2277-8-3175
Start wt. 31.45013g Sartorius RC210 SN 10704379
End wt. 31.4689g Mettler AE 240 SN# 101237 cal 03/02/01
2 PTFE Crevice Washers Attached Using
Proto 6104 At 50 In·oz SN# 314047

Solution 4m Cl⁻ 85 ppm NCO_3 20 ppm $SO_4^=$
10 ppm NO_3 2 ppm F^- 2000 mls Prepared As Follows

467.5g NACl Lot #000274
0.24038 $NAHCO_3$ Lot# 92337A
40 ml SO_4 - 02/01/2001 Stock Solution Pg 145
20 ml NO_3 - 02/01/2001 " "
4 ml F^- - 02/01/2001 " "
+ DI water To 2000 ml
Start PH 7.641 Fishen Scientific Accumet 950 SN# 3340
End PH 8.462

Temp= 95°c Hg thermometer C98-162
Reference SCE Fisher 13-620-52 SN 925-2111

Ecorr -212 mv Keithley 614 SN 555368
Ept +202 mv " " " "
E Applied +250 mv " " " "

Test started 02/05/2001
Test Ended 03/27/2001

02/05/01

C22L3I QD 2/5/2001

Specimen Alloy C22 2277-8-3175
Start wt. 47.22436g Sartorius RC210 SN# 10704379
End wt. 47.2421g Mettler AE 240 SN# 101237 cal 03/02/01
2 PTFE Crevice washers Attached At 50 In·oz
Using Proto 6104 SN# 314047 ZLO

Solution 4m Cl⁻ 85 ppm HCO_3^- 20 ppm SO_4^-
10 ppm NO_3^- 2 ppm F^- 2000 mls Prepared As Follows

467.5g NACl Lot # 000274
0.2403 $NAHCO_3$ Lot # 92337A
40 ml SO_4 - 02/01/2001 Stock Solution Pg 145
20 ml NO_3 - 02/01/2001 " "
4 ml F^- - 02/01/2001 " "
+ DI water To 2000 ml
Start PH 7.674 Fishen Scientific Accumet 950 SN 3340
End PH 8.846
Solution Bubbled w/ zero Air
T= 95°c Hg Thermometer H 98-197
Reference Fishen SCE 13-620-52 SN # 8238333

Ecorr -160 mv Keithley 614 SN 555368
Ept +169 mv " " " "
E Applied open Circuit " " " "

Test started. 02/05/2001
Test Ended 03/27/2001

02/05/01

OC825C1AE G 2/5/2001

Specimen Alloy 825 HH4371FG
Start wt. 39.29055g Sartorius RC210 SN 10704379
End wt 39.3020g Mettler AE 240 SN# 101237 cal 3/00/01
2 PTFE Crevice Washers Attached At 50 in-oz
Using Proto 6104 SN# 314047

Solution 1000 ppm Cl^- 85 ppm HCO_3 20 ppm SO_4
10 ppm NO_3 2ppm F^- 2000 mls Prepared As Follows

3.29714g NaCl Lot # 000274
0.24079g $NaHCO_3$ Lot # 897789
40 ml SO_4 - 02/01/2001 Stock Solution Pg 145
20 ml NO_3 - 02/01/2001 " "
4 ml F^- - 02/01/2001 " "
+ DI Water To 2000 ml
Solution Bubbled w/ zero Air
Start PH 9.203 Fisher Scientific Accumet 950 SN3340
End PH 9.587

Temp: 95°c Hg Thermometer H98-170
Reference Fisher SCE 13-620-51 SN 8131146

Ecorr -124 mv Keithley 614 SN 555368
Ept +123 mv " " " "
E Applied Open Circuit " " " "

Test Started 02/05/2001
Test Ended 03/27/2001

02/05/01

Cyclic Polarization of 316L

objective: Measure Repassivation Potential of 316L In
9.1 MoLal LiCl At 95°c

Specimen: 316 L P80746 600 Grit finish
Specimen Dimension Drawing # 20.01402.571.006
start wt 29.69720 g Sartorius RC210 SN# 10704379
End wt 29.66419 g Sartorius RC210 SN # 10704379
2 PTFE Crevice Washers Attached At 50 in-oz Using Proto 6104 SN# 314040
Solution: 9.1 MoLAL LiCl
77.18g LiCl Lot # 991524
+ DI water 200 mls

Potentiostat: EG+G Versastat SN # 20104

Counter Electrode: PT Flag

Reference: Fisher 13-620-52 SN # 8205245
with Saturated Potassium Chloride Solution

Temperature: 95°c Hg Thermometer H-98-179

Ecorr: -368 mv Keithley 614 SN # 704984
Ept: -146 mv

Solution Deaerated with 99.999% N_2

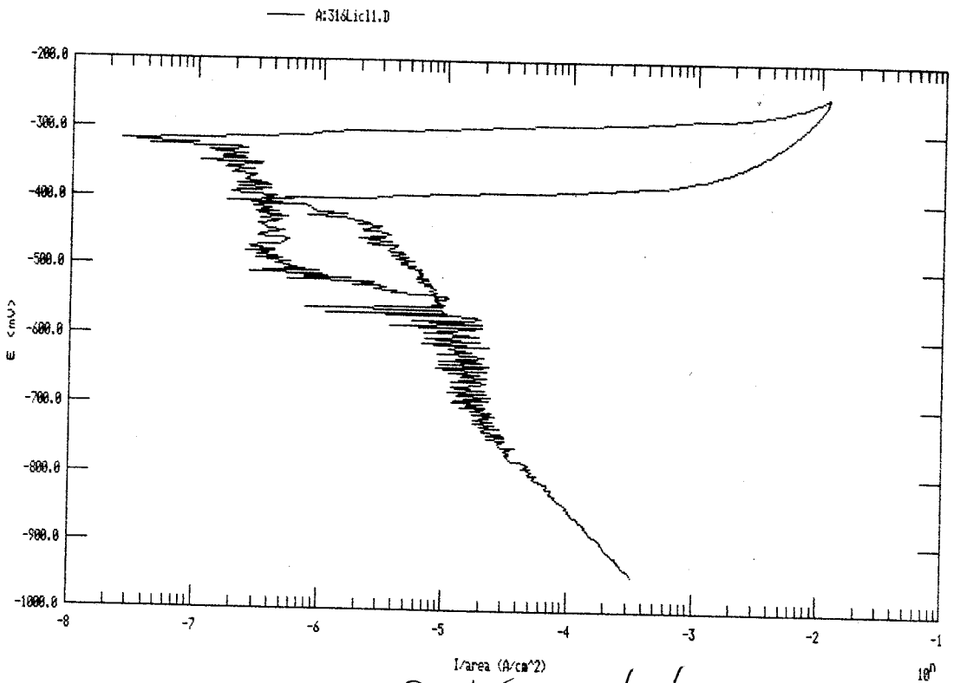
Specimen Examination
Mild Crevice Corrosion on All 24/24 Feet
Specimen Heavily Pitted And Broken Down
on All Sides - Staining on All sides

Data Saved As 316Lic11.Dat 02/05/01

Model 352/252 Corrosion Analysis Software, v. 2.30
CP CYCLIC POLARIZATION
File Status: NORMAL
Filename: A:316Licl1.DAT
Pstat: VStat[] Ver 2

CP	PASS vs. R	CT	PASS	IP	-0.200 vs. OC	FP	-0.600 vs. OC
SI	2.000E-03	SR	1.669E-04	ST	1.198E+01	IR	NONE
FL	I 5.3Hz	RT	HIGH STABILITY	REF	0.24150 SCE	LS	YES
IT	1.000E-01	ITA	2.000E+01	EW	2.550E+01	OC	-0.348
Date Run:	05-16-00	Time Run:	13:45:28				
ID	5 S	V1	0.100 vs. OC				
CR	AUTO	NP	500				
WRK	SOLID	AR	2.000E+01				
DEN	7.980E+00	AU	NO				

Comment: 316L SS in 9.1 MOLAL LiCl at 95 C N2 deaerated



B. E. [illegible] 02/05/2001

Model 352/252 Corrosion Analysis Software, v. 2.30
Filename: A:316Licl1.DAT
Pstat: VStat[] Ver 2
CP CYCLIC POLARIZATION — File Status: NORMAL
Date Run: 05-16-00 — Time Run: 13:45:28

Cond. Time	CT	pass	s	Initial Pot.	IP	-200.0E-3	V oc
Cond. Pot.	CP	pass	V	Vertex 1 Pot.	V1	100.0E-3	V oc
Initial Delay	ID	5	s	I Threshold	IT	5.000E-3	A/cm^2
				Final Pot.	FP	-600.0E-3	V oc
Scan Rate	SR	166.9E-3	mV/s	Curr. Range	CR	Auto	
Scan Incr.	SI	2.000	mV	Step Time	ST	11.98	s
No. of Points	NP	500					
				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 241.5E-3V	
Sample Area	AR	20.00	cm^2	Equiv. Wt.	EW	25.50	g
Density	DE	7.980	g/ml	AUX A/D	AU	no	
Open Circuit	OC	-348.0E-3	V				

Comment: 316L SS in 9.1 MOLAL LiCl at 95 C N2 deaerated

B. E. [illegible] 02/05/2001

Specimen: C-22 625 825 All Specimens In Cell #1

C-22 2277-8-3175 600 Grit Finish
Start wt: 12.44729g Sartorius RC210 SN# 10704379 Cal 09/15/2000
End wt: 12.637 OHaus Precision Standard SN# 2883 Cal 09/02/00

625 600 Grit Finish
start wt: 12.21829g Sartorius RC210 SN# 10704379 Cal 09/15/2000
End wt. 12.287 OHaus Precision Standard SN# 2883 Cal 09/02/00

825 HH 4371 PG 600 Grit Finish
Start wt 11.72759g Sartorius RC210 SN# 10704379 Cal 09/15/2000
End wt 11.836 OHaus Precision standard SN# 2883 Cal 09/02/00

Solution: 1000ppm Cl - 85ppm HCO_3 20ppm SO_4
10ppm NO_3 2ppm F^- 2000mls Prepared As Follows

3.2982g NACl Lot # 000274
.2410g $NaHCO_3$ Lot # 92337A
40mls SO_4 02/01/2001 stock Solution Pg # 145
20mls NO_3 02/01/2001 "
4mls F^- 02/01/2001 " "
+ DI Water To 2000mls
Solution Bubbled w/ zero Air
Start PH - Results Not Taken
End P.H 9.169 Fisher Accumet 950 meter SN# 3340 Cal 02/20/00

Temp. 95°C Hg Thermometer SN# E 98-273 Cal 01/29/01
Reference: Fisher 13-620-52 SN# 0089766
C
Specimen Examination. All specimens show No Sign of Corrosion
Just At Solution Line - Mild Build up of Material

Test Started 02/13/01
Test Ended 02/27/01

02/28/01 [illegible]

All measurements Taken with Keithley 614 SN# 704984
Cell #1 (Samples) - Specimen Cal 03/18/2000

			C-22	625	825	PT Flag
	02/13/2001	AM	-339 mv	-250 mv	-315 mv	+102 mv
	02/13/2001	PM	-266 mv	-174 mv	-273 mv	+83 mv
	02/14/2001	AM	-221 mv	-215 mv	-197 mv	+64 mv
	02/14/2001	PM	-216 mv	-225 mv	-189 mv	+65 mv
	02/15/2001	AM	-190 mv	-423 mv	-193 mv	+69 mv
	02/15/2001	PM	-192 mv	-112 mv	-205 mv	+70 mv
	02/16/2001	AM	-194 mv	-110 mv	-205 mv	+71 mv
	02/16/2001	PM	-189 mv	+8 mv	-199 mv	+71 mv
	02/19/2001	AM	-174 mv	+45 mv	-190 mv	+85 mv
	02/20/2001	AM	-183 mv	+11 mv	-183 mv	+89 mv
New Zero → Air Tank	02/20/2001	PM	-168 mv	+9 mv	-183 mv	+89 mv
	02/21/2001	AM	-159 mv	-103 mv	-178 mv	+89 mv
	02/21/2001	PM	-174 mv	+7 mv	-179 mv	+91 mv
	02/22/2001	AM	-145 mv	-76 mv	-195 mv	+90 mv
	02/22/2001	PM	-176 mv	-59 mv	-192 mv	+87 mv
	02/23/2001	AM	-155 mv	-79 mv	-178 mv	+85 mv
	02/23/2001	PM	-189 mv	-81 mv	-205 mv	+88 mv
	02/26/2001	AM	-166 mv	-147 mv	-200 mv	+88 mv
	02/26/2001	PM	-179 mv	-112 mv	-213 mv	+92 mv
	02/27/2001	AM	-161 mv	-39 mv	-211 mv	+93 mv
	02/27/2001	PM	-184 mv	-25 mv	-199 mv	+94 mv
	02/28/2001	AM	-154 mv	-75 mv	-161 mv	+94 mv
	02/28/2001	PM	-174 mv	-55 mv	-200 mv	+97 mv
	03/01/2001	AM	-165 mv	-49 mv	-178 mv	+96 mv
New Zero → Air Tank	03/01/2001	PM	-126 mv	-150 mv	-152 mv	+97 mv
	03/02/2001	AM	-149 mv	-175 mv	-145 mv	+96 mv
	03/02/2001	PM	-135 mv	-196 mv	-161 mv	+97 mv
	03/05/2001	AM	-172 mv	-199 mv	-162 mv	+101 mv
	03/06/2001	AM	-176 mv	-250 mv	-232 mv	+102 mv
	03/06/2001	PM	-174 mv	-237 mv	-208 mv	+101 mv
	03/07/2001	AM	-166	-212	-196	+102 mv
	03/07/2001	PM	-170	-235	-193	+101 mv

Continued on Pg # 166 [signature] 03/07/01

Specimen C-22 #1 #2 #3 All Specimens In Cell #2

#1 C-22 2277-8-3175 600 Grit Finish
Start wt 12.15925g Sartorius RC210 SN# 10704379 Cal 09/15/2000
End wt 12.232g OHaus Precision Standard SN# 2883 Cal 09/02/01

#2 C-22 2277-8-3175 600 Grit Finish
Start wt 12.50564g Sartorius RC210 SN# 10704379 Cal 09/15/2000
End wt 12.638 OHaus Precision standard SN# 2883 Cal 09/02/01

#3 C-22 2277-8-3175 600 Grit Finish
Start wt 12.47245g Sartorius RC210 SN# 10704379 Cal 09/15/2000
End wt 12.618 OHaus Precision standard SN# 2883 Cal 09/02/01

Solution: 1000ppm Cl^- 85ppm HCO_3 20ppm SO_4
10ppm NO_3 2ppm F^- 2000mls Prepared As Follows

3.29767 NaCl Lot# 000274
.2445g $NaHCO_3$ Lot# 92337A
40mls SO_4 02/01/2001 stock Solution Pg #145
20mls NO_3 02/01/2001 " "
4mls F^- 02/01/2001 " "
+ DI water To 2000mls

Solution Bubbled w/zero Air
Start PH: Results Not Taken
End PH 9.335 Fisher Accumet 950 meter SN# 3340 Cal 07/20/00

Temperature: 95°C Hg Thermometer SN# A2000-123 Cal 01/29/2001
Reference Fisher 13-620-52 SN# 0066119

Specimen Examination: All Specimens No sign of Corrosion
Just A solution line - Minor buildup of Material

Test started 02/13/2001
Test Ended 03/28/2001

02/13/01 [signature]

All Measurements Taken with Keithley 614 SN# 704984 Cal 03/14/2000

Cell #2 (Samples) - Specimens

			C-22 #1	C-22 #2	C-22 #3	PT Flag
	02/13/2001	Am	-333 mv	-247 mv	-315 mv	+54 mv
	02/13/2001	Pm	-141 mv	-208 mv	-180 mv	+55 mv
	02/14/2001	Am	-123 mv	-245 mv	-206 mv	+48 mv
	02/14/2001	Pm	-135 mv	-261 mv	-222 mv	+39 mv
	02/15/2001	Am	-242 mv	-234 mv	-237 mv	+69 mv
	02/15/2001	Pm	-253 mv	-215 mv	-228 mv	+82 mv
	02/16/2001	Am	-274 mv	-201 mv	-235 mv	+88 mv
	02/16/2001	Pm	-276 mv	-207 mv	-236 mv	+89 mv
	02/19/2001	Am	-245 mv	-204 mv	-217 mv	+103 mv
	02/20/2001	Am	-241 mv	-215 mv	-204 mv	+104 mv
New Zero Air Tank →	02/20/2001	Pm	-256 mv	-216 mv	-197 mv	+106 mv
	02/21/2001	Am	-282 mv	-230 mv	-227 mv	+163 mv
	02/21/2001	Pm	-252 mv	-225 mv	-204 mv	+108 mv
	02/22/2001	Am	-257 mv	-224 mv	-203 mv	+105 mv
	02/22/2001	Pm	-246 mv	-231 mv	-236 mv	+105 mv
	02/23/2001	Am	-255 mv	-225 mv	-204 mv	+107 mv
	02/23/2001	Pm	-252 mv	-270 mv	-197 mv	+107 mv
	02/26/2001	Am	-276 mv	-260 mv	-216 mv	+103 mv
	02/26/2001	Pm	-278 mv	-257 mv	-217 mv	+103 mv
	02/27/2001	Am	-273 mv	-250 mv	-225 mv	+101 mv
	02/27/2001	Pm	-274 mv	-245 mv	-220 mv	+101 mv
	02/28/2001	Am	-277 mv	-240 mv	-213 mv	+102 mv
	02/28/2001	Pm	-270 mv	-253 mv	-210 mv	+103 mv
	03/01/2001	Am	-273 mv	-252 mv	-195 mv	+101 mv
New Zero Air Tank →	03/01/2001	Pm	-270 mv	-242 mv	-194 mv	+99 mv
	03/02/2001	Am	-264 mv	-243 mv	-215 mv	+98 mv
	03/02/2001	Pm	-262 mv	-242 mv	-214 mv	+97 mv
	03/05/2001	Am	-256 mv	-203 mv	-197 mv	+95 mv
	03/06/2001	Am	-258 mv	-229 mv	-195 mv	+91 mv
	03/06/2001	Pm	-238 mv	-210 mv	-174 mv	+95 mv
	03/07/2001	Am	-235 mv	-205 mv	-186 mv	+95 mv
	03/07/2001	Pm	-232 mv	-206 mv	-176 mv	+94 mv

Continued on Pg #165 03/07/01

All Measurements Taken with Keithley 614 SN# 704984 Cal 03/12/2000

Cell #2 (Samples) - Specimens

			C-22 #1	C-22 #2	C-22 #3	PT Flag
	03/08/2001	Am	-226 mv	-213 mv	-182 mv	+92 mv
	03/08/2001	Pm	-222 mv	-218 mv	-189 mv	+90 mv
	03/09/2001	Am	-234 mv	-226 mv	-180 mv	+90 mv
	03/09/2001	Pm	-230 mv	-225 mv	-196 mv	+90 mv
	03/12/2001	Am	-236 mv	-234 mv	-173 mv	+85 mv
	03/12/2001	Pm	-217 mv	-233 mv	-185 mv	+86 mv
New Zero Air Tank →	03/13/2001	Am	-225 mv	-231 mv	-178 mv	+85 mv
	03/13/2001	Pm	-218 mv	-226 mv	-184 mv	+85 mv
	03/14/2001	Am	-228 mv	-223 mv	-184 mv	+83 mv
	03/14/2001	Pm	-213 mv	-243 mv	-184 mv	+82 mv
	03/15/2001	Am	-224 mv	-247 mv	-170 mv	+81 mv
	03/15/2001	Pm	-205 mv	-218 mv	-149 mv	+87 mv
	03/16/2001	Am	-233 mv	-245	-209 mv	+73 mv
	03/16/2001	Pm	-217 mv	-236	-177 mv	+70 mv
	03/19/2001	Am	-234 mv	-217	-185 mv	+65 mv
	03/19/2001	Pm	-178 mv	-237	-178 mv	+51 mv
	03/20/2001	Am	-173 mv	-208	-207 mv	+32 mv
	03/20/2001	Pm	-160 mv	-255	-161 mv	+35 mv
	03/21/2001	Am	-180 mv	-221	-175 mv	+40 mv
	03/21/2001	Pm	-187 mv	-145	-181 mv	+39 mv

Test Ended 03/21 pm

Measurements Taken with Keithley 617 SN# 0579628 Cal 02/22/01 After 03/16/01

03/22/01

All measurements Taken with Keithley 614 SN# 704984 Cal 03/18/2000

Cell #1

(Samples) - Specimens

	C-22	625	825	PT FLAG
03/08/2001 AM	-172 mV	-166 mV	-187 mV	+101 mV
03/08/2001 PM	-175 mV	-136 mV	-197 mV	+99 mV
03/09/2001 AM	-171 mV	-147 mV	-189 mV	+102 mV
03/09/2001 PM	-169 mV	-133 mV	-188 mV	+101 mV
03/12/2001 AM	-179 mV	-139 mV	-184 mV	+102 mV
03/12/2001 PM	-179 mV	-149 mV	-183 mV	+102 mV
New Zero Air Tank 03/13/2001 AM	-177 mV	-137 mV	-183 mV	+103 mV
03/13/2001 PM	-162 mV	-143 mV	-192 mV	+102 mV
03/14/2001 AM	-170 mV	-137 mV	-185 mV	+101 mV
03/14/2001 PM	-183 mV	-135 mV	-195 mV	+105 mV
03/15/2001 AM	-172 mV	-132 mV	-221 mV	+105 mV
03/15/2001 PM	-174 mV	-123 mV	-189 mV	+110 mV
03/16/2001	-188 mV	-126 mV	-186 mV	+101 mV
03/16/2001	-188 mV	-142 mV	-215 mV	+103 mV
03/19/2001	-189 mV	-112 mV	-212 mV	+104 mV
03/19/2001	-189 mV	-111 mV	-219 mV	+106 mV
03/20/2001	-152 mV	-109 mV	-198 mV	+107 mV
03/20/2001	-152 mV	-110 mV	-221 mV	+110 mV
03/21/2001	-175 mV	-114 mV	-186 mV	+120 mV
03/21/2001	-126 mV	-112 mV	-176 mV	+107 mV

Test Enoco
03/21/2001 P.M

measurements Taken with Keithley 617 SN# 0579628 Cal 02/22/01
After 03/16/01

[signature] 03/22/01

Open Circuit Potential Measurement

Specimen : C-22 625 825 All specimens In cell #1
C-22 2271-8-3175 600 Grit Finish
start wt. 12.487g OHaus Precision standard SN# 2883 Cal 09/02/00
End wt. 12.456g 05/29/01
625 600 Grit Finish
start wt 12.253g OHaus Precision standard SN# 2883 Cal 09/02/00
End wt 12.218g 05/29/01
825 HH 4371 F6 600 Grit Finish.
start wt 11.761g OHaus Precision standard SN# 2883 Cal 09/02/00
End wt 11.728g 05/29/01

Solution : 1000 ppm Cl - 200 ppm Na_2CO_3 - 20 ppm SO_4
10 ppm NO_3 - 2 ppm F^- 2000 mls Prepared As Follows

3.296g NaCl Lot# 005144
0.708g Na_2CO_3 Lot# 9601685
40 mls SO_4 " Stock Solution Pg # 145 " 03/23/01
20 mls NO_3 " "
4 mls F^-
+ DI water To 2000 mls
Solution Bubbled with Zero Air

PH - Readings Taken with Fisher Accumet 950 meter SN# 3340 Cal 02/20/00
start PH - 10.698
End PH 11.801 05/29/01

Temp 95°C Hg Thermometer SN# E 98-273 Cal 01/29/01

Reference: Fisher 13-620-52 SN# 0089766
Counter Electrode: PT Flag
Specimen Examination: Some Buildup of material Along Solution line
No Corrosion Noticed - Repolished for further Testing

Test started 03/26/01 · Test Stopped 05/25/01 [signature] 07/23/01

Cell #1 Measurements Taken with Keithley 617 SN#0579628 cal 2/22/01

Specimens

	Date		C-22	625	825	PT Flag
	03/26/01	Pm	-329 mv	-301 mv	-287 mv	+116 mv
	03/27/01	Am	-191 mv	-214 mv	-173 mv	+70 mv
	03/27/01	Pm	-150 mv	-194 mv	-168 mv	+67 mv
New Zero	03/28/01	Am	-131 mv	-141 mv	-178 mv	+66 mv
AIR Tank →	03/28/01	Pm	-118 mv	-158 mv	-159 mv	+68 mv
	03/29/01	Am	-125 mv	-129 mv	-139 mv	+68 mv
	03/29/01	Pm	-101 mv	-142 mv	-199 mv	+66 m
	03/30/01	Am	-104 mv	-149 mv	-214 mv	+66 mv
	03/30/01	Pm	-114 mv	-156 mv	-245 mv	+63 mv
	04/02/01	Am	-75 mv	-151 mv	-171 mv	+60 mv
	04/02/01	Pm	-70 mv	-129 mv	-178 mv	+61 mv
	04/03/01	Am	-68 mv	-132 mv	-173 mv	+60 mv
	04/03/01	Pm	-69 mv	-149 mv	-196 mv	+60 mv
	04/04/01	Am	-35 mv	-145 mv	-186 mv	+62 mv
	04/04/01	Pm	-64 mv	-133 mv	-213 mv	+61 mv
	04/05/01	Am	-71 mv	-123 mv	-170 mv	+65 mv
	04/05/01	Pm	-26 mv	-130 mv	-201 mv	+65 mv
	04/06/01	Am	-48 mv	-119 mv	-231 mv	+68 mv
	04/06/01	Pm	-49 mv	-119 mv	-201 mv	+69 mv
	04/09/01	Am	-22 mv	-61 mv	-214 mv	+118 mv
	04/09/01	Pm	-25 mv	-59 mv	-194 mv	+121 mv
	04/10/01	Am	-32 mv	-55 mv	-145 mv	+120 mv
	04/10/01	Pm	-15 mv	-57 mv	-211 mv	+120 mv
	04/11/01	Am	-45 mv	-22 mv	-226 mv	+125 mv
	04/11/01	Pm	-77 mv	-53 mv	-219 mv	+125 mv
	04/12/01	Am	-57 mv	-17 mv	-203 mv	+126 mv
	04/12/01	Pm	-65 mv	-39 mv	-201 mv	+127 mv
New Zero	04/13/01	Am	-56 mv	-27 mv	-187 mv	+130 mv
Air Tank	04/13/01	Pm	-90 mv	-26 mv	-162 mv	+127 mv
	04/16/01	Am	-106 mv	-9 mv	-164 mv	+132 mv
	04/16/01	Pm	-108 mv	-21 mv	-221 mv	+133 mv
	04/17/01	Am	-107 mv	-10 mv	-138 mv	+136 mv
	04/17/01	Pm	-84 mv	-3 mv	-124 mv	+137 mv

05/01/01

Cell #1 Measurements Taken with Keithley 617 SN#0579628 cal 2/22/01

Specimens

	Date		C-22	625	825	PT Flag
	04/18/01	Am	-115 mv	-7 mv	-64 mv	+134 mv
	04/18/01	Pm	-124 mv	-12 mv	-127 mv	+139 mv
	04/19/01	Am	-116 mv	-3 mv	-134 mv	+134 mv
	04/19/01	Pm	-115 mv	-2 mv	-169 mv	+138 mv
	04/20/01	Am	-76 mv	-5 mv	-100 mv	+138 mv
	04/20/01	Pm	-53 mv	-19 mv	-102 mv	+138 mv
	04/23/01	Am	-98 mv	-5 mv	-105 mv	+142 mv
	04/23/01	Pm	-106 mv	-27 mv	-136 mv	+140 mv
New Zero Air Tank	04/24/01	Am	-86 mv	-29 mv	-149 mv	+143 mv
	04/24/01	Pm	-123 mv	-30 mv	-155 mv	+141 mv
	04/25/01	Am	-61 mv	-8 mv	-148 mv	+145 mv
	04/25/01	Pm	-24 mv	-20 mv	-188 mv	+147 mv
	04/26/01	Am	-52 mv	-26 mv	-158 mv	+147 mv
	04/27/01	Am	-28 mv	-7 mv	-179 mv	+148 mv
	04/27/01	Pm	-74 mv	-14 mv	-164 mv	+148 mv
	04/30/01	Am	-54 mv	-37 mv	-49 mv	+151 mv
	04/30/01	Pm	-110 mv	-30 mv	-79 mv	+157 mv
	05/01/01	Am	-15 mv	-60 mv	-81 mv	+154 mv
	05/01/01	Pm	-27 mv	-61 mv	-14 mv	+163 mv
New Zero Air → Tank	05/02/01	Am	-123 mv	-40 mv	-90 mv	+158 mv
	05/02/01	Pm	-141 mv	-24 mv	-53 mv	+157 mv
	05/03/01	Am	-74 mv	-28 mv	-97 mv	+163 mv
	05/03/01	Pm	-136 mv	-13 mv	-111 mv	+158 mv
	05/04/01	Am	-90 mv	-12 mv	-180 mv	+157 mv
	05/04/01	Pm	-76 mv	-39 mv	-192 mv	+153 mv
	05/07/01	Am	-48 mv	-27 mv	-116 mv	+159 mv
	05/07/01	Pm	-54 mv	-35 mv	-164 mv	+152 mv
	05/08/01	Am	-81 mv	-27 mv	-137 mv	+152 mv
	05/08/01	Pm	-91 mv	-32 mv	-134 mv	+151 mv
	05/09/01	Am	-98 mv	-21 mv	-180 mv	+152 mv
	05/09/01	Pm	-125 mv	-28 mv	-174 mv	+151 mv

Continued on Pg # 187 Final Results

05/30/01

open Circuit Potential Measurement

Specimen : C-22 #1 #2 #3 All Specimens In Cell #2
#1 C-22 2277-8-3175 600 Grit Finish
Start wt 12.205 g OHaus Precision standard SN# 2883 Cal 09/02/00
End wt 12.208 g 05/29/01
#2 C-22 2277-8-3175 600 Grit Finish
Start wt 12.537 OHaus Precision standard SN# 2883 Cal 09/02/00
End wt 12.514 g 05/29/01
#3 C-22 2277-8-3175 600 Grit Finish
Start wt 12.509 OHaus Precision standard SN# 2883 Cal 09/02/00
End wt 12.466 g 05/29/01

Solution : 1000 ppm Cl - 200 ppm Na_2CO_3 - 20 ppm SO_4
10 ppm NO_3 - 2 ppm F^- 2000 mls Prepared As Follows

3.293 NaCl Lot # 005144
0.710 Na_2CO_3 Lot # 960685
40 mls SO_4 03/~~23~~/2001 Stock Solution, Pg # 145
20 mls NO_3 "
4 mls F^- " "
+ DI water To 2000 mls
Solution Bubbled with Zero Air

PH : Reading Taken with Fisher Accumet 950 meter SN# 3340 Cal 07/20/00
Start PH : 10.678
End PH 11.706 05/29/01

Temperature - 95°C Hg Thermometer SN# A2000-123 Cal 01/29/2001

Reference : Fisher 13-620-52 SN# 0066119
Counter Electrode : PT Flag
Specimen Examination - Some Buildup of Material Along Solution line
No Corrosion Noticed - Repolished Specimens for further Testing

Test Started 03/26/01 Start Stopped 05/25/01 03/23/01

Cell #2 measurement taken with Keithley 617 SN# 0579628 Cal 2/22/01

Date		Specimens C-22 #1	C-22 #2	C-22 #3	PT Flag
03/26/01	Pm	-315 mV	-294 mV	-282 mV	+75 mV
03/27/01	Am	-238 mV	-279 mV	-68 mV	+64 mV
03/27/01	Pm	-245 mV	-178 mV	-78 mV	+60 mV
03/28/01	Am	-236 mV	-297 mV	-155 mV	+58 mV
03/28/01	Pm	-320 mV	-286 mV	-170 mV	+62 mV
03/29/01	Am	-220 mV	-329 mV	-174 mV	+59 mV
03/29/01	Pm	-219 mV	-312 mV	-142 mV	+58 mV
03/30/01	Am	-206 mV	-310 mV	-165 mV	+60 mV
03/30/01	Pm	-199 mV	-315 mV	-159 mV	+60 mV
04/02/01	Am	-180 mV	-99 mV	-142 mV	+56 mV
04/02/01	Pm	-158 mV	-101 mV	-153 mV	+53 mV
04/03/01	Am	-162 mV	-107 mV	-150 mV	+54 mV
04/03/01	Pm	-145 mV	-84 mV	-203 mV	+57 mV
04/04/01	Am	-127 mV	-99 mV	-214 mV	+52 mV
04/04/01	Pm	-122 mV	-85 mV	-197 mV	+52 mV
04/05/01	Am	-101 mV	-98 mV ~~-123 mV~~ DMB 04/11/01	-182 mV	+52 mV
04/05/01	Pm	-96 mV	-87 mV ~~-130 mV~~ DMB 04/11/01	-206 mV	+52 mV
04/06/01	Am	-87 mV	-91 mV	-215 mV	+52 mV
04/06/01	Pm	-90 mV	-97 mV	-198 mV	+52 mV
04/09/01	Am	-66 mV	-104 mV	-186 mV	+66 mV
04/09/01	Pm	-45 mV	-46 mV	-202 mV	+75 mV
04/10/01	Am	-25 mV	-49 mV	-189 mV	+87 mV
04/10/01	Pm	-44 mV	-26 mV	-149 mV	+94 mV
04/11/01	Am	-10 mV	-72 mV	-39 mV	+97 mV
04/11/01	Pm	-31 mV	-76 mV	-152 mV	+100 mV
04/12/01	Am	-82 mV	-89 mV	-146 mV	+94 mV
04/12/01	Pm	-110 mV	-113 mV	-190 mV	+103 mV
04/13/01	Am	-117 mV	-53 mV	-141 mV	+104 mV
04/13/01	Pm	-152 mV	-90 mV	-142 mV	+95 mV
04/16/01	Am	-94 mV	-70 mV	-160 mV	+105 mV
04/16/01	Pm	-58 mV	-46 mV	-119 mV	+102 mV
04/17/01	Am	-140 mV	-113 mV	-154 mV	+107 mV
04/17/01	Pm	-80 mV	-83 mV	-158 mV	+100 mV

Cell #2 Measurements taken with Keithley 617 SN#0579628 cal 2/22/01

Specimens

	Date		C-22 #1	C-22 #2	C-22 #3	PT Flag
	04/18/01	Am	-168 mv	-84 mv	~~-134~~ -163	+104 mv
	04/18/01	pm	~~-124~~ -83 mv	-47 mv	-160 mv	+113 mv
	04/19/01	Am	~~-116~~ -23 mv	-123 mv	-133 mv	+111 mv
	04/19/01	Pm	~~-115~~ -31 mv	-127 mv	-112 mv	+110 mv
	04/20/01	Am	-93 mv	-36 mv	-129 mv	+109 mv
	04/20/01	PM	-121 mv	-115 mv	-158 mv	+108 mv
	04/23/01	Am	-18 mv	-134 mv	-85 mv	+104 mv
	04/23/01	Pm	-175 mv	-127 mv	-83 mv	+108 mv
New Air Tank Zero Air	04/24/01	Am	-146 mv	-129 mv	-19 mv	+110 mv
	04/24/01	pm	-159 mv	-121 mv	-50 mv	+111 mv
	04/25/01	Am	-128 mv	-80 mv	-43 mv	+114 mv
	04/25/01	pm	-100 mv	-104 mv	-22 mv	+112 mv
	04/26/01	Am	-118 ~~-52 mv~~	-83 mv	-126 mv	+112 mv
	04/27/01	Am	-145 mv	-103 mv	-48 mv	+113 mv
	04/27/01	Pm	-144 mv	-125 mv	-93 mv	+114 mv
	04/30/01	Am	-190 mv	-123 mv	-82 mv	+115 mv
	04/30/01	pm	-181 mv	-73 mv	-91 mv	+120 mv
	05/01/01	Am	-188 mv	-40 mv	-69 mv	+119 mv
	05/01/01	Pm	-88 mv	-127 mv	-127 mv	+116 mv
	05/02/01	Am	-115 mv	-98 mv	-80 mv	+117 mv
	05/02/01	pm	-138 mv	-122 mv	-91 mv	+116 mv
	05/03/01	Am	-180 mv	-92 mv	-136 mv	+120 mv
	05/03/01	pm	-179 mv	-135 mv	-30 mv	+114 mv
	05/04/01	Am	-221 mv	-8 mv	-150 mv	+116 mv
	05/04/01	pm	-204 mv	-103 mv	-100 mv	+116 mv
	05/07/01	Am	-23 mv	-33 mv	-143 mv	+121 mv
	05/07/01	pm	-200 mv	-89 mv	-134 mv	+121 mv
	05/08/01	Am	-209 mv	-89 mv	-124 mv	+117 mv
	05/08/01	pm	-190 mv	-57 mv	-111 mv	+117 mv
	05/09/01	Am	-210 mv	-37 mv	-118 mv	+119 mv
	05/09/01	Pm	-204 mv	-61 mv	-31 mv	+118 mv

Continued on Pg #188 Final Results

05/30/01

C22L13A

Specimen C-22 welN6D

Start wt 39.4898 g Mettler AE240 SN#101237 cal 03/02/01

End wt ~~39.505~~ g 39.4936 g

2 PTFE Crevice washers Attached At 50 In-Oz Using Proto 6104 SN# 314047 cal 11/9/00

Solution 4m Cl⁻ 85 ppm HCO_3 20 ppm SO_4 10 ppm NO_3 2 ppm F⁻ 2000 mls Prepared As Follows

467.52 g NaCl Lot # 005144

0.240 g $NaHCO_3$ Lot # 92337A

40 mls SO_4 - 03/23/01 Stock Solutions Pg #145

20 mls NO_3 - 03/23/01 " "

4 mls F⁻ - 03/23/01 " "

+ DI water To 2000 mls

Start PH 7.487 Fisher Accumet 950 SN# 3340 cal 7/20/00

End PH 8.694

Temperature 95°C Hg Thermometer SN# #1238002 cal 01/10/01

Ecorr -267 mv Keithley 614 SN# 555368 cal 02/23/01

Ept +173 mv "

E Applied +100 mv

Reference : Fisher 13-620-52 SN# 8238320

Test started 04/06/01

Test Ended 06/01/01

04/09/01

C22L12B

Specimen : C-22 WGLPCO
Base Metal 2277-8-3235
Filler XX 1045 B611
Start wt 39.4212g Mettler AE240 SN# 101237 cal 03/02/01
End wt 39.4219g
2 PTFE Crevice Washers Attached At 50 In-Oz Using
Proto 6104 SN# 314047 cal 11/9/00

Solution 4 mCl 85 ppm HCO_3 20 ppm SO_4
10 ppm NO_3 2 ppm F^- 2000 mls Prepared As Followers

467.54g NaCl Lot# 005144
0.241g $NaHCO_3$ Lot# 92337A
40 mls SO_4 - 03/23/01 Stock Solutions Pg #145
20 mls NO_3 - 03/23/01 " "
4 mls F^- - 03/23/01 " "
+ DI water To 2000 mls
Start PH 7.354 Fisher Accumet 950 SN# 3340 cal 7/20/00
End PH 8.495

Temperature 95°C Hg Thermometer SN# F98-393 cal 12/21/00
Econn -227 mv Keithley 614 SN# 555368 cal 02/23/01
Ept +218
E Applied +150 mv
Reference : Fisher 13-620-52 SN# 8205236
Test started 04/06/01
Test stopped 06/01/01

04/09/01 Bi K Dd

C-22L11D

Specimen : C-22 2277-8-3175
Start wt 31.4689g Mettler AE240 SN# 101237 cal 03/02/01
End wt 31.4516g
2 PTFE Crevice Washers Attached At 50 In-Oz Using
Proto 6104 SN# 314047 cal 11/9/00

Solution : 4 m Cl 85 ppm HCO_3 20 ppm SO_4
10 ppm NO_3 2 ppm F^- 2000 mls Prepared As Follows

467.51 NaCl Lot# 005144
0.243 $NaHCO_3$ Lot# 92337A
40 mls SO_4 - 03/23/01 Stock Solutions Pg #145
20 mls NO_3 - 03/23/01 " "
4 mls F^- - 03/23/01 " "
+ DI water To 2000 mls
Start PH 7.420 Fisher Accumet 950 SN# 3340 cal 7/20/00
End PH 8.678

Temperature 95°C Hg Thermometer SN# E98-191 12/21/00
Reference - Fisher 13-620-52 SN# 9252111

Econn -72 mv Keithley 614 SN# 555368 cal 02/23/01
Ept +248 mv
E Applied +250 mv

Start Test 04/06/01
Test Stopped 06/01/01

04/09/01 Bi K Dd

C-22L3J

Specimen : C-22 2277-8-3175
Start wt. 47.2421g Mettler AE240 SN#101237 cal 03/02/01
End wt. 47.2501g
2 PTFE Crevice washers Attached At 50 In-Oz Using
Proto 6104 SN# 314047 Cal 11/9/00

Solution 4m Cl 85 ppm HCO_3 20 ppm SO_4
10 ppm NO_3 2 ppm F^- 2000 mls Prepared As Follows

467.51 NaCl Lot# 005144
0.240g $NaHCO_3$ Lot# 92337A
40 mls SO_4 - 03/23/01 Stock Solution Pg #145
20 mls NO_3 - 03/23/01 " "
4 mls F^- - 03/23/01 " "
+ DI water To 2000 mls
Start PH 7.401 Fisher Accumet 950 meter SN# 3340 cal 7/20/00
End PH 8.778

Temperature 95°C Hg Thermometer C96-637 cal 12/21/00
Reference : Fisher 13-620-52 SN# 8238333
Solution Bubbles with Zero Air
Econn -238 Keithley 614 SN# 555368 cal 02/28/01
Ept +146
E Applies - Open Circuit

Test Started 04/06/01
Test stopped 06/01/01

04/09/01 Brian [illegible]

DC825C1AH

Specimen : 825 HH4371FG
Start wt 39.3020g Mettler AE 240 SN# 101237 cal 5/02/01
End wt 39.2992g
2 PTFE Crevice washers Attached At 50 In-Oz
Using Proto 6104 SN# 314047 cal 11/9/00

Solution 1000 ppm Cl 85 ppm HCO_3 20 ppm SO_4
10 ppm NO_3 2 ppm F^- 2000 mls Prepared As Follows

3.298g NaCl Lot# 005144
.240g $NaHCO_3$ Lot# 92337A
40 mls SO_4 - 03/23/01 Stock Solutions Pg #145
20 mls NO_3 - 03/23/01 " "
4 mls F^- - 03/23/01 " "
04/09/01 + DI water To 2000 mls
Start PH 9.683 Fisher Accumet 950 Meter SN# 3340 cal 07/20/00
End PH 9.400

Temperature - 95°C Hg Thermometer SN# H98-149 cal Dec/21/00
Reference - Fisher 13-620-51 SN# 8131146
Solution Bubbles with Zero Air
Econn - 127 mv Keithley 614 SN# 555368 cal 02/23/01
Ept +93
E Applies - Open Circuit

Test Started 04/06/01
Test stopped 06/01/01

04/09/01 Brian [illegible]

Repassivation Potential of Alloy C-22

objective: Measure passive current Density of Alloy 22

Specimen: Alloy C-22 600 Grit Finish
with 2 PTFE Crevice Washers Attached At 50 In-Oz
Using Proto 6104 SN# 314047 cal 11/9/00

Start wt 45.91g Ohaus Precision Standard SN# 2883 cal 03/02/01
End wt. 45.89g

Solution 4 m Cl
467.54g NaCl Lot # 005144
+ DI water To 2000 mls

Potentiostat: EG+G Model #273 SN# 41108

Counter Electrode: PT Flag

Reference: Fisher 13-620-52 SN# 8205245

Temperature: 95°C Hg Thermometer SN# 115749 cal 01/29/01

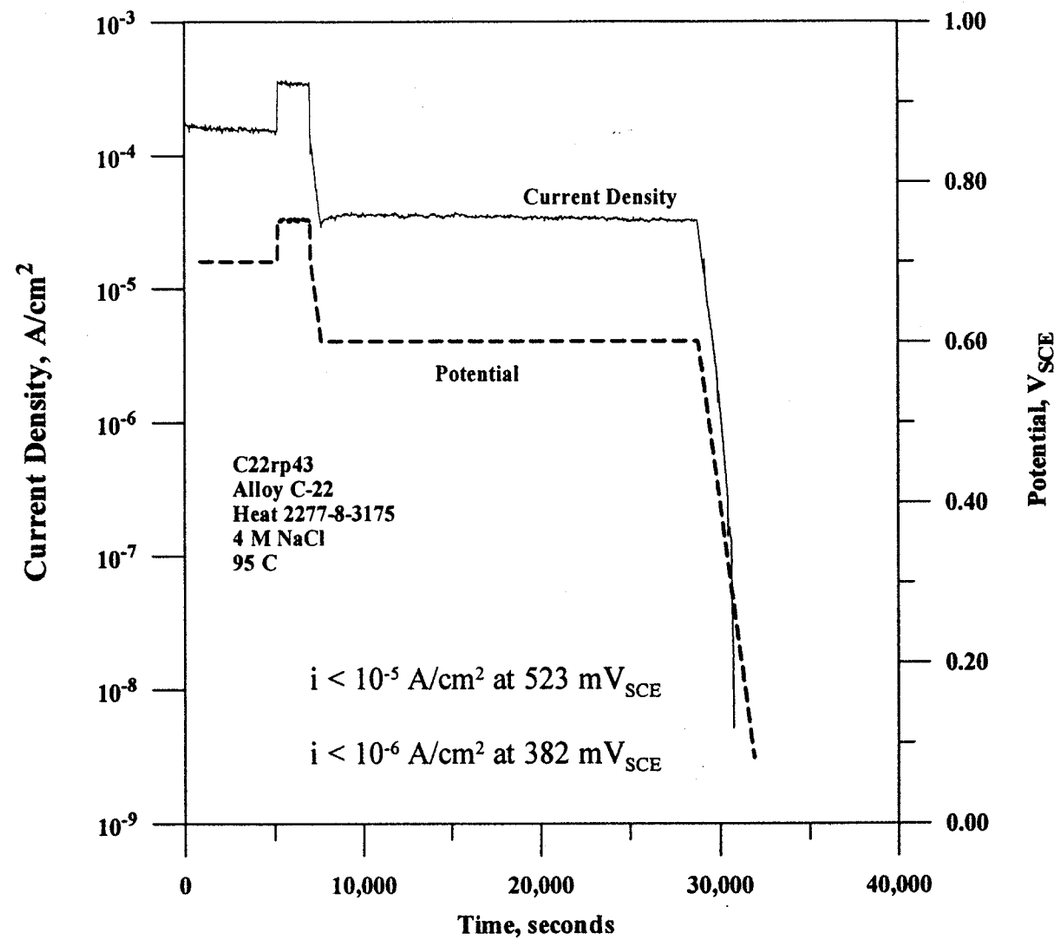
Econn -210 mV Keithly 619 SN# 0579628 cal 02/22/01
Ept +154 mV

Solution Deaerated with 99.999% N_2

Held At +700 mV

* Note: Specimen Not Saved - Specimen will be Repolished for further Testing

Specimen Examination: Crevice Corrosion on 3/24 feet
All Surfaces of Specimen Are Stained Gold Film - Corrosion Shallow
Grain Exposed In Crevice Only - No Measurement Depth of Corrosion
Data File C22RP43.Dat 05/03/01 B. K. Dat



B. K. Dat
05/03/01

Repassivation Potential of Alloy C-22

objective: Measure passive current Density of Alloy 22

Specimen: Alloy C22 600 Grit Finish - Repolished Specimen from Pg #178
with 2 PTFE Crevice Washers Attached At 50 In-Oz Using
Proto 6104 SN# 314047 Cal 11/9/00

Start wt 45.42g OHaus Precision Standard SN#2853 cal 03/02/01
End wt 45.32g

Solution 1 m Cl
116.82g NaCl Lot#005144
+ DI water To 2000 mls

Start PH 6.183 Fisher Accumet 950 meter SN# 3440 cal 7/20/00
End PH 5.420

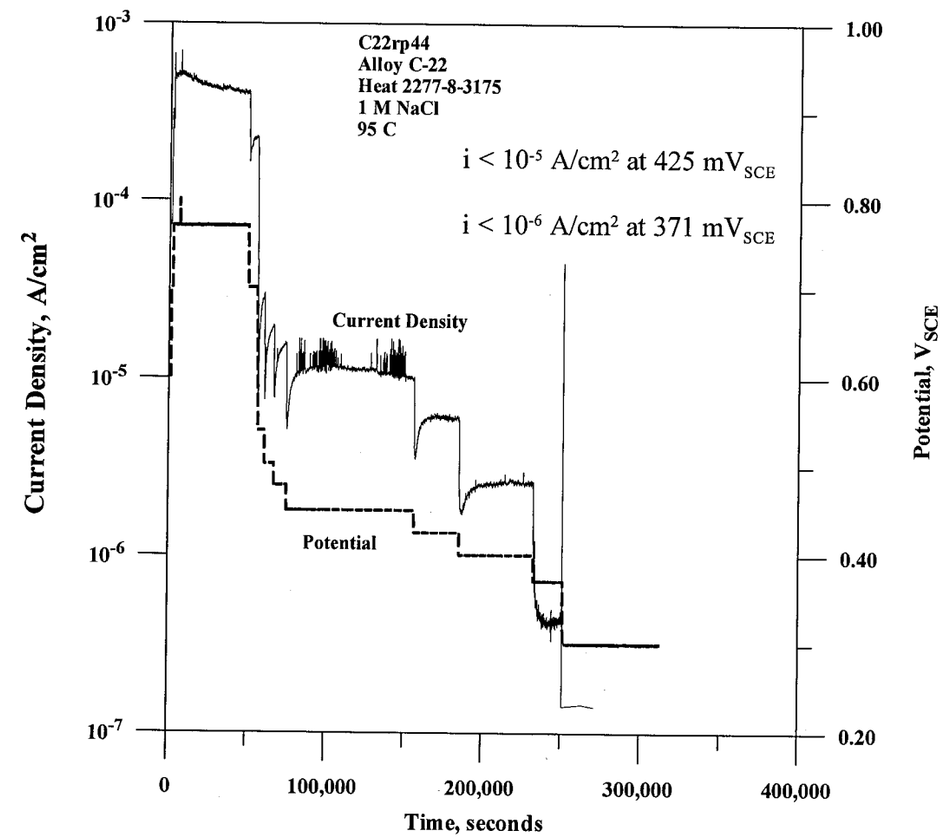
Potentiostat: EG+G Model #273 SN# 41108
Counter Electrode: PT Flag
Reference: Fisher 13-620-52 SN# 8205245
Temperature: 95°C Hg Thermometer SN# 115749 cal 01/29/00

Econn -410 mV Keithley 617 SN# 0579628 cal 02/22/01
Ept -87 mV

Solution Deaerated with 99.999% N_2

Specimen Examination: Transpassive Dissolution No Crevice
Corrosion from Washers - Deep Etching In Grain Pattern
* Note:
Repolish + Re Use Specimen

Data File C22RP44.Dat 05/04/01



05/04/01

Repassivation Potential of Alloy C-22

objective: Measure passive current Density of Alloy 22

specimen: Alloy C22 600 Grit Finish - Repolished specimen with 2 PTFE Crevice washers Attached At 100 In-Oz Using Photo 6104 SN #314047 cal 11/9/00

start wt 46.35g OHaus Precision Standard SN #2883 cal 02/02/00
End wt 46.31g

Solution 4 m Cl
467.54g NaCl Lot #005144
+ DI water To 2000 mls

start PH 8.097 Fisher Accumet 950 meter SN #3440 cal 7/20/00
End PH 5.249

Potentiostat: EG + G model #273 SN # 41108
Counter Electrode: PT Flag
Reference: Fisher 13-620-52 SN # 8203245
Temperature: 95°C Hg Thermometer SN # 115749 cal 01/29/00

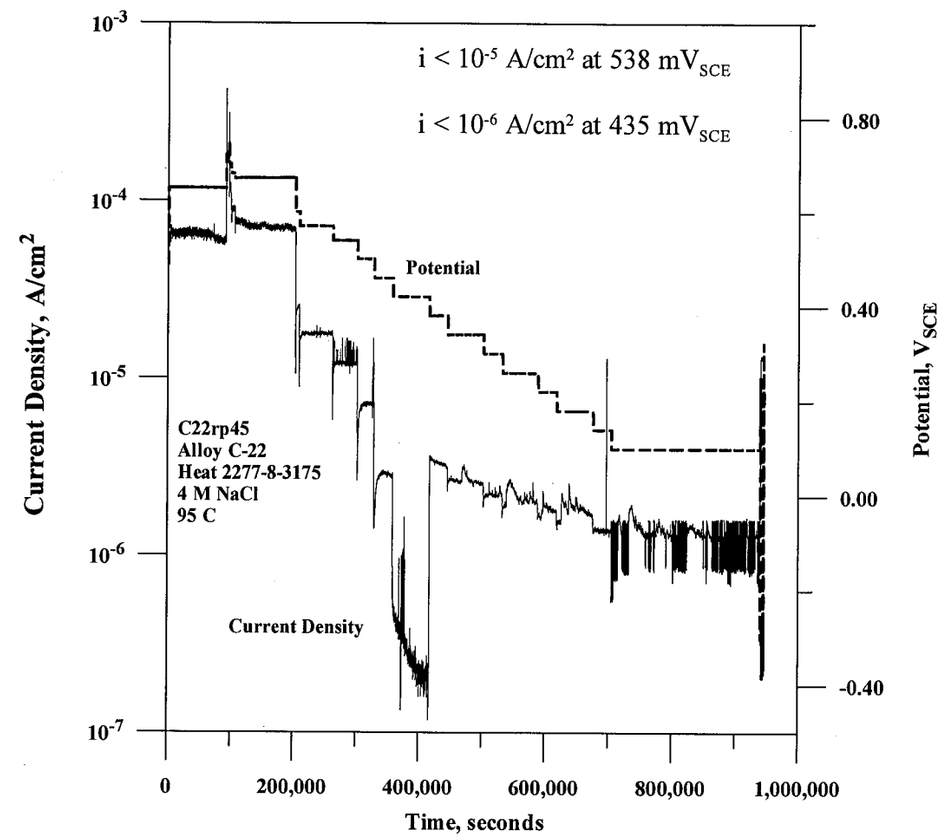
Ecorr -256 mV Keithley 617 SN # 0579628 cal 02/22/00
Ept -211 mV

Solution Deaerated with 99.999% N_2

Specimen Examination: Specimen turned Brownish gold with Staining Crevice Corrosion on 3 of 24 feet.

Data File C22rp45.Dat

05/18/01



05/18/01

Initial Scientific notebook entry for ~~**passive current density with metal ion concentration measurements**~~ Thermal Stability Tests

Title: Alloy 22 Thermal Stability tests 4/26/02

Tests Preformed by: Darrell S. Dunn, Div 20; Brian Derby, Div. 18

Objectives: Determine the effect of thermal aging time and temperature on the localized corrosion susceptibility of Alloy 22.

Equipment: Laboratory oven for exposure of test specimens at 600 to 900 °C, Thermocouple and thermocouple meter. Keithley 614/617. EG&G Versastat Model Potentiostat serial number 20104 or equivalent, EG&G model 352c software or equivalent, Electrochemical test cell.

Materials: Alloy C-22, heat 2277-8-3175. Other materials and heats to be added and identified prior to testing.

Specimen specifications: Specimens will be equivalent to 20.01402.571.006 unless otherwise specified.

Measurement Parameters: Temperature and time of exposure, Potential and Current of specimen during test.

Required level of accuracy: Temperature ± 10 °C, Time of exposure ± 1 minute, Potentials ± 1mV, Current ± 0.01 microamp.

Uncertainty and Sources of Error: Error in temperature measurement may occur after thermocouples are exposed to elevated temperatures and rapidly cooled by quenching in water. Current measurement error can occur for localized corrosion processes because the actively corroding area is not the same as the surface area of the test specimen.

05/24/01

Checking Oven Temperature with Calibrated Thermocouple

Thermo Couple SN# 326 AN# 008430 cal Dec/6/00

Omega H22 Thermometer SN# T 94140 cal Ja/15/01

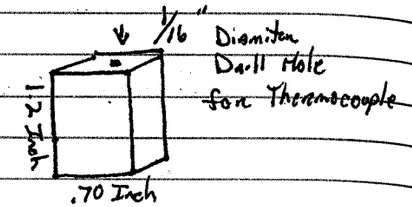
Room Temp 20.2 °C
Initial Readings
Oven Set Point Temperature 600 °C
Oven Meter Reading 639 °C

Temperature Build up.		Temperature Decrease	
#1	Set Point Oven 566 °C Meter Reading 600 °C	#8	Set Point Oven 832 °C Meter Reading 843.2 °C
#2	Set Point Oven 658 °C Meter Reading 700 °C	#9	Set Point 658 °C Meter Reading 661 °C
#3	Set Point Oven 750 °C Meter Reading 800 °C		
#4	Set Point Oven 832 °C Meter Reading 870 °C		
#5	Set Point Oven 863 °C Meter Reading 900 °C		
#6	Set Point oven 918 °C Meter Reading 950 °C		
#7	Set Point oven 976 °C Meter Reading 1000 °C		

05/24/01

Thermal Aging of Test specimen's

C-22 Alloy Specimen Dimensions
measurements Taken with
Fowlen Calipers SN# 20-8C-1 Cal 4/30/01



Sample Specimen To check Thermal Ageing of Material

Thermal Couple SN# 332 AN# 008435 Cal Dec-6-00
Thermal Couple Meter Omega H22 SN# T 94140 Cal Jan-15-01

Oven Set Point Temperature	Specimen Temperature	Time
865°C	155°C	15 sec
867°C	254°C	30 sec
870°C	355°C	45 sec
871°C	450°C	1 min
872°C	530°C	1 min 15 sec
873°C	590°C	1 min 30 sec
874°C	646°C	1 min 45 sec
875°C	688°C	2 min
875°C	781°C	2 min 45 sec
875°C	830°C	3 min 15 sec
Drop Oven Temp 875°C	860°C	3 min 45 sec
To Set Point → 847°C	875°C	6 min

Thermal Ageing of C-22 Alloy · Specimen Dimensions See 20.01402.571.006

3 specimens 10 min @ 870°C · Thermal Couple Reading 870.6°C
oven Set Point 870°C Drop To 860°C @ 7:00 min Into Procedure

3 specimens 20 mins @ 870°C - Thermal Couple Reading 871.2°C
oven Set Point 874°C Drop To 855°C @ 6:00 min Into Procedure

3 specimens 30 min @ 870°C - Thermal Couple Reading 873.4°C
oven Set Point 882°C Drop To 855 @ 8:00 min Into Procedure

05/24/01

Cell #1 measurements Taken with Keithley 617 SN# 0579628 Cal 2/22/01

	Date	C-22	625	825	PT Flag
	5-10-01 Am	-130 mV	-16 mV	-180 mV	+155 mV
	5-10-01 Pm	-72 mV	-10 mV	-137 mV	+157 mV
	5-11-01 Am	-101 mV	-37 mV	-181 mV	+168 mV
	5-11-01 Pm	-74 mV	-5 mV	-52 mV	+164 mV
	5-14-01 Am	-58 mV	-4 mV	-170 mV	+166 mV
	5-14-01 Pm	-84 mV	-3 mV	-153 mV	+165 mV
	5-15-01 Am	-100 mV	-5 mV	-171 mV	+151 mV
New Zero	5-15-01 Pm	-64 mV	-25 mV	-171 mV	+154 mV
He Tank →	5-16-01 Am	-32 mV	-5 mV	-165 mV	+156 mV
	5-16-01 Pm	-108 mV	-24 mV	-153 mV	+154 mV
	5-17-01 Am	-84 mV	-36 mV	-140 mV	+154 mV
	5-17-01 Pm	-128 mV	-24 mV	-152 mV	+156 mV
	5-18-01 Am	-57 mV	-13 mV	-171 mV	+153 mV
	5-18-01 Pm	-68 mV	-17 mV	-176 mV	+165 mV
	5-21-01 Am	-106 mV	-11 mV	-165 mV	+163 mV
	5-21-01 Pm	-74 mV	-38 mV	-149 mV	+162 mV
	5-22-01 Am	-122 mV	-43 mV	-143 mV	+164 mV
	5-22-01 Pm	-49 mV	-20 mV	-166 mV	+161 mV
	5-23-01 Am	-57 mV	-46 mV	-137 mV	+167 mV
	5-23-01 Pm	-121 mV	-29 mV	-124 mV	+166 mV
	5-24-01 Am	-48 mV	-34 mV	-164 mV	+156 mV
	5-24-01 Pm	-14 mV	-32 mV	-151 mV	+158 mV
	5-25-01 Am	-36 mV	-5 mV	-134 mV	+161 mV
	5-25-01 Pm	-46 mV	-23 mV	-124 mV	+161 mV

Test stopped 05/25/01 pm

* Continues
from Pg # 169

Cell #2 measurements Taken with Keithley 617 SN# 0579628 Cal 2/22/01

	Date	C-22 #1	C-22 #2	C-22 #3	PT Flag
	5-10-01 Am	-231 mV	-74 mV	-98 mV	+116 mV
	5-10-01 Pm	-209 mV	-98 mV	-50 mV	+116 mV
	5-11-01 Am	-175 mV	-30 mV	-135 mV	+120 mV
	5-11-01 Pm	-157 mV	-115 mV	-120 mV	+115 mV
	5-14-01 Am	-159 mV	-48 mV	-45 mV	+119 mV
	5-14-01 Pm	-173 mV	-84 mV	-61 mV	+115 mV
	5-15-01 Am	-118 mV	-42 mV	-32 mV	+118 mV
New Zero	5-15-01 Pm	-175 mV	-116 mV	-42 mV	+116 mV
Air Tank →	5-16-01 Am	-162 mV	-103 mV	-115 mV	+121 mV
	5-16-01 Pm	-184 mV	-52 mV	-80 mV	+123 mV
	5-17-01 Am	-141 mV	-39 mV	-3 mV	+120 mV
	5-17-01 Pm	-154 mV	-74 mV	-83 mV	+120 mV
	5-18-01 Am	-178 mV	-8 mV	-75 mV	+118 mV
	5-18-01 Pm	-172 mV	-37 mV	-21 mV	+118 mV
	5-21-01 Am	-176 mV	-119 mV	-50 mV	+117 mV
	5-21-01 Pm	-181 mV	-74 mV	-5 mV	+116 mV
	5-22-01 Am	-175 mV	-54 mV	-18 mV	+118 mV
	5-22-01 Pm	-173 mV	-106 mV	-9 mV	+118 mV
	5-23-01 Am	-190 mV	-64 mV	-14 mV	+114 mV
	5-23-01 Pm	-147 mV	-69 mV	-6 mV	+116 mV
	5-24-01 Am	-165 mV	-104 mV	-8 mV	+116 mV
	5-24-01 Pm	-148 mV	-106 mV	-6 mV	+116 mV
	5-25-01 Am	-181 mV	-61 mV	-24 mV	+116 mV
	5-25-01 Pm	-150 mV	-123 mV	-20 mV	+118 mV

Stopped Test on 5/25/01 pm

* Continued from Pg #172

Starting New Test Matrix for thermal Aged C-22 Alloy

will Run 30 min Specimens
20 min Specimens
10 min Specimens

In that Sequence In Cl solutions AS
4 molar NaCl
1 molar NaCl
.5 molar NaCl

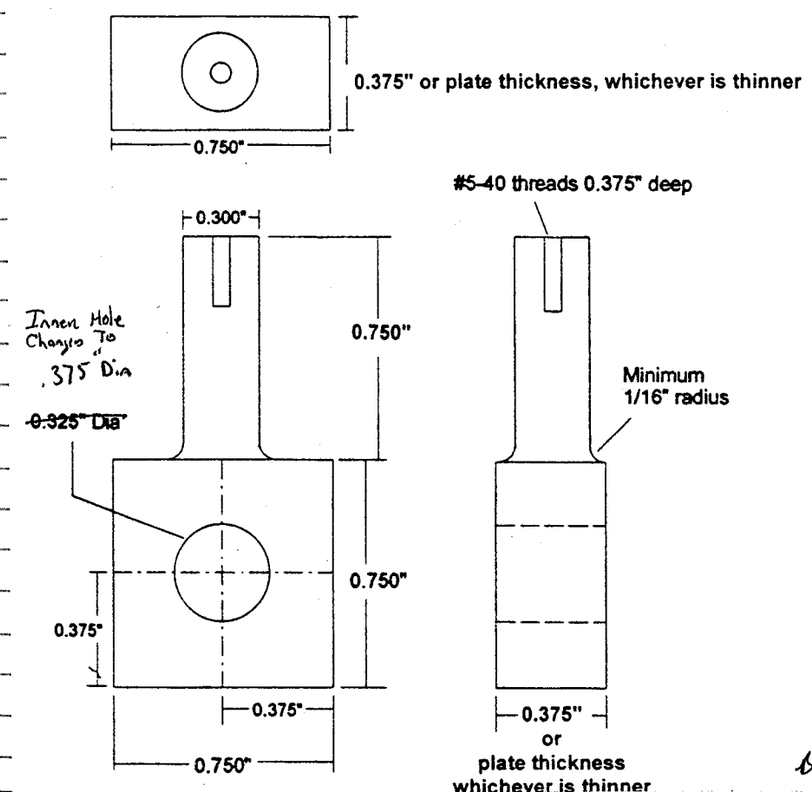
Drawing no: 20.01402.571.006

Specimen Dimensions of C-22 Alloy Specimens

S. Brossia — Date 8/2/2000
N. Sridhar — Date 8/2/00
Reviewer

S. Brossia for D. Dunn — Date 8/3/00
D. Dunn
Initiator

CREVICE REPASSIVATION SPECIMEN
All Dimensions +/- 0.003"



05/30/01

Repassivation Potential of Alloy C-22.

objective: See Pg# 184

Specimen: Alloy C-22 Thermally Aged for 30 min @ 870°C · 600 Grit Finish
with 2 PTFE Crevice Washers Attached At 50 In-Oz Using
Proto 6104 SN# 314047 Cal 11/9/00

Start wt 38.179 g OHAUS Precision Standard SN# 2583 cal 3/2/01
End wt 38.081 g

Solution 4 m Cl
467.54 g NaCl Lot# 005144
+ DI water To 2000 mls

Start PH Not Taken
End PH 7.253 ORION 720A Meter SN# 005885 7/20/00

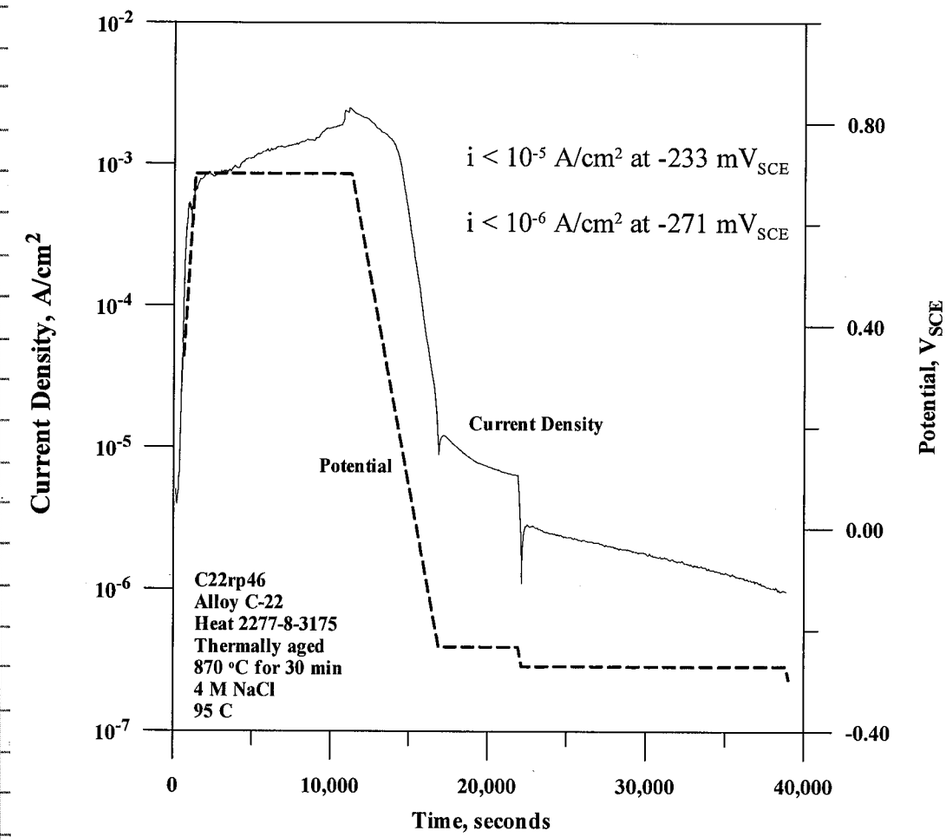
Potentiostat: EG & G Model # 273 SN # 41108
Counter Electrode: PT Flag
Reference: Fisher 13-620-52 SN# 8203245
Temperature: 95°C Hg Thermometer SN# 115749 cal 1/29/01

Econn -366 mV Keithley 617 SN# 0579628 cal 2/22/01
Ept 442 mV

Solution Deaerated with 99.999% N_2

Specimen Examination: Corrosion on 19/24 feet
Specimen Stained on All sides - Corrosion Noticed on Inner Hole
for Crevice washer Bolt

Data Saved As C22rp46.Dat 05/30/01



05/30/01

Repassivation Potential of Alloy C-22

objective : See Pg # 184

Specimen : Alloy C-22 Thermally Aged for 30 min @ 870°C · 600 Grit Finish
with 2 PTFE Crevice Washers Attached At 50 In-Oz Using
Proto 6104 SN# 314047 Cal 11/9/00

Start wt 38.296 g Ohaus Precision Standards SN# 2888 Cal 3/2/01
End wt 38.204 g

Solution 1 m Cl
116.81 g NaCl Lot# 005144
+ DI water To 2000 mls

Start PH 6.137 Orion 720A Meter SN# 005885 7/20/00
End PH 5.268

Potentiostat : EG+G Model #273 SN# 41108
Counter Electrode : PT Flag
Reference : Fisher 13-620-52 SN# 8203245
Temperature : 95°C Hg Thermometer SN# 115749 Cal 1/29/01

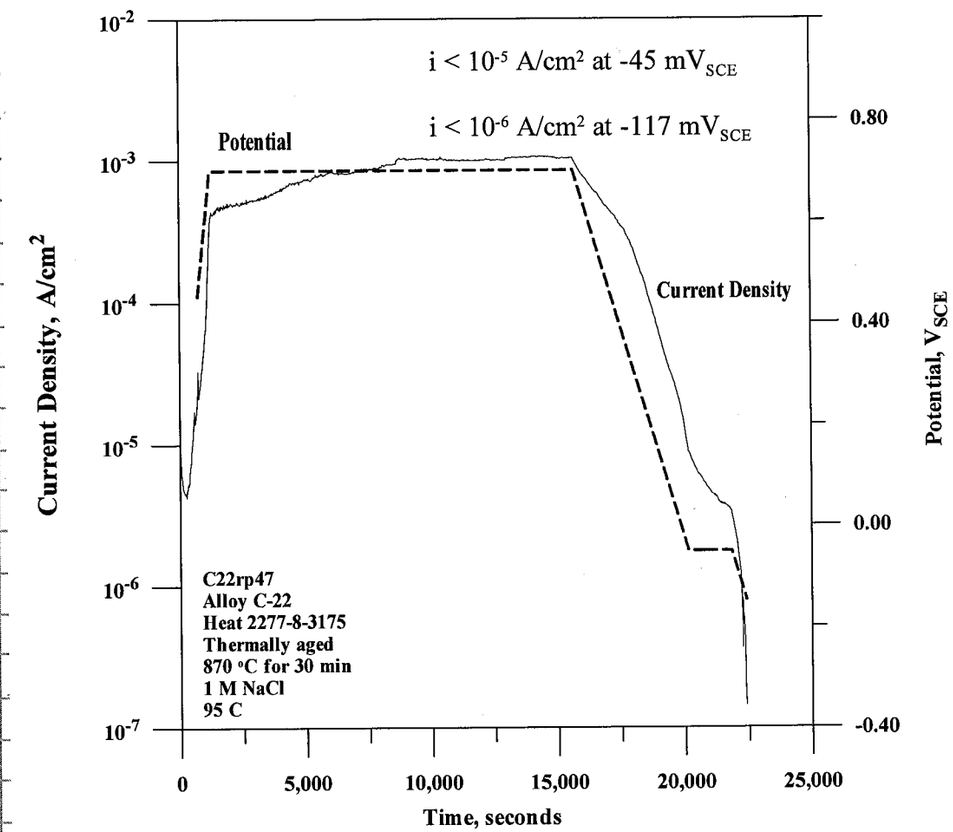
Econn -306 mv Keithley 617 SN# 0579628 Cal 2/22/01
Ept -37 mv

Solution Deaerated with 99.999% N_2

Specimen Examination : Crevice Corrosion on 8/24 feet
Gold tint staining on All sides of Specimen · Corrosion Noticed on
Inner Diameter Hole for Crevice washer Bolt

Data Saved As C-22 RP 47

05/31/01



05/31/01

Repassivation Potential of Alloy C-22

Objective : See Pg # 184

Specimen : Alloy C-22 Thermally Aged for 30 min @ 870°C · 600 Grit Finish
with 2 PTFE Crevice washers Attached At 50 In-Oz Using
Proto 6104 SN# 314047 Cal 11/9/00

Start wt. 38.487 g Ohaus Precision Standard SN# 2883 Cal 3/2/01
End wt 38.430 g

Solution : .5 m Cl
58.40 g NaCl
+ DI water To 2000 mls

Start PH 6.284 Orion 720# Meter SN# 005885 7/20/00 Cal
End PH 7.094
Potentiostat : EG+G Model # 273 SN# 41108
Counter Electrode : PT Flag
Reference : Fisher 13-620-52 SN# 8203245
Temperature : 95°C Hg Thermometer SN# 115749 Cal 1/25/01

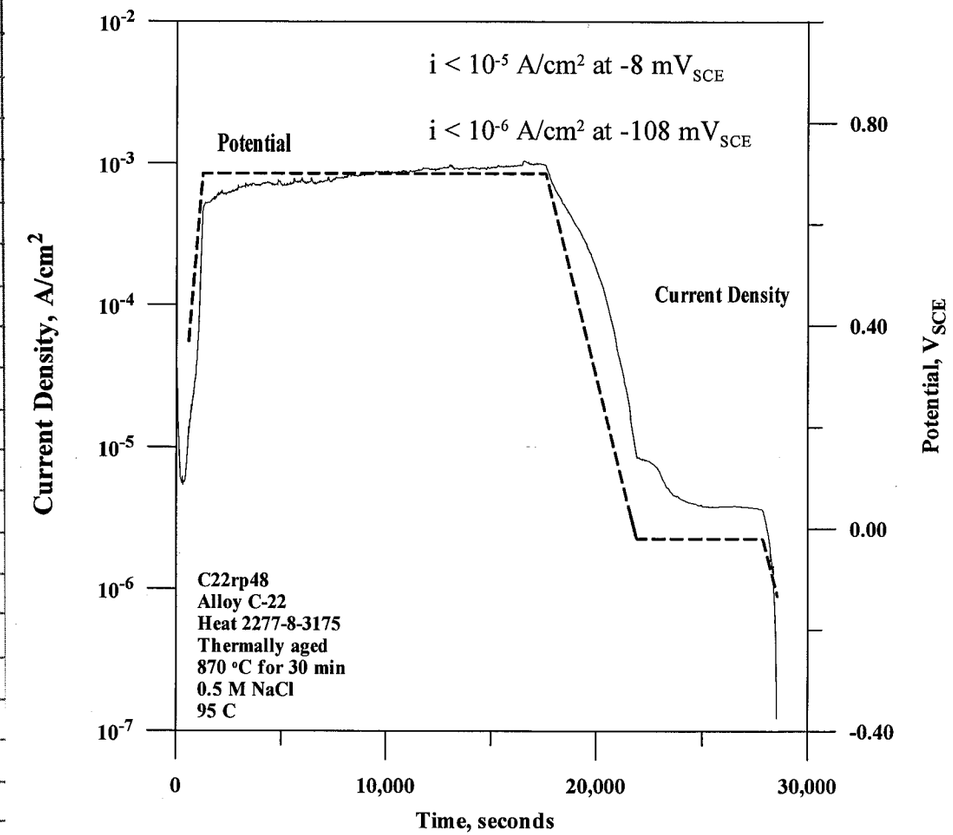
Ecorr -579 mv Keithley 617 SN# 0579628 Cal 2/22/01
Ept -485 mv

Solution Deaerated with 99.995% N_2

Specimen Examination : Crevice Corrosion on 10/24 feet
Gold tint staining on All sides of Specimen - Corrosion Noticed on
Inner Diameter Hole for Crevice Washer Bolt.

Data Saved As C22rp48

06/01/01



06/01/01

Repassivation Potential of Alloy C-22

objective: See Pg #184

Specimen: Alloy C-22 Thermally Aged for 20 min @ 870°C - 600 Grit Finish
with 2 PTFE Crevice Washers Attached At 50 In-Oz Using
Photo 6104 SN# 314047 cal 11/9/00

Start wt 37.535 OHaus Precision Standard SN# 2888 cal 3/2/01
End wt 37.395

Solution 4 molar Cl
467.56g NaCl Lot# 005144
+ DI water To 2000 ml's

Start PH 7.535 ORION 720a Meter SN# 005885 Cal 7/20/00
End PH 7.839

Potentiostat: EG & G Model # 273 SN# 41108
Counter Electrode: PT Flag
Reference: Fisher 13-620-52 SN# 8203245
Temperature: 95°C Hg Thermometer SN# 115749 cal 1/29/01

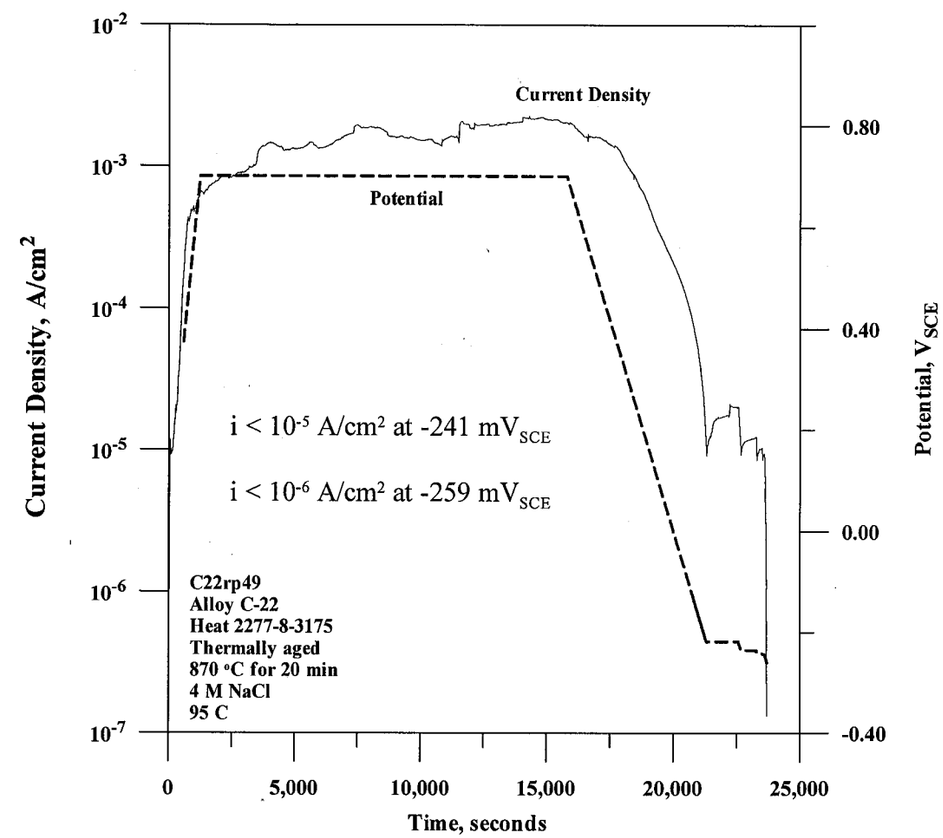
Ecorr -404 Keithley 617 SN# 0579628 cal 2/22/0
Ept -470

Solution Deaerated with 99.999% N_2

Specimen Examination: Crevice Corrosion on 24/24 feet
Color tint staining on All sides of Specimen - Corrosion Noticed
on Crevice Washer Bolt Hole Inner Surface

Data Saved As C22rp49

06/04/01



06/04/01

Repassivation Potential of Alloy C-22

objective : See Pg #184

Specimen: Alloy C-22 Thermally Aged for 10 min @ 870°C - 600 Grit Finish with 2 PTFE Crevice Washers Attached At 50 In-Oz Using Proto 6163 SN# 2 Cal 5/11/01

Start wt 38.758 OHaus Precision Standard SN#2883 cal 3/7/01
End wt 38.593

Solution 4 m Cl
467.56 g NaCl Lot # 005144
+ DI water To 2000 mls

Start PH 7.100 Fisher Accumet 950 meter SN# 3340 cal 7/20/00
End PH 7.840

Potentiostat: EG & G model # 273 SN# 41108
Counter Electrode: PT Flag
Reference: Fisher 13-620-52 SN# 8203245
Temperature: 95°C Hg Thermometer SN# 115749 cal 1/29/01

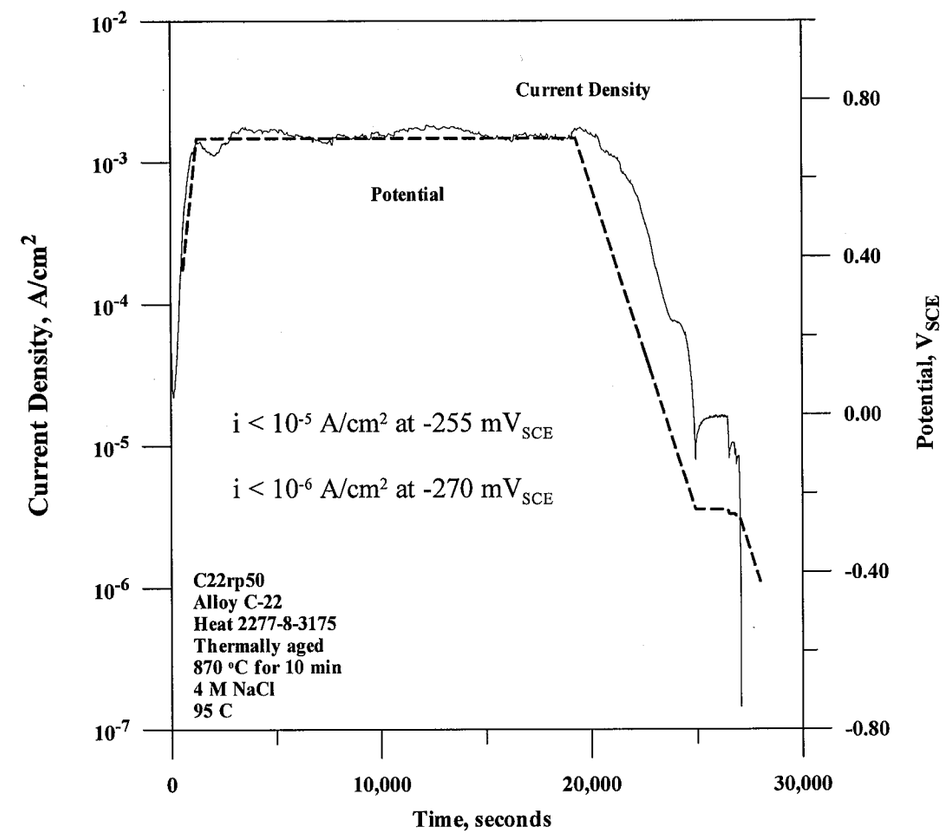
Ecorr -467mV Keithley 617 SN# 0579628 Cal 2/22/01
Ept -472mV

Solution Deaerated with 99.999% N_2

Specimen Examination: Crevice Corrosion on 22/24 feet
Gold tint staining on All sides of Specimen - Corrosion Noticed on Inner Diameter Crevice Bolt Hole

Data Saved As C22RP50

06/05/01



06/05/01

Repassivation Potential of Alloy C-22

objective : See Pg #184

Specimen : Alloy C-22 Thermally Aged for 20min @ 870°C - 600 Grit Finish
with 2 PTFE Crevice Washers Attached At 50 - In - Oz Using
Proto 6104 SN#314047 cal 6/4/01

Start wt 38.441 OHaus Precision Standards SN#2883 cal 3/8/01
End wt 38.382

Solution 1 m Cl
116.81 g NaCl Lot#005144
+ DI water To 2000 mls

Start PH 5.856
End PH 7.926 Fisher Accumet 950 meter SN#3340 cal 7/30/00

Potentiostat : EG+G model #273 SN#4110B
Counter Electrode : PT Flag
Reference : Fisher 13-620-52 SN#8203245
Temperature : 95°C Hg Thermometer SN#115749 cal 1/24/01

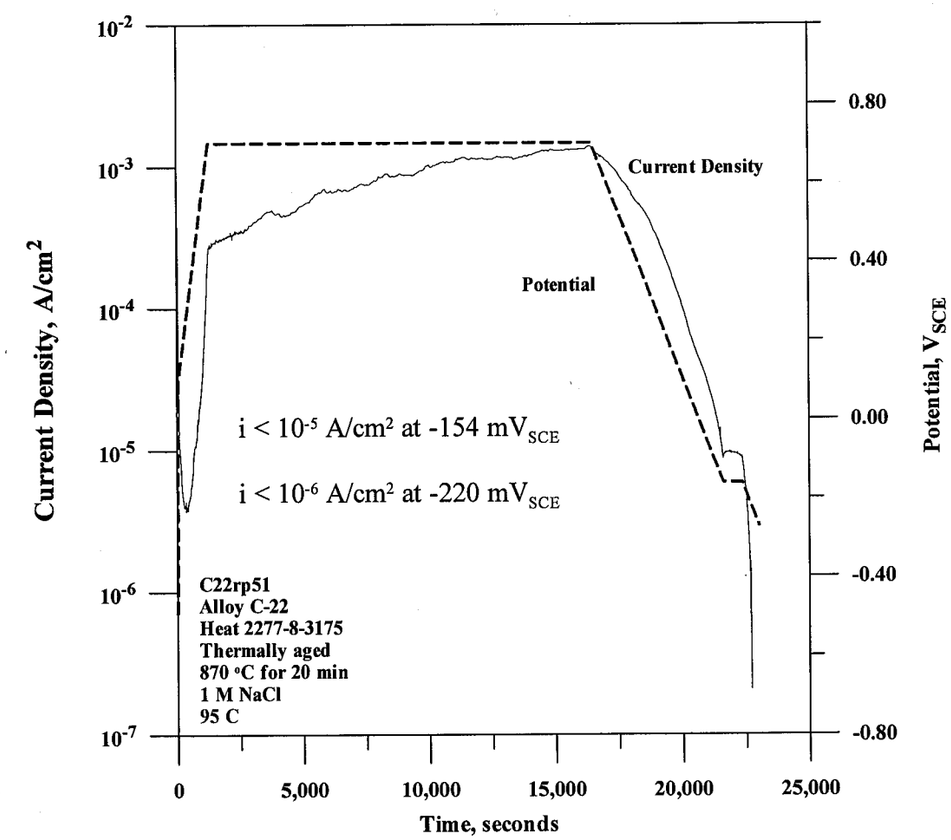
Econn -489 Keithley 617 SN#0579628 cal 2/22/01
Ept -466

Solution Deaerated with 99.999% N_2

Specimen Examination : Crevice Corrosion on 18/24 feet
Specimen Has Gold tint staining on All surfaces - Also Corrosion
Noticed on Inner Diameter Crevice Bolt Hole

Bill [illegible]
06/05/01

Data Saved As C22RP51



Bill [illegible]
06/05/01

Thermal Ageing of C-22 Alloy Specimens

Thermal Ageo 3 specimens for 5 mins

Using Thermal Couple SN# 326 Cal 12/6/00
Thermal Couple Meter Omega H22 SN# T 94140 Cal Jan/15/01

Start Procedure
oven Temperature thermal couple 882°C
oven Set Point Temperature 864°C

Placed Specimens In Oven All 3 specimens Simultaneously

@ 2:00 min In To Procedure
oven Temperature Thermal Couple 880°C
oven Set Point Temperature 873°C

@ 3:00 min Into Procedure
oven Temperature Thermal Couple 870.6°C
oven ~~Set~~ 06/05/01 Set Point Temperature 863°C

@ 4:00 min Into Procedure
oven Temperature Thermal Couple 874.6°C
oven Set Point Temperature 855°C

will Continue with Test Matrix
But Add 5 min Thermal Ageo Specimens To Matrix
Using Same Test Solutions of 4 molar Cl - 1 molar Cl
And .5 molar Cl @ 95°C

B-K 06/05/01

Thermal Ageo C-22 Alloy Specimens

All Specimens Are Same Dimensions As the
Drawing on Pg # 189
Drawing Number # 20.01402.571.006

B-K 06/07/01

Repassivation Potential of Alloy C-22

Accidently Skipped Pg 6/6/01
B. Kod

Accidently skipped Pg 6/6/01
B. Kod

Repassivation Potential of Alloy C-22

objective : See Pg #184

Specimen : Alloy C-22 Thermally Aged for 5min @ 870°C -600 Grit Finish
with 2 PTFE Crevice Washers Attached At 50 In-Oz Using
Proto 6104 SN#314047 cal 6/4/01

Start wt 38.856g OHaus Precision Standard SN#2883 cal 3/8/01
End wt 38.734g

Solution : 4 m Cl
461.54g NaCl Lot #005144
+ DI water To 2000 mls

Start PH 6.965 Fisher Accumet 950 meter SN#3340 cal 7/20/00
End PH 7.678

Potentiostat : EG&G Model #273 SN#41608
Counter Electrode : PT Flag
Reference : Fisher 13-620-52 SN# 8203245
Temperature : 95°C Hg Thermometer SN#115749 cal 1/29/01

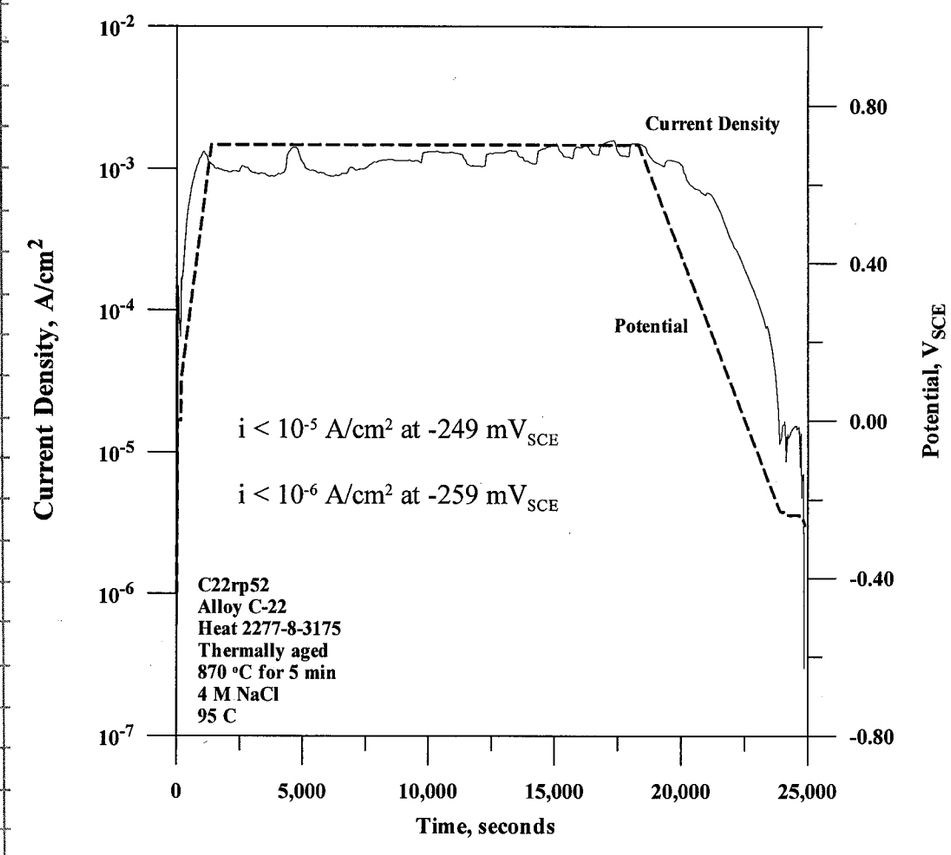
Econn -441mv Keithley 617 SN#0579628 cal 2/22/01
Ept -460mv

Solution Deaerated with 99.999% N_2

Specimen Examination : Crevice Corrosion on 18/24 feet
Gold tint staining on surfaces of specimen - Crevice Bolt
Hole Has Corrosion on Inner Diameter of Hole

Data Saved As C22RP52.

6/6/01



6/6/01

Repassivation Potential of Alloy C-22

objective : See Pg # 184

Specimen : Alloy C-22 Run As Recieved 600 ~~grit~~ Finish
with 2 PTFE Crevice Washers Attached At 50 In-Oz Using
Photo 6104 SN# 314047 Cal 6/4/01

Start wt 38.052g OHaus Precision Standards SN# 2883 cal 3/2/01
End wt 38.0460 METTLER AG 240 SN 1012359 CAL 2/MAR 01

Solution : 4 m Cl
467.54g NaCl Lot # 005144
+ DI water To 2000 mls

Start PH 7.687
End PH 7.453 FISHER 950 SN 3940 cal 7/20/00 probe 13-620-296 SN 1100208

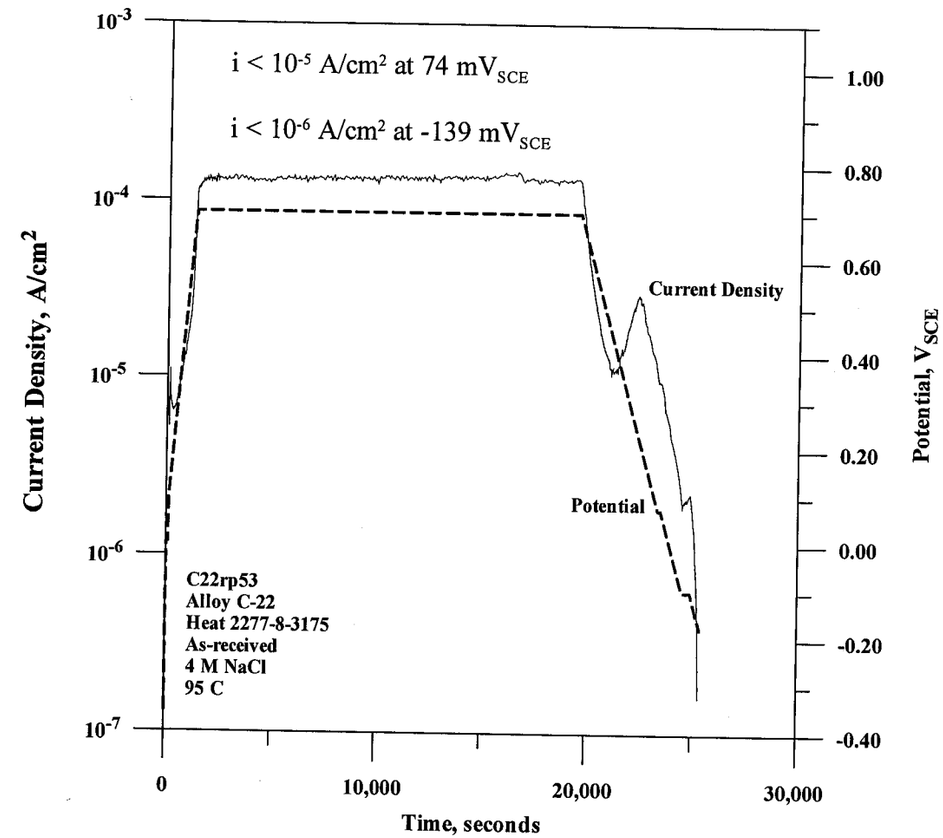
Potentiostat : EG&G model # 273 SN # 41108
Counter Electrode : PT Flag
Reference : Fisher 13-620-52 SN# 8203245
Temperature : 95°C Hg Thermometer SN# 115749 cal 1/29/01

Econ -363 Keithley 617 SN# 0579628 cal 2/22/01
Ept -274

Solution Deaerated with 99.999% N_2

Specimen Examination Crevice Corrosion on 5/24 feet
Gold tint staining on all sides of Specimen - No Corrosion
Notices on Inner Diameter Hole

Data Saved as C22RP53A.DAT



Repassivation potential of alloy 22

Objective see p. 184

Specimen alloy 22 welded
Base metal heat 2277-8-3235
Filler metal heat XX1045BG11
600 grit finish
2 PTFE crevice washers attached using Proto
6104 SN 314047 Cal 6/4/01 Torque 50 in.oz

Start wt 39.4716 Mettler AE 240 SN 101237 CAL 2 MAR 01
END WT 39.4370

Solution 4 m Cl as NaCl
467.5 g NaCl Lot 005144
+ DI water to 2000 mL

Start pH 6.35 Fisher 950 SN 3340 ~~SN~~ RD 6/10/01 Cal 7/20/00
End pH 7.35 Probe 13-620-296 SN 1100208

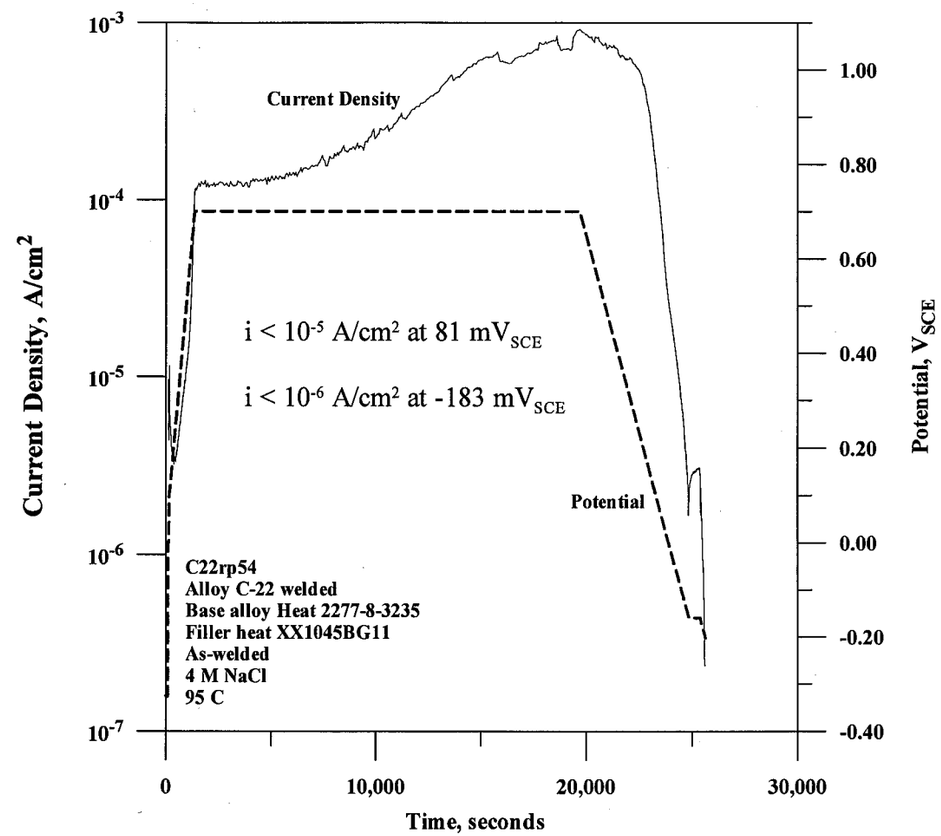
Potentiostat EG&G 273 SN 41108
Counter electrode Pt flag
Reference Fisher 13-620-52 SN 8203245
Temperature 95°C Hg thermometer 115749 Cal 1/29/01

E_{corr} −327 Keithley 617 SN 0579628 Cal 2/22/01
E_{pt} −76

Solution deaerated with 99.999% N_2

Specimen Examination
Crevice Corrosion on 12/24 locations some
deep penetration appears to start in weld region

Data saved as C22RP54A.DAT [signature] 6/9/2001



[signature] 6/9/2001

[signature] 6/9/2001

Repassivation Potential of Alloy 22

Objective see p. 184

Specimen Alloy 22 2277-8-3175
600 grit finish
2 PTFE crevice washers attached at 50 in-oz
using Proto 6104 SN 314047 Cal 6/4/01

Start wt 39.2936 g Mettler AG 240 SN 101237
END WT 39.3069 g Cal 2 Mar 01

Solution 1 M Cl as NaCl
116.88 g NaCl LOT 010166
+ DI WATER TO 2000 mL
NaCl weighed using OHAUS SN 2883 Cal 2 mar 01

Start pH 6.20 Fisher 950 SN 3340 Cal 7/20/00
END pH 6.37 Probe 13-620-296 SN 1100208

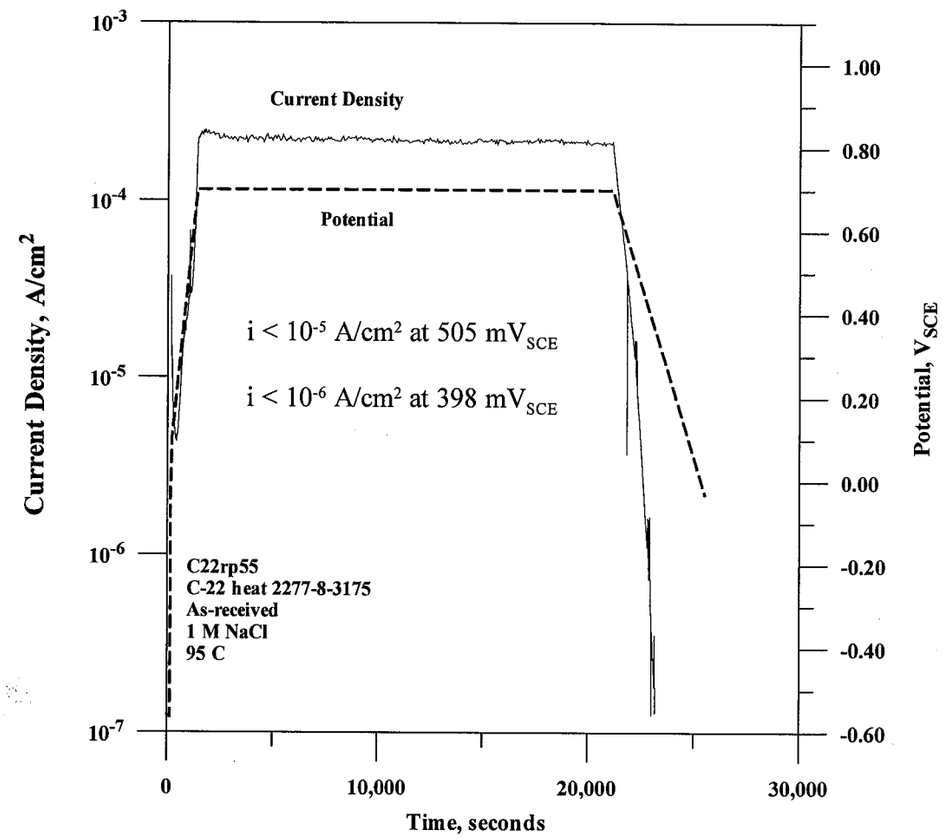
Potentiostat EG&G 273 SN 41108
Counter Electrode Pt flag
Reference Fisher 13-620-52 SN 8203245
Temperature 95°C Hg thermometer 115749 Cal 1/29/01

Ecorr -556 mV KEITHLEY 617 SN 0579628 CAL 2/22/01
Ept -142 mV

Specimen Examination
No crevice corrosion. Specimen has a thick gold-colored film on surface

Specimen will be repolished and re-used in a later test.

Data served as C22RP55N.Dat 6/10/01



6/10/01

6/10/01

Repassivation Potential of Alloy 22

Objective: see p 184

Specimen Alloy 22 2277-8-3175
600 grit finish
2 PTFE Crevice washers attached at
50 in-oz using Proto 6104 SN 314047 Cal 6/4/01
Specimen thermally aged at ~~86~~ 6/10/01 870°C for 5 min p. 202
Start wt: 38.5947 Mettler AE240 SN 101237 Cal 3/2/01
END WT 38.521 g OHaus Precision Standards

Solution 1 M Cl⁻ as NaCl
116.88 g NaCl lot 010166
+ DI water to 2000 mL
NaCl weighed using OHAUS SN 2883 Cal 3/2/01

Start pH 6.03 Fisher 950 SN 3340 Cal 7/20/00
END pH 5.579 probe 13-620-296 SN 1100208

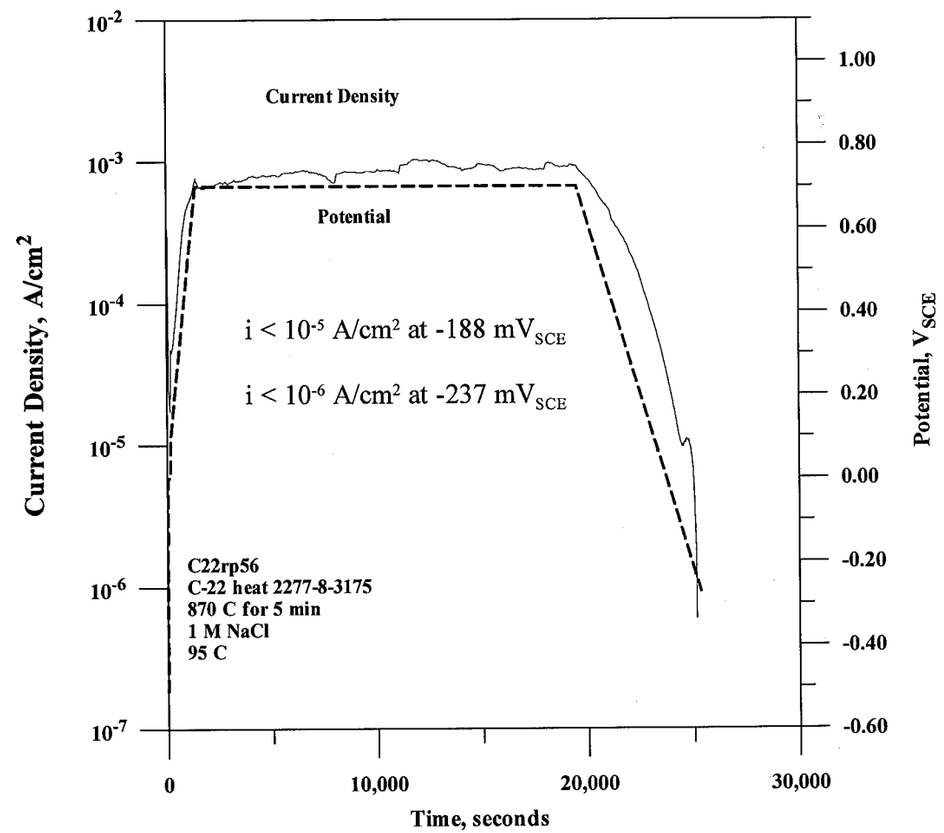
Potentiostat EG&G 273 SN 41108
Counter Electrode Pt Flag
Reference Fisher 13-620-51 SN 8203245
Temperature 95°C Hg Thermometer 115749 cal 1/29/01

Ecorr -510 mV Keithley 617 SN 0579628 Cal 2/22/01
Ept -95

Specimen examination: Crevice Corrosion on 19/24 feet
Gold tint Staining on All sides of Specimen - Corrosion Noticed
on Inner Diameter Crevice washer Bolt Hole

Data Saved As C22 RP 56.Dat

6-11-01



Darrell Dunn 6/10/01

Darrell Dunn 6/10/01

Repassivation Potential of Alloy C-22

objective : See Pg # 184

Specimen : Alloy C-22 Thermally Aged @ 870°C for 5 min 600 Grit Finish with 2 PTFE Crevice Washers Attached At 50 In-Oz Using Proto 6104 SN# 314047 cal 6/4/01

Start wt 38.722g Ohaus Precision Standard SN# 2483 cal 3/2/00
End wt 38.658g

Solution .5 m Cl
58.41 g NaCl Lot# 005144
+ DI water To 2000 mls

PH Start 6.318 Fisher Accumet 950 meter SN# 3340 cal 7/20/00
End PH 4.477 Probe 13-620-296 SN# 1100208

Potentiostat : EG+G Model # 273 SN# 41108
Counter Electrode : PT Flag
Reference : Fisher 13-620-52 SN# 8203245
Temperature : 95°C Hg Thermometer SN# 115749 cal 1/28/01

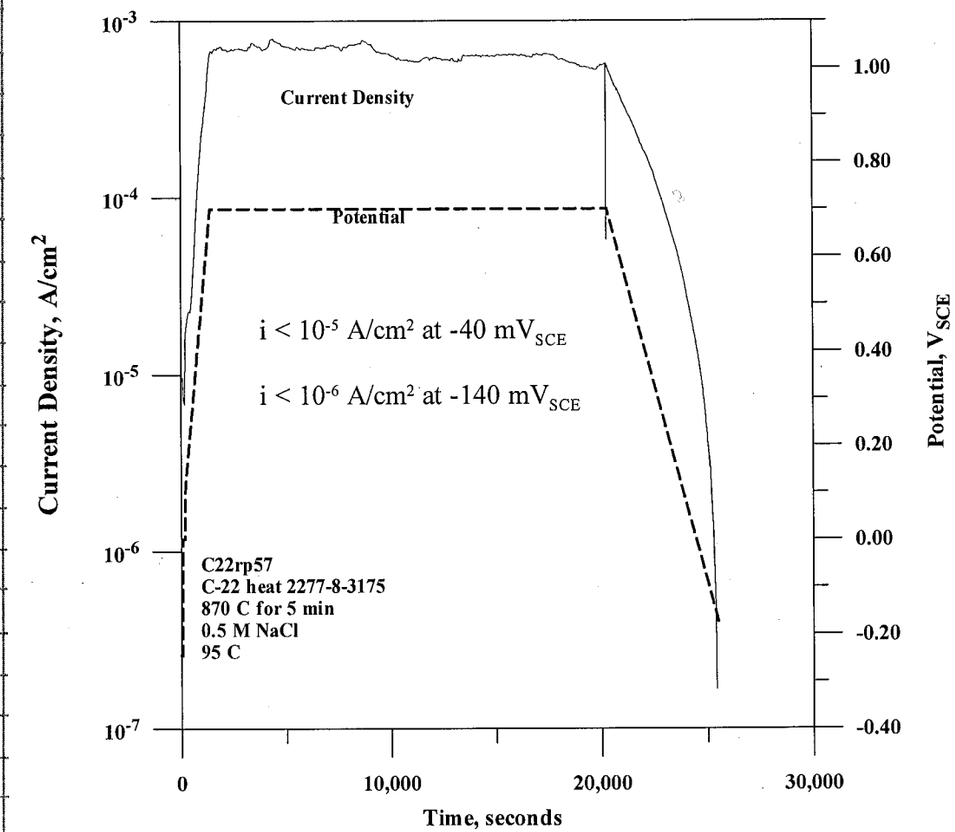
Ecorr -242 mv Keithley 617 SN# 0579628 cal 2/22/01
Ept +264 mv

Solution Deaerated with 99.999% N_2

Specimen Examination : Crevice Corrosion on 6 of 24 feet
Specimen Is Gold tint stained on All surfaces - Corrosion Noticed on Inside Crevice Bolt Diameter Hole

6/12/01

Data Saved As C22RP57.DAT



6/12/01

Repassivation Potential of Alloy C-22

objective : See Pg #184

Specimen : Alloy C-22 Thermally Aged 10 min @ 870°C 600 Grit Finish with 2 PTFE Crevice Washers Attached At 50 In-Oz Using Proto 6104 SN# 314047 Cal 6/4/01

Start wt 38.231g Ohaus Precision Standard SN# 2883 Cal 3/2/01
End wt 38.142g

Solution 1 m Cl
116.88 g NaCl Lot# 005144
+ DI water To 2000 mls

Start PH 6.257 Fisher Accumet 950 meter SN# 3340 Cal 7/20/00
End PH 7.613 Probe 13-620-296 SN# 1100208

Potentiostat : EG & G model #273 SN# 41108
Counter Electrode : PT Flag
Reference : Fisher 13-620-52 SN# 8203245
Temperature : 95°C Hg Thermometer SN# 115749 Cal 1/29/01

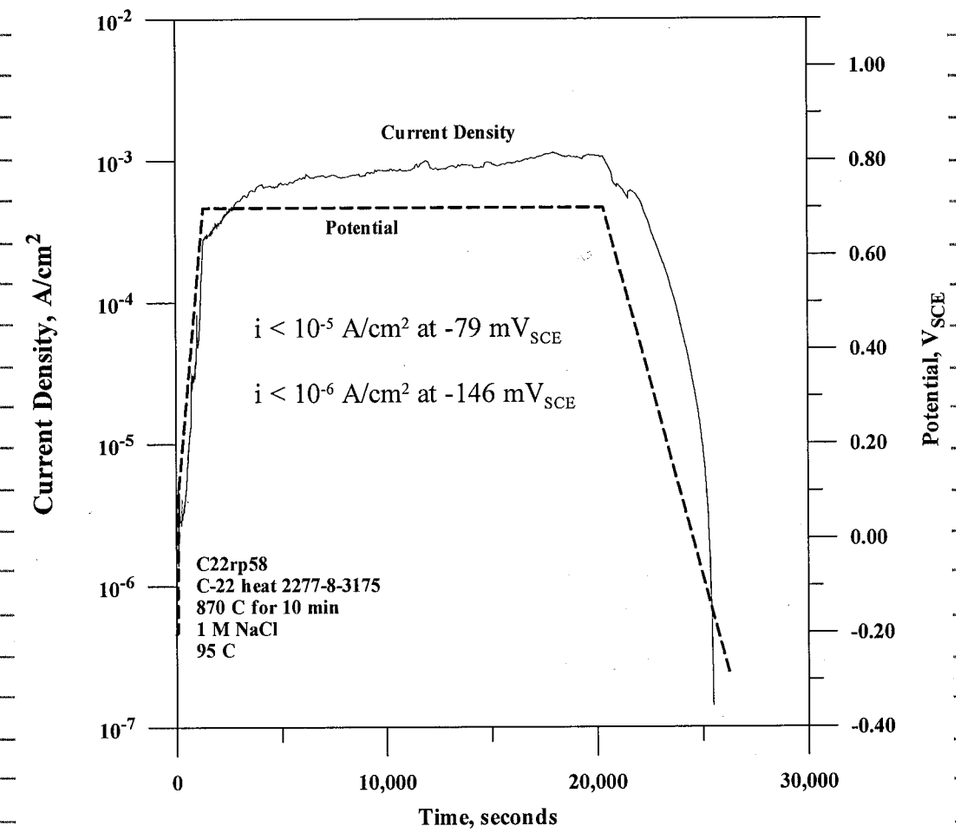
Econd -200 mV Keithley 617 SN# 0579628 Cal 2/22/01
Ept +265 mV

Solution Deaerated with 99.999% N_2

Specimen Examination : Crevice Corrosion on 6/24 Seat
Cobalt tint staining on All Surfaces of Specimen . Corrosion Noticed on Inside of Crevice Bolt Hole

Data Saved As C22 RP 58

6/13/01



4/26/02

C22L13b

Specimen: C-22 WelN6D
Start wt = 39.493 g Mettler AE240 SN# 101237 cal 03/02/01
End wt = 39.50161 g Sartorious Genius SN# 12809099 cal 6/22/01
2 PTFE Crevice Washers Attached At 50 In-Oz Using
Proto 6104 SN# 314047 cal 6/4/01

Solution 4 m Cl^- 85 ppm HCO_3 20 ppm SO_4
10 ppm NO_3 2 ppm F^- 2000 mls Prepared As Follows

467.55 g NaCl Lot# 010166
0.241 g $NaHCO_3$ Lot# 92337A
40 mls SO_4 = 5-29-01 Stock Solutions Pg #145
20 mls NO_3 = 5-29-01 " "
4 mls F^- = 5-29-01 " "
+ DI water To 2000 mls

Start PH ~~8.227~~ 7.487 6.15 Fisher Accumet 950 meter SN# 3340 cal 7/20/00
End PH 8.754 Probe 13-620-296 SN# 1100208

Temperature 95°C Hg Thermometer SN# 1238002 cal 1/10/01
Econn -230 mv Keithley 617 SN# 537418 cal 2/22/01
Ept +194 mv
E Applied +100 mv

Reference: Fisher 13-620-52 SN# 0066110
Test Started 6/15/01
Test Ended 8/4/01 Computer shutdown

6/15/01

C22L12C

Specimen: C-22 WGLPCD
Base Metal 2277-8-3225
Filler XX 1045 BG11
Start wt = 39.4219 Mettler AE240 SN# 101237 cal 03/02/01
End wt = 39.41756 g Sartorious Genius SN# 12809099 cal 6/22/01
2 PTFE Crevice Washers Attached At 50 In-Oz Using
Proto 6104 SN# 314047 cal 6/4/01

Solution 4 m Cl^- 85 ppm HCO_3 20 ppm SO_4
10 ppm NO_3 2 ppm F^- 2000 mls Prepared As Follows

467.54 g NaCl Lot# 010166
0.240 g $NaHCO_3$ Lot 92337A
40 mls SO_4 = 5-29-01 Stock Solutions Pg #145
20 mls NO_3 = 5-29-01 " "
4 mls F^- = 5-29-01 " "
+ DI water To 2000 mls

Start PH ~~7.544~~ 7.481 6.15 Fisher Accumet 950 meter SN# 3340 cal 7/20/00
End PH 8.457 Probe 13-620-296 SN# 100208

Temperature 95°C Hg Thermometer SN# A2000-130 cal 5/29/01
Econn -262 mv Keithley 617 SN# 537418 cal 2/22/01
Ept +224 mv
E Applied +150 mv

Reference: Fisher 13-620-52 SN# 0089771
Test Started 6/15/01
Test Ended 8/4/01 Computer shutdown

6/15/01

C-22 L11 E

Specimen : C-22 2277-8-3175
start wt : 31.4516 Mettler AE240 SN# 101237 cal 3/02/01
End wt : Not Taken
2 PTFE Crevice Washers Attached At 50 In-Oz Using
Proto 6104 SN# 314047 cal 6/4/01

Solution : 4 m Cl^- 85 ppm NCO_3 20 ppm SO_4
10 ppm NO_3 2 ppm F^- 2000 mls Prepared As Follows

467.53 g NaCl Lot # 010166
.242 g $NaHCO_3$ Lot # 92337A
40 mls SO_4 : 5/29/01 Stock Solutions Pg #145
20 mls NO_3 : 5-29-01 " "
4 mls F^- : 5-29-01 " "
+ DI water To 2000 mls

Start PH 7.543 Fisher Accumet 950 SN# 3340 cal 7/20/01
End PH Not Taken Probe 13-620-296 SN# 100208

Temperature : 95°C Hg Thermometer SN# H98-179 cal 5/3/01

Econn -446 mv Keithley 617 SN# 537418 cal 2/22/01
Ept +241
E Applied +230 mv

Reference : Fisher 13-620-52 SN# 0066128
Test Started 6-15-01
Test Ended 6-18-01 - Specimen Rod Broke off In Specimen
Ended Test And Restarted with New Specimen on 6-19-01
See Pg # 225 will Keep Same File Name
~~Restarted 6-18-01 3:40pm~~ BKP 8-4-01
~~Test ended 8-4-01 Computer shutdown~~

6/15/01

C-22 L3 K

Specimen : C-22 2277-8-3175
start wt 47.2501 g Mettler AE240 SN# 101237 cal 03/02/01
End wt 47.2444 g Sartorious Genius SN# 12409099 cal 6/22/01
2 PTFE Crevice washers Attached At 50 In-Oz Using
Proto 6104 SN# 314047 cal 6/4/01

Solution : 4 m Cl^- 85 ppm HCO_3 20 ppm SO_4
10 ppm NO_3 2 ppm F^- 2000 mls Prepared As Follows

467.54 g NaCl Lot # 010166
0.241 g $NaHCO_3$ Lot # 92337A
40 mls SO_4 : 5-29-01 Stock Solution Pg #145
20 mls NO_3 : 5-29-01 "
4 mls F^- : 5-29-01 " "
+ DI water To 2000 mls

Start PH 7.541 Fisher Accumet 950 meter SN# 3340 cal 7-20-01
End PH 8.699 Probe 13-620-296 SN# 100208

Temperature : 95°C Hg Thermometer SN# C96-783 cal 5-1-01

Econn -9 mv Keithley 617 SN# 537418 cal 2/22/01
Ept +169 mv
E Applied : Open Circuit

Solution Bubbled with Zero Air

Reference : Fisher 13-620-52 SN# 9250063
Test Started 6-15-01
Test Ended 8-4-01 computer shutdown

6/15/01

OC 825 C1AI

Specimen : 825 HH 4371 FG
Start wt 39.2992 g Mettler AE240 SN# 101237 cal 3-2-01
End wt 39.2938 g 5-01 Sartorious Genius SN# 12809099 cal 6/22/01
2 PTFE Crevice washers Attached At 50 In-Oz
Using Proto 6104 SN# 314047 cal 6/4/01

Solution: 1000 ppm Cl 85 ppm HCO_3 20 ppm SO_4
10 ppm NO_3 2 ppm F^- 2000 mls Prepared As Follows

3.298 g NaCl Lot # 010166
.241 g $NaHCO_3$ Lot # 923337A
40 mls SO_4 : 5-29-01 stock Solutions Pg # 145
20 mls NO_3 : 5-29-01 " "
4 mls F^- : 5-29-01 " "
+ DI water To 2000 mls

Start PH 8.227 Fisher Accumet 950 meter SN# 3340 Cal 7-20-00
End PH 9.295 Probe 13-620-296 SN# 100208

Temperature : 95°c Hg Thermometer SN# 183305 cal 5-2-01

Econn -277 mv Keithley 617 SN# 537418 cal 2/22/01
Ept +113 mv
E Applied : Open Circuit

Solution Bubbled with Zero Air.

Reference : Fisher 13-620-52 SN# 9250047
Test Started 6-15-01
Test Ended 8-4-01 computer shutdown

6-15-01

C-22 LII E

Specimen : C-22 2277-8-3175
Start wt : 39.0582 g Mettler AE240 SN# 101237 cal 3/2/01
End wt: 38.92335 g Sartorious Genius SN# 12809099 Cal 6/22/01
2 PTFE Crevice Washers Attached At 50 In-Oz Using
Proto 6104 SN# 314047 cal 6/4/01

Solution : 4 m Cl^- 85 ppm HCO_3 20 ppm SO_4
10 ppm NO_3 2 ppm F^- 2000 mls Prepared As Follows

467.53 g NaCl Lot # 010166
.241 g $NaHCO_3$ Lot # 92337A
40 mls SO_4 : 5-29-01 stock Solutions Pg # 145
20 mls NO_3 : 5-29-01 " "
4 mls F^- : 5-29-01 " "
+ DI water To 2000 mls

Start PH 7.434 Fisher Accumet 950 SN# 3340 cal 7/20/01
End PH 8.373 Probe 13-620-296 SN# 100208

Temperature : 95°c Hg Thermometer SN# ~~537418~~ H98-179 SKU 6/19/01 cal 2/22/01

Econn -216 mv Keithley 617 SN# 537418
Ept +187 mv
E Applied +250 mv

Reference : Fisher 13-620-52 SN# 0066128
Test Started 6-19-01
Test Ended 8-4-01 computer shutdown
Specimen: Crevice Corrosion on 22 SKU 8-9-01 21/24 feet
mild staining on specimen

6/19/01

06/21/01

Experiment for C-22 speimen using

solartron Instrument and CorrWare 2.2 software

Solarton S1 1287A Elertrochemical Interface
SN 00153550

Computer
~~0199 02593~~ J.Y. 06/21/01
SN 0199 02593

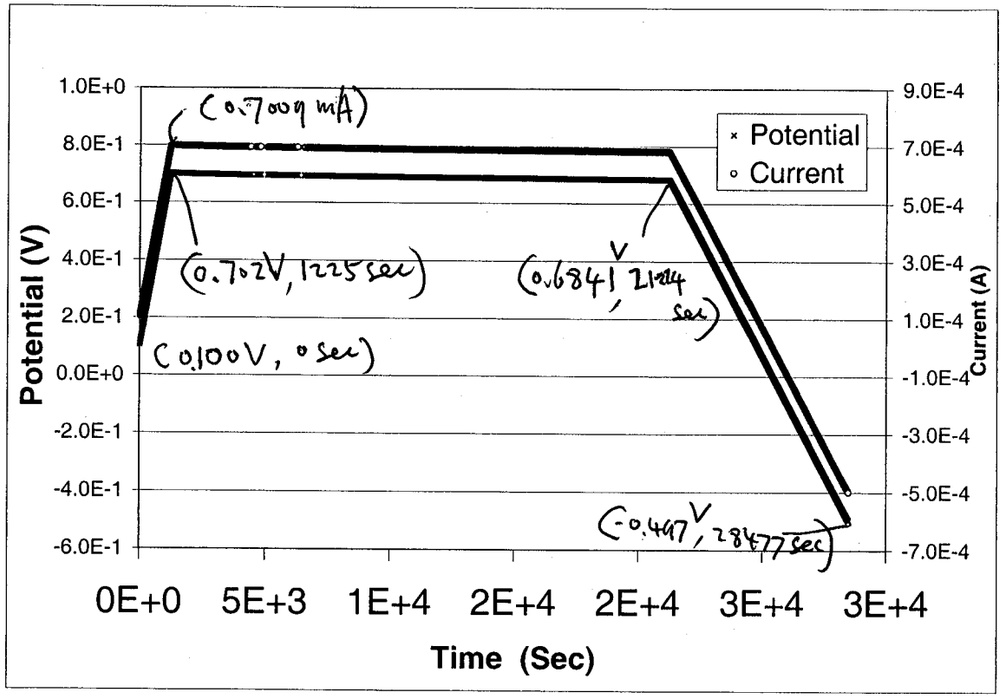
Verification of equipment as per Top 22

Resistance Box: 1000 Ω, SN 171001

Caliberated April 27/01

Scan set up: Start 0.1 V
Scan to 0.7 V at 0.5 mV/sec
Hold for 20 000 sec
Scan to -0.5V at 0.167 mV/sec
Data point: 3000
Data File: Dunntst1

J.Yang 4/15/02



Sweep rate: up $\frac{0.702 - 0.1}{1225} = \cancel{0.45}\ 0.4914$ mV/s

J.Y. 06/21/01

Down $\frac{0.6841 + 0.497}{28477 - 21224} = \frac{1.181}{7253} = 0.163$ mV/s

Hold time: 21224 - 1225 = 19999 sec.

J.Yang 4/15/02

Hold potential: 0.702 V to 0.6841 V,

$\frac{\text{Voltge}}{\text{Current}} = \frac{0.702}{0.7009 \times 10^{-3}} = \cancel{1000.2}\ 1002$ ohm. Good.

J.Y. 06/21/01

06/22/01

Soln: 2 l, 0.5 M Cl^-

58.40 g NaCl, Lot # 010166

put in 2000 ml DI Water

PH = 6.142

Specimen: C-22, aged to 870°C, 20 min

Polish: ~~2000~~ 600 grit J.Y. 07/13/01

Installed in Teflon Crevice at 50 in-oz torque, Teflon Crevice surface polished to 2000 grit J.Y. 07/13/01

Cell cap (head) Installed, 60 in-oz torque

Joint of coupon and lead $\frac{1}{4}$" above water line.

Reference electrode: Fisher, 13-620-52, SN 8205245 SCE.

Termometer, Hg glass, SN 115749, calib'd Jan. 29/01

Setup File: C22test-0622, Same as shown in Page 226 for verification test.

Data File: C22-0622a

Coupon weight: 38.142 g

Density: 8.69

Eq. weight: 25.12

J. Yang 4/25/02

Surface Area: use 20 cm^2 (to be verified)

06/22/01

9:39 set temp. to 95°C, start ~~air~~ J.Y. 06/22/01

Start N_2 bubbling. N_2: Praxair, 5.0 Grade, # 5301603

13:12 Temperature steady, T = 98.0°C (Thermometer) default

T = 94.7°C (RTD)

Set controller T = 92°C

13:24 ~~Scan started~~ J.Y. 06/22/01 E_{corr} = -0.3407 V (SCE), T = 97°C

$E_{counter}$ = -118 mV (SCE)

13:26 $E_{counter}$ = -238 mV/SCE

These E measured with Electrometer SN 0579628 Cal'd Feb 22/01

13:28 E_{corr} = -313 mV ; $E_{counter}$ = -305.0 mV, T = 96°C.

13:28 Scan started.

13:46 T = 96°C (default is the glass thermometer)

15:40 T = 95.5°C, E = 0.693 V (shown by SI 1287)

I = 11 mA (by SI 1287)

06/25/01

08:41 T = 95.5°C, measurement completed

Data were not good. A large number of data point missing.

J. Yang 4/25/02

Contacted Software Vendor and Installed new versions of Zplot, ZView, CorrWare and CorrView.

Lietai Yang

From: Derek Johnson [djohnson@scribner.com]
Sent: Wednesday, June 27, 2001 3:20 PM
To: LTyang@swri.org
Subject: RE: CorrWare 2.1 & 2.2

Hello Lietai,

I have posted the modified CorrWare tor our web site.

Go to http://www.scribner.com/zupdates.html

and download the ZPlot and ZView programs
(files ZP23F_32.EXE and ZV23F_32.EXE)

Go to http://www.scribner.com/corr2/

and download the CorrWare and CorrView programs
(files CW23F_32.EXE and CV23F_32.EXE)

On the lab computer, close all programs and run each of the downloaded files. Use all the default settings when running the installer programs.

Run them in the following order
ZP23F_32 (ZPlot)
ZV23F_32 (ZView)
CW23F_32 (CorrWare)
CV23F_32 (CorrView)

Start CorrWare and use Help | About to check the version (is should say 2.3f2) and then try running you scan/hold experiment.

Best Regards,
Derek

L Yang 4/10/02

Derek Johnson
djohnson@scribner.com
support@scribner.com

(925) 862-2416

Software + Applications Support
Scribner Associates Inc.
Designers and Manufacturers of Software, Instruments, and Accessories for Electrochemistry
http://www.scribner.com

The four Files are copied onto a CD and given to QA for storages

Clear Day

Lietai Yang

From: Lietai Yang [LTyang@swri.org]
Sent: Friday, July 06, 2001 11:09 AM
To: 'jmgonzalez@gargol.cnwra.swri.edu'
Subject: Zplot and CorrWare Software Version 2.3f to be copied to CD and Deposited with the QA OFFICE

L Yang 4/10/02

Janie

Enclosed are 4 updated files for the above mentioned software packages. I have installed them in a computer in the lab for high level waste experiment. Please copy them to a CD and give the CD to QA for storage.

Thank you

Lietai

June 28 11:25 Restarted run, all condition same as before (page 228), electrochemical cell not opened, coupon has been in solution since 9:39 June 22 at 95°C + Air

File: C22-0628a.xls (cor)

Data has severe drifting problem. after about 17000 seconds of hold. drift as large as 40 mV!

L Yang 4/10/02

Software Vendor suggets to use setup:

① P. dynamic 0.1 → 0.7 V (0.5 mV/s)

② P. static at 0.7 V for 20,000 sec.

③ P. dynamic 0.7 V to -0.5 V (0.1667 mV/s)

Run the 3 segments and combine the data file (using Append feature).

June 29 15:07.

Run started again. Same setup and condition as in page 228.

Data File: C22-0629e.Cor

After test coupon taken out.

final pH = 5.913

It was verified that the electrode was not placed under open circuit condition during transition from segment to segment. by using a fast response electrometer and a resistor.

J. Yuan 4/25/02

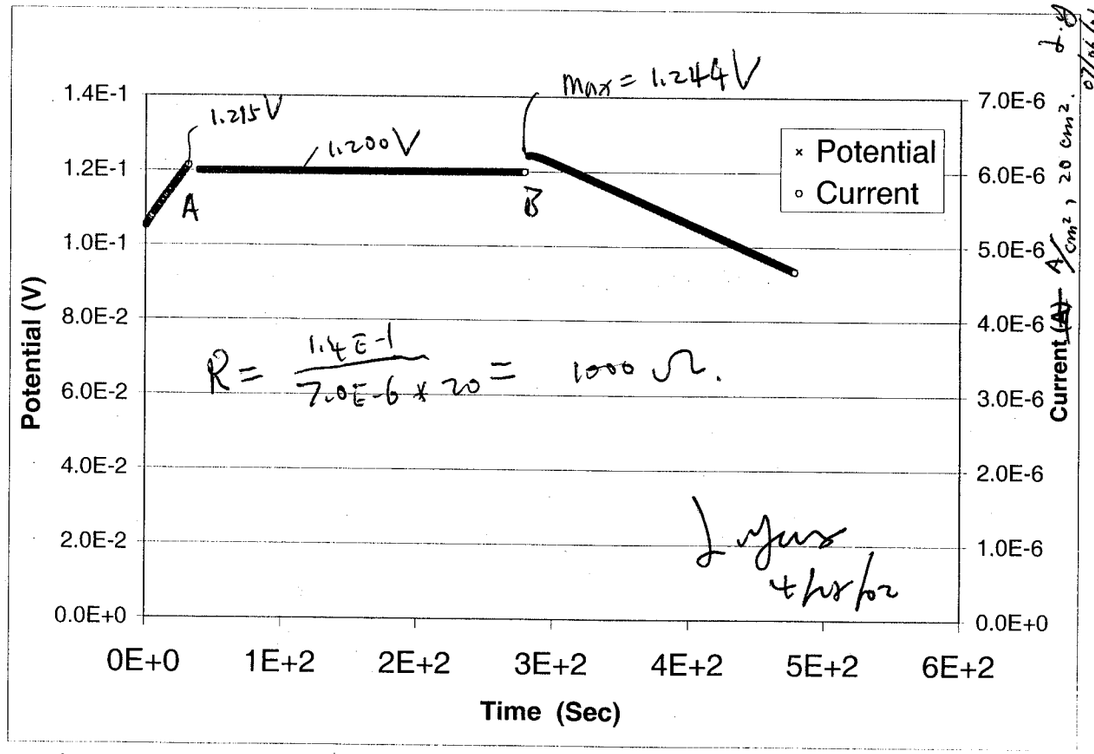
Reverification of equipment and new software.

using same resistor described on page 226.

Setup: start: 0.1 V
scan: 0.5 mV/s
static: 240 seconds at 0.12 V
Scan: 0.167 mV/s
end: -0.09 V.

Data File: C22-0702C.Cor

7/6/01 c22_0702c Chart 3



J. Yuan 4/25/02

J. Yuan 4/25/02

Data C22-0702C shows that the Resistor is measured correctly (1000Ω)

There are small jump during transition of segment.

Point A; from 1.215 V to 1.200

Point B; from 1.200 V to 1.244 V

Maximum of 44 mV !

This jump is also verified using an Electrometer.

J.Y. 07/06/01

J. Yang 20/04/02

Test with C-22 coupon.

aged at 870 °C, 20 min.

$PH_{(before)} = 6.087$ $PH_{after} = 7.819$

Weight (before) = 35.44797 g; Weight after = 35.44273 g

$E_{o.p.} = -0.3953$; E_{pt} = Not measured

0.5 M NaCl ; Same specimen as 06/22/01, repolished to 600 # paper
Lot # 010166

Data File: C-22-0702F.cor

July 2/01 J.Y. 07/03/01

13:36 Heating and ~~air~~ N_2 bubbling started.

15:46 $T_{glass\ meter} = 94.0$ °C

16:03 run started.

July 3/01

9:02 $T_{glass\ meter} = 95$ °C; Air bubble good.

Test finished

$E_{o.p.} = -0.3044$ V_{SCE}

J. Yang 20/04/02

July 3/01

Coupon: C-22 aged to 1min at 870°C
J.y. 07/06/01

Start weight: 38.82081 g ~~End~~ End wt: 38.78823

Start pH: 6.350 End pH: 7.921

Cl^-: 0.1 M (Nacl from lot # 010166)

Crevice corrosion found on 11 of 24 feet of Crevice washer. C-22-0703a.cor
Data File:

10:30 heating and ~~air~~ N_2 bubbling started 12/13/01 J.y.

14:30 $T_{glass\ meter}$ = 94.5°C

$E_{o.p.}$ = -0.4121 V_{SCE} E_{Pt} Not measured.

Run started.

July 5/01

9:23 Test finished.

$T_{glass\ meter}$ = 95°C

$E_{o.p.}$ = -0.2212 V_{SCE}, E_{pt} not measured

Cell opened, coupon weighed
solution pH measured

J.Yang
4/07/02

July 6/01

Coupon: C-22 aged at 870°C for 1hr

Start weight: 36.38822g End wt: 36.38829

Start pH: 8.313 End pH: 7.811

Cl^-: 0.001 M lot # 010166

Sample polished to 600 # paper.
Data File: C22-0708a.cor

16:09 heating and ~~air~~ N_2 bubbling started J.y. 12/13/01

July 8/01

18:10 $T_{glass\ meter}$ = 95°C

E_{op} = -0.3632 V

E_{pt} = -0.108 V

Run started. Data File: C22-0708a.cor

July 9/01

14:05 Air bubbling good, $T_{glass\ meter}$ = 94°C

$E_{o.p.}$ = -0.3471 V_{SCE}

E_{pt} = -110 mV_{SCE}

Cell opened.

Sample washed and weighed
solution pH taken (7.811)

J.Yang
4/07/02

July 10/01

Compon: C-22, same as July 6 test. repolished.

Start weight 36.33484

End weight 36.32720

Start pH = 7.867

End pH = 6.920

Data File: C22-0710a.cor

Solution: 0.01M Cl^- Lot # 010166

J.y. 12/13/01

20:05 $T_{glass\ meter}$ = 95°C, ~~Air~~ N_2 bubble: good

$E_{o.p.}$ = −0.3688 V

E_{pt} = −0.4286 V ? So different than others.

Test for thermally treated specimen (870oC), Test Temp 95 oC

File Name	Age time (min)	NaCl (M)	pH before	pH after	Weight (g) before	Weight (g) after	Ecorr before	Ecorr after	Ept before	Ept after	Comments
c22-0622A	20	0.5	6.142	NA	38.142		-0.313		-0.305		Many data points lost due to software
c22-0628A	Same as c22-0622a, cell not opened										Hold Potential drifted by 50 mV
c22-0629e	Same as c22-0628a		5.913		NA						Hold Potential drifted by 50 mV
c22-0702f*	20	0.5	6.087	7.819	35.4979	35.4427	-0.3953	-0.3044	NA	NA	Same Specimen as c22-0622a, repolished
c22-0703a	10	0.5	6.35	7.921	38.82081	38.78823	-0.4121	-0.2212	NA	NA	
c22-0708a	60	0	8.313	7.811	36.38822	36.38829	-0.3632	-0.3471	-0.108	-0.11	no crevice corr
c22-0710a	60	0.01	7.867	6.92	36.33484	36.3272	-0.3688		-0.4286		Same Specimen as c22-0708a, repolished
c22-0711a	5	0.01	7.245	6.739	39.27467	39.26487	-0.5315		0.118		
c22-0712a	5	0.1	6.346		38.30811		to be run				

* from c-22-0629e on started to use the 3-segment test setup
Used surface area of 20 cm^2
Density: 8.69
Weigth equ: 25.12

J. Yang 4/02/02

J. Yang 4/02/02

07/11/01

C-22 5 min, at 870°C, aged.

Weight: 39.27467 (Start)
39.26487 (end)

Solution 0.01 M Cl Lot # 010166

pH = 7.245 (Start)
= 6.739 (End)

Data File: C22-0711a.cor

13:00 ~~Air bubble~~ and heating started
N_2 bubbling J.y. 12/13/01

16:30 $T_{glass\ meter}$ = 95°C

$E_{o.p.}$ = −0.5315 V_{SCE}

E_{pt} = +118 mV_{SCE}

16:45 Run started.

07/12/01

8:00 Cell opened

Crevice corrosion on 3 of the crevice feet

J. Yang 4/02/02

07/12/01

Coupon C-22, aged for 5 /min at 870°C

Start weight: 38.30811 g End weight = 38.28175

Solution: 0.1 M NaCl Lot # 010166

Start pH: 6.346 End pH: 6.528

Data File: ~~C22-0713a.Cor~~ J.y. 07/16/01 C22-0712a.cor

11:43 ~~Air~~ N_2 bubble and heating started J.y. 12/13/01

T* = 23°C, $E_{o.p.}$ = -0.3080 ~~E_S~~ V_{SCE} J.y. 07/17/01 E_{pt} = +0.267 V_{SCE}

12:07 T = 36°C $E_{o.p.}$ = -0.3367 V_{SCE} E_{pt} = 0.253 V_{SCE}

12:14 T = 45°C $E_{o.p.}$ = -0.3498 V_{SCE} E_{pt} = 0.234 V_{SCE}

17:23 T = 95°C $E_{o.p.}$ = -0.5293 V_{SCE} E_{pt} = +11.8 mV_{SCE}

17:25 Run Started.

07/13/01

7:00 End $E_{o.p.}$ = -0.076 V_{SCE}

E_{pt} = +0.1847 V_{SCE}

Air good, $T_{glass\ meter}$ = 95°C

Crevice corrosion observed.

*

T means temperature from the calibrated glass thermometer.

J. Yang

4/17/02

07/13/01

Coupon C-22 aged for 5 /min at 870°C

Start Wt 38.42214 g End Wt: 38.41259 g

Solution: 0.0001 M NaCl Lot # 010166

verified — J.y. 07/13/01

Start pH: 5.964 End pH: 6.649

12:30 ~~Air~~ N_2 J.y. 12/13/01 bubble and heating started

15:29 $T_{glass\ meter}$ = 95°C. $E_{o.p.}$ = -0.451 $_{SCE}$, E_{pt} = +145 mV_{SCE}

16:53 $T_{glass\ meter}$ = 95°C $E_{o.p.}$ = -0.4498 V, E_{pt} = +126 mV

16:57 Run started

File: C22-0713a.Cor

Heating and air bubbling was terminated on weekend.

07/16/01

8:38 Current during hold 0.00004 A/cm^2

(Ten times less than that of C22-0712a.cor)

Coupon has no crevice corrosion, no localized corrosion

Coupon repolished for next test in 0.001 M Cl^-

J. Yang

4/17/02

07/16/01

Coupon: 5 min 87°C aged.
repolished from 07/13/01 test

Start wt: 38.2244 g End wt: 38.22222

Start pH: 5.949 END pH: 6.666

Solution: 0.001 M NaCl
(prepared by mixing
20 ml 0.1 M NaCl with DI.W. to 2 L
lot: #010166
0.1 M NaCl: 11.690 g in 2 L D.I.W.)

11:00 Heating + ~~Air~~ N_2 bubbling started. J.y. 12/13/01

E_{op} = -0.200 V_{SCE}, E_{pt} = +0.312 V_{SCE}, T = 20.3°C

11:10 $T_{glass\ meter}$ = 27°C, $E_{o.p.}$ = -0.290 V_{SCE}, E_{pt} = +0.327 V_{SCE}

17:31 $T_{glass\ meter}$ = 95°C, $E_{o.p.}$ = -0.445 V_{SCE}, E_{pt} = +75 mV_{SCE}

Run started.

File: C22-0716a.cor

07/17/01
09:20 E_{op} = -15 mV_{SCE}, E_{pt} = +112 mV_{SCE}

No crevice/localized corrosion found

coupon repolished to #600.

L. Yang
4/28/02

07/17/01

Coupon: 5 min, 87°C aged
repolished from 07/16/01 test

Start wt: 38.13312 g End wt: 38.12725

Start pH: 6.945 End pH: 6.311

Solution: 0.005 M NaCl (prepared by mixing
100 ml of 0.1 M NaCl (Lot#: 010166)
with D.I. water to 2 L
0.1 M NaCl: 11.690 g in 2 L D.I.W.)

12:27 Heating and ~~Air~~ N_2 bubbling started J.y. 12/13/01

16:31 $T_{glass\ meter}$ = 94°C.

$E_{o.p.}$ = -0.434 V_{SCE} E_{pt} = +132 mV_{SCE}

16:45 Run started

~~Data File: C22-0717a.cor~~

07/18/01
8:22 $E_{o.p.}$ = -0.245 V_{SCE} E_{pt} = +48 mV_{SCE}

Examined under Microscope, No L.C. observed.

Coupon repolished to 600 #.

L. Yang
4/28/02

07/18/01

Coupon 5 min 870°C aged.
repolished from 07/17/01 test

Start wt: 38.04742 g End wt: 38.01578 g

Start pH: 5.92 End pH = 6.85

Solution: 0.05 M NaCl
5.839 g in 2 L D.I. water
Lot # 010166

13:40 Heating and ~~air~~ N_2 bubbling started. J.Y. 12/13/01

17:11 $E_{o.p.}$ = −0.317 V_{SCE}, E_{pt} = 121 mV_{SCE}

$T_{glass\ meter}$ = 95°C

17:19 Run started

File: C22-0718a.cor

07/19/01
3:19 $T_{glass\ meter}$ = 95°C. $E_{o.p.}$ = −0.7 mV_{SCE}, E_{pt} = +214 mV_{SCE}

localized corrosion observed under 3 of the crevice feet.

J. Yang
4/8/02

07/19/01

Coupon 240 hr, 870°C aged.

Start wt: 46.14920 g. End Wt ~~46.13037~~ 46.12970 g J.Y. 07/20/01

Start pH: 5.90 End pH: 6.51

Solution 0.01 M NaCl
1.169 g in 2 L DIW
Lot # 010166

13:15 Heating + ~~Air~~ N_2 bubbling started. J.Y. 12/13/01

16:12 $T_{G.M.}$ = 95°C, $E_{o.p.}$ = −0.273 V_{SCE} E_{pt} = +0.201 V_{SCE}

16:26 ~~Run started~~ J.Y. 07/19/01

File: C22-0719a.cor

16:32 Run started.

07/20/01
8:38 Air bubbling good, $T_{G.M.}$ = 95.0°C

E_{pt} = +0.222 V_{SCE} $E_{o.p.}$ = +42 mV_{SCE}

localized corrosion observed under most of the crevice feet

J. Yang
4/8/02

$1.0 \times (\frac{1}{4} * 2.54)^2 \frac{1}{4} * 3.14 = 0.317\ cm^2$

Note: ~~This specimen has a longer round section.~~ extra surface area

~~About 1.0 cm~~ depth ~~more of the round section was in electrolyte during the test. (1.0 cm more immersed than usual)~~

07/20/01

coupon: 875°F, 12 hr aged

Start wt: 39.89902 End wt: 39.88822 g

Start pH: 5.92 End pH: 7.0

Solution 0.01 M, 1.1671 g in 2 L DI Wat.

Lot # 010166

12:00 Heating and N_2 ~~air~~ bubbling started.

J.y. 12/13/01

16:00 $T_{G.m.}$ = 95°C $E_{o.p.}$ = −0.437 V_{SCE}

J.y. 07/20/01

E_{pt} = +0.180 ~~mV/SCE~~ V_{SCE}

17:53 $T_{G.m.}$ = 95°C $E_{o.p.}$ = −0.422 V_{SCE}

E_{pt} = +0.169 V_{SCE}

17:53 Run started.

File: C220720a.Cor

07/21/01

12:11 $T_{G.m.}$ = 95°C $E_{o.p.}$ = +18.8 mV_{SCE} E_{pt} = +164 mV_{SCE}

Heating stopped.

Crevice corrosion observed under most of the crevice feet.

J. Yang 4/25/02

07/23/01

870°F 8 hr aged.

Start wt: 31.30317 End wt: 31.29321

Start pH: 6.25 End pH: 6.39

Solution: 0.01 M 1.168 g in 2 L DI W.

Lot # 010166

13:00 Heating + N_2 bubbling started.

17:08 $T_{G.m.}$ = 95°C, $E_{o.p.}$ = −0.2918 V_{SCE}, E_{pt} = +0.115 V_{SCE}

17:20 Run started

File: C-22-0723a.Cor

07/24/01

8:40 $T_{G.m.}$ = 95°C, $E_{o.p}$ = −15.6 mV_{SCE}, E_{pt} = +221.5 mV_{SCE}

Crevice corrosion observed on one side:

under all crevice feet

on the other side

under half of the crevice feet.

Note: this coupon is thinner than others. (0.85 cm). Other specimen thickness is 1.2 cm.

J. Yang 4/25/02

Compon C-22 870°C, 2hr aged

St.wt. 36.36781 End wt: 36.35900
St. pH. 6.24 after stir End pH: 6.51
Solution 0.01 M NaCl
~~0.1~~ d.y. 07/24/01
1.168 g in 2 L D.I. water
lot # 010166.

12:50 Heating and N_2 bubbling started.

16:51 $T_{G.M.}$ = 95°C $E_{o.p.}$ = -0.324 V_{SCE} ; E_{pt} = +0.108 V_{SCE}

Run started.

File: C-22-0724a.Cor

07/25/01
8:12 $T_{G.M.}$ = 95°C, $E_{o.p.}$ = -0.2 mV$_{SCE}$ E_{pt} = +0.315 V_{SCE}

Crevice corrosion observed under only 3 feet of the crevices.

d. yang
4/25/02

Compon ~~weld~~ C-22 870°C, ~~8~~ 12 hrs aged. d.y. 07/25/01

~~Start~~ Wt: 38.8974 g End wt: 38.88461

St. pH: 6.40 d.y. 12/13/01 End pH: 6.70

14:30 heating started, ~~air~~ N_2 bubbling started.

17:30 $T_{G.M.}$ = 94.5°C $E_{o.p.}$ = -0.348 V_{SCE}, E_{pt} = +0.219 V_{SCE}

Run started

File: C-22-0725a.Cor

07/26/01
7:05 $T_{G.M.}$ = 95°C, $E_{o.p.}$ = -0.024 V_{SCE}, E_{pt} = 0.320 V_{SCE}

Crevice corrosion observed under most of the crevice feet.

d. yang
4/25/02

Open Circuit Potential Measurement

Specimens : C-22 625 825 All Specimens In Cell #1

C-22 2277-8-3175 600 Grit Finish

Start wt = 12.441g OHaus Precision Standard SN# 2883 Cal ~~9-2-00~~ 3-2-01 8-1-01 8/10

End wt = ~~12.213~~ 8/10 8-1-01 12.418g

625 600 Grit Finish

Start wt = 12.213g OHaus Precision Standard SN# 2883 Cal ~~9-2-00~~ 3-2-01 8-1-01 8/13

End wt = 12.194g

825 600 Grit Finish

Start wt = 11.713g OHaus Precision Standard SN# 2883 Cal 3-2-01

End wt = 12.065g

Solution : 1000 ppm Cl - 20 ppm SO_4 - 10 ppm NO_3

4/ 8/16 8-1-01 2 ppm F^- 2000 mls Prepared As Follows

3.039g NaCl Lot # 010166

40 mls of .1m HCl Solution

40 mls of SO_4 } Stock Solutions

20 mls of NO_3 } Pg # 145

4 mls of F^- } All made on 5-29-01

+ DI water To 2000 mls

Solution Bubbled with Zero Air

Start PH = 1.628 Fisher Accumet 950 meter SN# 3340 7/24/01 Cal

End PH = 1.589

Temperature : 95°C Hg Thermometer SN# E98-273 Cal 1/29/01

Reference : Fisher 13-620-52 SN# 0089766

Counter Electrode : PT Flag

Specimen Examination : C-22 - No Corrosion - Specimen looks Good - No Staining

625 - No Corrosion - Specimen looks Good - No Staining

825 - No Corrosion - Specimen looks Good - No Staining

Specimen Roo Holden Broke In Top of Specimen BKD

will Replace 825 Specimen

Test started 5-31-01

Test Ended 7-31-01 Repolish Specimens for Next Test [signature] 8-1-01

Cell #1 All measurements Taken with Keithley 617 SN# 0579628 Cal 2-22-01

	Date		C-22	625	825	PT Flag
	5-31-01	pm	+320 mv	+23 mv	+41 mv	+580 mv
	6-1-01	Am	+487 mv	+73 mv	+129 mv	+620 mv
	6-1-01	pm	+370 mv	+131 mv	+94 mv	+627 mv
	6-4-01	Am	+551 mv	+92 mv	+59 mv	+562 mv
	6-4-01	pm	+442 mv	+160 mv	+50 mv	+558 mv
	6-5-01	Am	+538 mv	+62 mv	+41 mv	+544 mv
	6-5-01	pm	+532 mv	+45 mv	+61 mv	+543 mv
	6-6-01	Am	+525 mv	+36 mv	+18 mv	+535 mv
	6-6-01	pm	+516 mv	+25 mv	+37 mv	+527 mv
New Air Tank (Zero Air) →	6-7-01	Am	+497 mv	+46 mv	+58 mv	+511 mv
	6-7-01	pm	+492 mv	+116 mv	+61 mv	+506 mv
	6-8-01	Am	+490 mv	+125 mv	+20 mv	+504 mv
	6-8-01	pm	+490 mv	+246 mv	+32 mv	+503 mv
	6-11-01	Am	+479 mv	+472 mv	+484 mv	+495 mv
	6-11-01	pm	+486 mv	+481 mv	-63 mv	+499 mv
	6-12-01	Am	~~358~~ 8-1-01 +358 mv	+503 mv	-56 mv	+501 mv
	6-12-01	pm	+486 mv	+510 mv	-98 mv	+498 mv
	6-13-01	Am	+ ~~358~~ 8-1-01 +308 mv	+483 mv	-41 mv	+494 mv
	6-13-01	pm	+480 mv	+478 mv	-36 mv	+490 mv
	6-14-01	Am	+474 mv	+471 mv	-38 mv	+486 mv
	6-14-01	pm	+451 mv	+467 mv	-36 mv	+483 mv
	6-15-01	Am	+461 mv	+458 mv	-74 mv	+479 mv
	6-15-01	pm	+452 mv	+455 mv	-36 mv	+474 mv
	6-18-01	Am	+439 mv	+437 mv	-54 mv	+456 mv
	6-18-01	pm	+435 mv	+434 mv	-36 mv	+454 mv
	6-19-01	Am	+430 mv	+424 mv	-5 mv	+450 mv
	6-19-01	pm	+427 mv	+418 mv	+109 mv	+449 mv
	6-20-01	Am	+238 mv	+429 mv	+370 mv	+453 mv
	6-20-01	pm	+233 mv	+436 mv	+445 mv	+461 mv
New Zero Air Tank →	6-21-01	Am	+448 mv	+421 mv	+453 mv	+465 mv
	6-21-01	pm	+451 mv	+430 mv	+378 mv	+465 mv
	6-22-01	Am	+446 mv	+395 mv	+316 mv	+463 mv
	6-22-01	pm	+447 mv	+382 mv	+345 mv	+460 mv

[signature] 8-1-01

Cell #1 All measurements taken with Keithley 617 SN#0579628 cal 2-22-01

Date		C-22	625	825	PT Flag
6-25-01	Am	+407 mv	+359 mv	+15 mv	+431
6-25-01	pm	+405 mv	+366 mv	+3 mv	+432 mv
6-26-01	Am	+238 mv	+345 mv	+8 mv	+434 mv
6-26-01	pm	+401 mv	+340 mv	-74 mv	+431 mv
6-27-01	Am	+402 mv	+353 mv	-43 mv	+432 mv
6-27-01	pm	+404 mv	+357 mv	-75 mv	+433 mv
6-28-01	Am	+402 mv	+375 mv	-76 mv	+433 mv
6-28-01	pm	+400 mv	+362 mv	-50 mv	+428 mv
6-29-01	Am	+403 mv	+366 mv	-39 mv	+434 mv
6-29-01	pm	+400 mv	+363 mv	-71 mv	+428 mv
7-2-01	Am	+408 mv	+425 mv	-76 mv	+435 mv
7-2-01	pm	+407 mv	+424 mv	-75 mv	+435 mv
7-3-01	Am	+410 mv	+425 mv	-51 mv	+432 mv
7-3-01	pm	+410 mv	+426 mv	-62 mv	+434 mv
7-5-01	Am	+406 mv	+421 mv	-31 mv	+433 mv
7-5-01	pm	+404 mv	+420 mv	-88 mv	+430 mv
7-6-01	Am	+405 mv	+422 mv	-55 mv	+432 mv
7-6-01	pm	+402 mv	+421 mv	+85 mv	+431 mv
7-9-01	Am	+407 mv	+424 mv	+46 mv	+434 mv
7-9-01	pm	+401 mv	+424 mv	+36 mv	+433 mv
7-10-01	Am	+408 mv	+425 mv	-12 mv	+434 mv
7-10-01	pm	+406 mv	+422 mv	-21 mv	+432 mv
7-11-01	Am	+253 mv	+421 mv	-14 mv	+431 mv
7-11-01	pm	+183 mv	+422 mv	-46 mv	+430 mv
7-12-01	Am	+402 mv	+423 mv	-5 mv	+431 mv
7-12-01	pm	+407 mv	+425 mv	-51 mv	+433 mv
7-13-01	Am	+245 mv	+426 mv	-86 mv	+435 mv
7-13-01	pm	+406 mv	+425 mv	-51 mv	+434 mv
7-16-01	Am	+399 mv	+425 mv	-4 mv	+433 mv
7-16-01	pm	+401 mv	+425 mv	+16 mv	+434 mv
New zero Air Tank → 7-17-01	AM	+402 mv	+424 mv	-5 mv	+433 mv
7-17-01	pm	+413 mv	+431 mv	-51 mv	+438 mv

8-1-01

Cell #1 All measurements taken with Keithley 617 SN#0579628 cal 2-22-01

Date		C-22	625	825	PT Flag
7-18-01	Am	+257 mv	+424 mv	-54 mv	+432 mv
7-18-01	pm	+186 mv	+416 mv	-47 mv	+426 mv
7-19-01	Am	+399 mv	+421 mv	-89 mv	+430 mv
7-19-01	pm	+402 mv	+420 mv	-79 mv	+431 mv
7-20-01	Am	+400 mv	+422 mv	-36 mv	+431 mv
7-20-01	pm	+406 mv	+426 mv	-71 mv	+431 mv
7-23-01	Am	+398 mv	+420 mv	-13 mv	+434 mv
7-23-01	pm	+399 mv	+415 mv	-12 mv	+433 mv
7-24-01	Am	+189 mv	+419 mv	-34 mv	+433 mv
7-24-01	pm	+398 mv	+416 mv	+18 mv	+432 mv
7-25-01	Am	+401 mv	+415 mv	+10 mv	+432 mv
7-25-01	pm	+400 mv	+420 mv	+7 mv	+433 mv
7-26-01	Am	+395 mv	+422 mv	-3 mv	+432 mv
7-26-01	pm	+402 mv	+418 mv	-8 mv	+431 mv
7-27-01	Am	+224 mv	+421 mv	+5 mv	+433 mv
7-27-01	pm	+391 mv	+420 mv	+9 mv	+433 mv
7-30-01	Am	+407 mv	+424 mv	+71 mv	+433 mv
7-30-01	pm	+399 mv	+424 mv	+97 mv	+436 mv
7-31-01	Am	+402 mv	+425 mv	+42 mv	+437 mv

Test Ended. 7-31-01 pm

8-1-01

Open Circuit Potential Measurements

Specimens : C-22 #1 #2 #3 All Specimens In Cell #2

#1 C-22 2277-8-3175 600 Grit Finish

Start wt 12.121g OHaus Precision Standard SN# 2883 cal 3/2/01

End wt 12.117g

#2 C-22 2277-8-3175 600 Grit Finish

Start wt 12.455g OHaus Precision Standard SN# 2883 cal 3/2/01

End wt 12.449

#3 C-22 2277-8-3175 600 Grit Finish on Specimen

Start wt 12.536g OHaus Precision Standard SN# 2883 cal 3/2/01

End wt 12.503

Solution 1000 ppm Cl - 20 ppm SO_4 - 10 ppm NO_3

2 ppm F^- 2000 mls Prepared As Follows

3.040g NaCl Lot# 010166

40 mls of 1m HCl Solution

40 mls SO_4 } Stock Solutions

20 mls NO_3 } pg # 145

4 mls of F^- } All Prepared on 5-29-01

+ DI water To 2000 mls

Solution Bubbled with Zero Air

Start PH : 1.632 Fisher Accumet 950 meter SN# 3740 cal 7/24/01

End PH = 1.542

Temperature: 95°C Hg Thermometer SN# A-20000-127

Reference: Fisher 13-620-52 SN# 0066119

Counter Electrode: PT Flag

Specimen Examination: C-22 All C-22 Specimens look Good

No Corrosion - No Staining - Repolish for Next Test

Test Started 5-31-01

Test Ended 7-31-01

6-1-01

Cell #2 All measurements Taken with Keithley 617 SN# 0579628 cal 2-22-01

All C-22 Specimens

	Date		#1	#2	#3	PT Flag
	5-31-01	PM	+138 mV	+89 mV	+85 mV	+531 mV
	6-1-01	AM	+45 mV	+101 mV	+96 mV	+500 mV
	6-1-01	PM	+23 mV	+108 mV	+79 mV	+495 mV
	6-4-01	AM	+30 mV	+161 mV	+92 mV	+458 mV
	6-4-01	PM	+16 mV	+158 mV	+161 mV	+462 mV
	6-5-01	AM	+38 mV	+145 mV	+161 mV	+444 mV
	6-5-01	PM	+34 mV	+134 mV	+139 mV	+449 mV
	6-6-01	AM	+31 mV	+130 mV	+188 mV	+460 mV
	6-6-01	PM	+65 mV	+18 mV	+197 mV	+461 mV
	6-7-01	AM	+24 mV	+50 mV	+194 mV	+456 mV
New Zero Air Tank →	6-7-01	PM	+18 mV	+63 mV	+203 mV	+452 mV
	6-8-01	AM	+11 mV	+7 mV	+206 mV	+452 mV
	6-8-01	PM	+11 mV	+13 mV	+216 mV	+454 mV
	6-11-01	AM	+220 mV	+169 mV	+257 mV	+462 mV
	6-11-01	PM	+272 mV	+122 mV	+292 mV	+468 mV
	6-12-01	AM	+278 mV	+87 mV	+280 mV	+459 mV
	6-12-01	PM	+293 mV	+100 mV	+281 mV	+458 mV
	6-13-01	AM	+294 mV	+104 mV	+283 mV	+454 mV
	6-13-01	PM	+303 mV	+119 mV	+280 mV	+458 mV
	6-14-01	AM	+310 mV	+193 mV	+299 mV	+459 mV
	6-14-01	PM	+201 mV	+150 mV	+307 mV	+459 mV
	6-15-01	AM	+115 mV	+169 mV	+310 mV	+438 mV
	6-15-01	PM	+303 mV	+175 mV	+309 mV	+458 mV
	6-18-01	AM	+230 mV	+228 mV	+326 mV	+461 mV
	6-18-01	PM	+238 mV	+231 mV	+328 mV	+460 mV
	6-19-01	AM	+287 mV	+242 mV	+332 mV	+461 mV
	6-19-01	PM	+320 mV	+259 mV	+330 mV	+460 mV
	6-20-01	AM	+334 mV	+265 mV	+336 mV	+461 mV
	6-20-01	PM	+323 mV	+275 mV	+342 mV	+466 mV
New Zero Air Tank →	6-21-01	AM	+349 mV	+267 mV	+345 mV	+461 mV
	6-21-01	PM	+351 mV	+268 mV	+345 mV	+461 mV
	6-22-01	AM	+353 mV	+271 mV	+350 mV	+462 mV
	6-22-01	PM	+354 mV	+265 mV	+348 mV	+460 mV

8-1-01

Cell #2 All measurements Taken with Keithley 617 sn#0579628 cal 2-22-01

All C-22 Specimens

Date		#1	#2	#3	PT Flag
6-25-01	AM	+287 mv	+271 mv	+355 mv	+460 mv
6-25-01	PM	+266 mv	+271 mv	+350 mv	+459 mv
6-26-01	AM	+265 mv	+279 mv	+355 mv	+460 mv
6-26-01	PM	+202 mv	+283 mv	+352 mv	+458 mv
6-27-01	AM	+201 mv	+285 mv	+353 mv	+459 mv
6-27-01	PM	+143 mv	+287 mv	+351 mv	+458 mv
6-28-01	AM	+125 mv	+286 mv	+355 mv	+458 mv
6-28-01	PM	+115 mv	+283 mv	+351 mv	+456 mv
6-29-01	AM	+109 mv	+287 mv	+353 mv	+457 mv
6-29-01	PM	+101 mv	+284 mv	+352 mv	+456 mv
7-2-01	AM	+92 mv	+287 mv	+355 mv	+455 mv
7-2-01	PM	+67 mv	+287 mv	+353 mv	+454 mv
7-3-01	AM	+56 mv	+288 mv	+350 mv	+453 mv
7-3-01	PM	+17 mv	+285 mv	+350 mv	+453 mv
7-5-01	AM	+68 mv	+293 mv	+349 mv	+453 mv
7-5-01	PM	+51 mv	+292 mv	+351 mv	+453 mv
7-6-01	AM	+77 mv	+286 mv	+349 mv	+454 mv
7-6-01	PM	+45 mv	+292 mv	+352 mv	+452 mv
7-9-01	AM	+8 mv	+280 mv	+356 mv	+451 mv
7-9-01	PM	+6 mv	+282 mv	+353 mv	+451 mv
7-10-01	AM	-7 mv	+275 mv	+355 mv	+451 mv
7-10-01	PM	-19 mv	+279 mv	+357 mv	+451 mv
7-11-01	AM	-3 mv	+285 mv	+359 mv	+450 mv
7-11-01	PM	+24 mv	+276 mv	+350 mv	+451 mv
7-12-01	AM	+21 mv	+274 mv	+360 mv	+451 mv
7-12-01	PM	+4 mv	+281 mv	+362 mv	+451 mv
7-13-01	AM	+74 mv	+274 mv	+573 mv	+453 mv
7-13-01	PM	+156 mv	+284 mv	+366 mv	+453 mv
7-16-01	AM	+55 mv	+290 mv	+370 mv	+452 mv
7-16-01	PM	+51 mv	+284 mv	+366 mv	+452 mv
New Zero Air Tank 7 7-17-01	AM	+85 mv	+244 mv	+365 mv	+452 mv
7-17-01	PM	+126 mv	+301 mv	+371 mv	+453 mv

[signature] 8-1-01

Cell #2 All measurements Taken with Keithley 617 sn#0579628 / Cal 2-22-01

All Specimens C-22

Date		#1	#2	#3	PT Flag
7-18-01	AM	+41 mv	+302 mv	+355 mv	+455 mv
7-18-01	PM	+130 mv	+297 mv	+377 mv	+454 mv
7-19-01	AM	+53 mv	+293 mv	+374 mv	+455 mv
7-19-01	PM	+132 mv	+307 mv	+377 mv	+455 mv
7-20-01	AM	+58 mv	+301 mv	+381 mv	+455 mv
7-20-01	PM	+162 mv	+300 mv	+382 mv	+455 mv
7-23-01	AM	+172 mv	+316 mv	+384 mv	+455 mv
7-23-01	PM	+60 mv	+311 mv	+379 mv	+456 mv
7-24-01	AM	+42 mv	+305 mv	+382 mv	+457 mv
7-24-01	PM	+76 mv	+303 mv	+386 mv	+455 mv
7-25-01	AM	+130 mv	+310 mv	+381 mv	+455 mv
7-25-01	PM	+69 mv	+308 mv	+385 mv	+456 mv
7-26-01	AM	+103 mv	+309 mv	+385 mv	+455 mv
7-26-01	PM	+89 mv	+315 mv	+379 mv	+456 mv
7-27-01	AM	+21 mv	+307 mv	+379 mv	+455 mv
7-27-01	PM	+22 mv	+308 mv	+385 mv	+452 mv
7-30-01	AM	+29 mv	~~+36~~ +318 mv BKD 8-1-01	+386 mv	+457 mv
7-30-01	PM	+158 mv	+316 mv	+342 mv	+457 mv
7-31-01	AM	+89 mv	+314 mv	+393 mv	+456 mv

Test Ended 7-31-01 PM

[signature] 8-1-01

Passive Current Density

Specimen : C-22 Block
Polished Specimen To 2000 Grit Finish

No weight measurements Taken

Solution : 1000 ppm Cl · 85 ppm HCO_3 · 20 ppm SO_4
10 ppm NO_3 · 2 ppm F · 2000 mls Prepared As Follows

3.296 g NaCl Lot # 006924
0.245 g $NaHCO_3$ Lot # ~~923337A~~ #92337A
40 mls SO_4 } Stock Solutions
20 mls NO_3 } from Pg #145
4 mls F^- } Prepared 8-10-01
+ DI water To 2000 mls

Start PH 8.328 Fisher Accumet 950 meter SN# 3340 Cal 7/24/01
End PH 9.161 Fisher PH Probe 13-620-296 SN# 1160208

Temperature : 95°C Hg Thermometer SN# C96-377 Cal 7/16/01

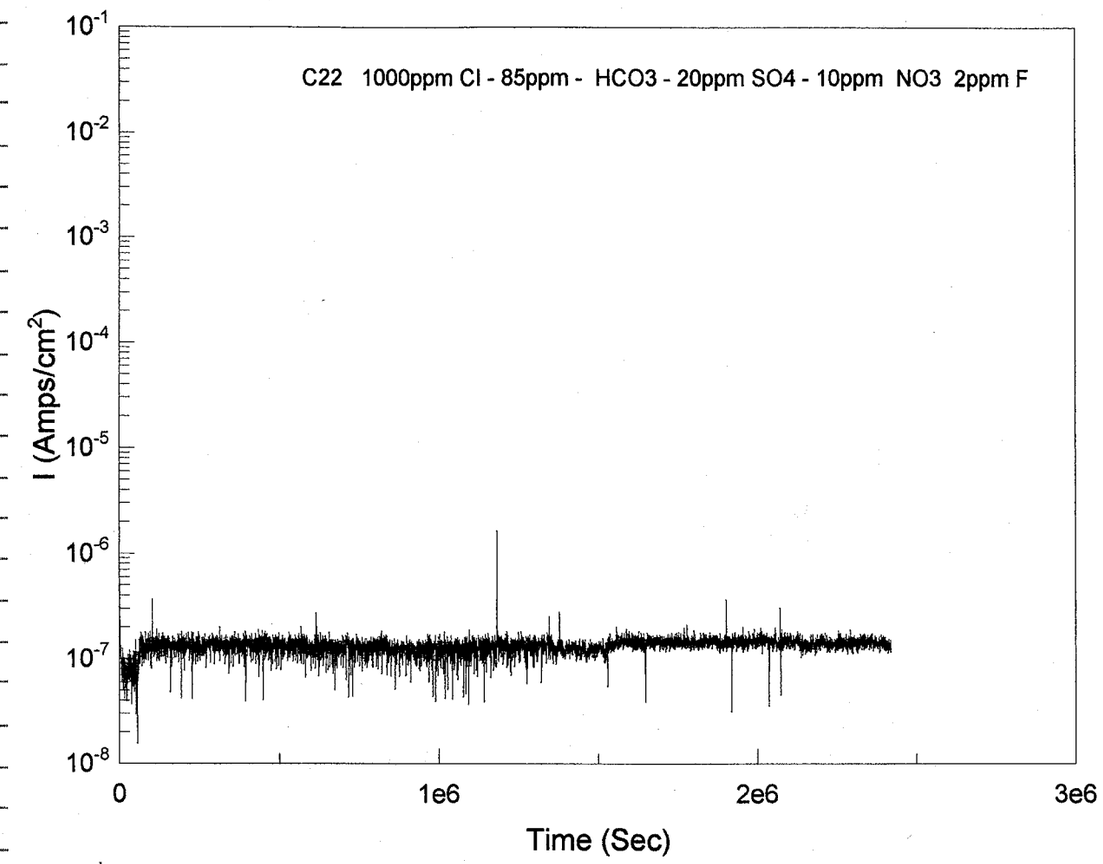
Potentiostat : Solartron 1287

Reference : Fisher 13-620-51 SN# 8027166

Econn : -459 mv Keithley SN# 537418 Cal 2/22/01
Ept -300 mv

Specimen Examination : No Signs of Corrosion - Build up of material on Stem of Specimen

8/10/01



9/11/01

C22113C

Specimen : C-22 WelNGD
Start wt : 39.50161 g Sartorious Genius SN# 12809699 Cal 6/22/01
End wt : ~~39.2~~ 39.49437 g
2 PTFE Crevice washers Attached At 50 In-Oz Using
Proto 6104 SN# 314047 Cal 6/4/01

Solution 4 m Cl⁻ 85 ppm HCO_3 20 ppm SO_4
10 ppm NO_3 2 ppm F^- 2000 mls Prepared As Follows

467.58 g NaCl Lot# 006924
0.241 g $NaHCO_3$ Lot# 92337A
40 mls SO_4 } Stock Solution
20 mls NO_3 } Pg #145
4 mls F^- } Prepared 8-10-01
+ DI water To 2000 mls

Start PH : 7.536 Fisher Accumet 950 meter SN# 3340 Cal 7/24/01
End PH : 8.479 Fisher PH Probe 13-620-296 SN# 1100208

Temperature : 95°C Hg Thermometer SN# 1238002 Cal 1/10/01
Econn = -183 mv Keithley 617 SN# 537418 Cal 2/22/01
Ept = +208 mv
E Applied = +100 mv

Reference: Fisher 13-620-52 SN# 0066110
Test started : 8/14/01
Test Ended = Computer shutdown 8/31/01 Restart File = C22113D
Computer shutdown 9/1/01 Restart File = C22113E
Test Stopped 10-15-01

Specimen Examination - No Sign of Crevice Corrosion
mild staining on Specimen [illegible] 10-15-01

[illegible]
8-14-01

C22112D

Specimen : C-22 WGLPCD
Base Metal 2277-S-3235 Filler : XX1045 0611
Start wt : 39.41756 g Sartorious Genius SN# 12809699 Cal 6/22/01
End wt : 39.41928 g
2 PTFE Crevice washers Attached At 50-In-Oz Using
Proto 6104 SN# 314047 Cal 6/4/01

Solution 4 m Cl⁻ 85 ppm HCO_3 20 ppm SO_4
10 ppm NO_3 2 ppm F^- 2000 mls Prepared As Follows

467.56 g NaCl Lot# 006924
0.243 g $NaHCO_3$ Lot# 92337A
40 mls SO_4 } Stock Solutions
20 mls NO_3 } From Pg #145
4 mls F^- } Prepared 8-10-01
+ DI water To 2000 mls

Start PH : 7.519 Fisher Accumet 950 meter SN# 3340 Cal 7/24/01
End PH = 8.441 Fisher PH Probe 13-620-296 SN# 1100208

Temperature : ~~950~~ 95°C Hg Thermometer SN# A2000-130 Cal 5/29/01
Econn = -182 mv Keithley 617 SN# 537418 Cal 2/22/01
Ept = +220 mv
E Applied = +150 mv

Reference = Fisher 13-620-52 SN# 0089771
Test started = 8/14/01
Test Ended = Computer shutdown 8/31/01 Restart File = C22112E
Computer shutdown 9/1/01 Restart File = C22112F
Test Stopped 10-15-01

Specimen Examination - No Sign of Crevice Corrosion
Mild staining on All surfaces - Buildup of
material on Stem Cause of wt Gain
[illegible] 10-15-01

[illegible]
8-14-01

C22114A
New Specimen
Specimen: C-22 2277-8-3175
Start wt: 39.16131 g Sartorious Genius SN# 12809099 Cal 6/22/01
End wt: 39.16173 g
2 PTFE Crevice Washers Attached At 50 In-Oz Using
Proto 6104 SN# 314047 Cal 6/4/01

Solution: 4m Cl^- 85 ppm HCO_3 20 ppm SO_4
10 ppm NO_3 2 ppm F^- 2000 mls Prepared As Follows

467.58 g NaCl Lot# 006924
0.245 g $NaHCO_3$ Lot# 923374
40 mls SO_4 } stock solutions
20 mls NO_3 } From Pg #145
4 mls F^- } Prepared on 8-10-01
+ DI water To 2000 mls

Start PH = 7.491 Fisher Accumet 950 SN# 3340 Cal 7/24/01
End PH = 8.579 Fisher PH Probe 13-620-296 SN# 100208
Cal 6-19-01 ~~Cal 8/20/01~~ 8-14-01
Temperature: 95°C Hg Thermometer SN# H98-179
Econn = -61 mv Keithley 617 SN# 537418 Cal 2/22/01
Ept = +200 mv
E Applied = +250 mv

Reference: Fisher 13-620-52 SN# 0066128
Test Started = 8/14/01
Test Ended = Computer shutdown 8/31/01 Restart File = C22114b
Computer shutdown 9/1/01 Restart File = C22114c
Test stopped 10-15-01

Specimen Examination - No Sign of Crevice Corrosion
Mild staining on Surfaces of Specimen
10-15-01 8-14-01

C2213L

Specimen: C-22 2277-8-3175
Start wt = 47.24443 g Sartorious Genius SN# 12809099 Cal 6/22/01
End wt = 47.22315 g
2 PTFE Crevice Washers Attached At 50 In-Oz Using
Proto 6104 SN# 314047 Cal 6/4/01

Solution: 4m Cl^- 85 ppm HCO_3 20 ppm SO_4
10 ppm NO_3 2 ppm F^- 2000 mls Prepared As Follows

467.55 g NaCl Lot# 006924
0.241 g $NaHCO_3$ Lot# 923374
40 mls SO_4 } stock solutions
20 mls NO_3 } From Pg #145
4 mls F^- } Prepared 8-10-01
+ DI water To 2000 mls

Start PH = 7.471 Fisher Accumet 950 meter SN# 3340 Cal 7/24/01
End PH = 8.738 Fisher PH Probe 13-620-296 SN# 100208

Temperature: 95°C Hg Thermometer SN# C96-783 Cal 5/1/01
Econn = -416 mv Keithley 617 SN# 537418 Cal 2/22/01
Ept = +170 mv
E Applied = Open Circuit

Solution Bubbled with Zero Air

Reference: Fisher 13-620-52 SN# 92500063
Test Started = 8/14/01
Test Ended = Computer shutdown 8/31/01 Restart File = C2213M
Computer shutdown 9/1/01 Restart File = C2213N
Test stopped 10-15-01

Specimen Examination - No Sign of Crevice Corrosion
mild staining on Specimen 10-15-01 8-14-01

OC825C1AJ

Specimen : 825 HM 4371 F6
Start wt = 39.29396g Sartorious Genius SN# 12809099 Cal 6/22/01
End wt = 39.29821g
2 PTFE Crevice Washers Attached At 50 In-Oz Using
Proto 6104 SN# 314047 Cal 6/4/01

Solution : 1000 ppm Cl^- 85 ppm HCO_3 20 ppm SO_4
10 ppm NO_3 2 ppm F^- 2000 mls Prepared As Follows

3.297g NaCl Lot# 006924
0.244g $NaHCO_3$ Lot# 92337A
40 mls SO_4 } Stock Solutions
20 mls NO_3 } From Pg #145
4 mls F^- } Prepared 8-10-01
+ DI water To 2000 mls

Start PH : 8.327 Fisher Accumet 950 meter SN# 3340 Cal 7/24/01
End PH = 9.211 Fisher PH Probe 13-620-296 SN# 100208

Temperature = 95°C Hg Thermometer SN# 183305 Cal 5/2/01
Econn = -91 mv Keithley 617 SN# 537418 Cal 2/22/01
Ept = +105 mv
E Applied = Open Circuit

Solution Bubbles with Zero Air

Reference : Fisher 13-620-52 SN# 9250047
Test Started : 8-14-01
Test Ended : Computer shutdown 8/31/01 Restart File = OC825C1AK
Computer shutdown 9/1/01 Restart File = OC825C1AL
Test Stopped 10-15-01

Specimen Examination: No Sign of Corrosion
Buildup of material on stem of Specimen
Cause of wt. Gain Bill Dod 10-15-01

Bill Dod 8-14-01

Repassivation Potential of Alloy C-22 #59

objective : See Pg # 184

Specimen : Alloy C-22 welded sample 600 Grit Finish
with 2 PTFE Crevice Washers Attached At 50 In-Oz Using
Proto 6104 SN# 314047 Cal 6/4/01

Start wt 39.50552g Sartorious SN# 12809099 Cal 6/22/01
End wt. 39.49458g

Solution : .1 m Cl
11.688g NaCl Lot# 015568
+ DI water To 2000 mls

Start PH : Not Taken Fisher Accumet 950 meter SN# 3340 Cal 7/24/01
End PH : 7.238 Probe 13-620-296 SN# 100208

Potentiostat : EG+G model # 273 SN# 41108
Counter Electrode : PT Flag
Reference : Fisher 13-620-52 SN# 0089741
Temperature : 95°C Hg Thermometer SN# 115749 Cal 1/29/01

Econn : -489 mv Keithley 617 SN# 0579628 Cal 2/22/01
Ept = +403 mv

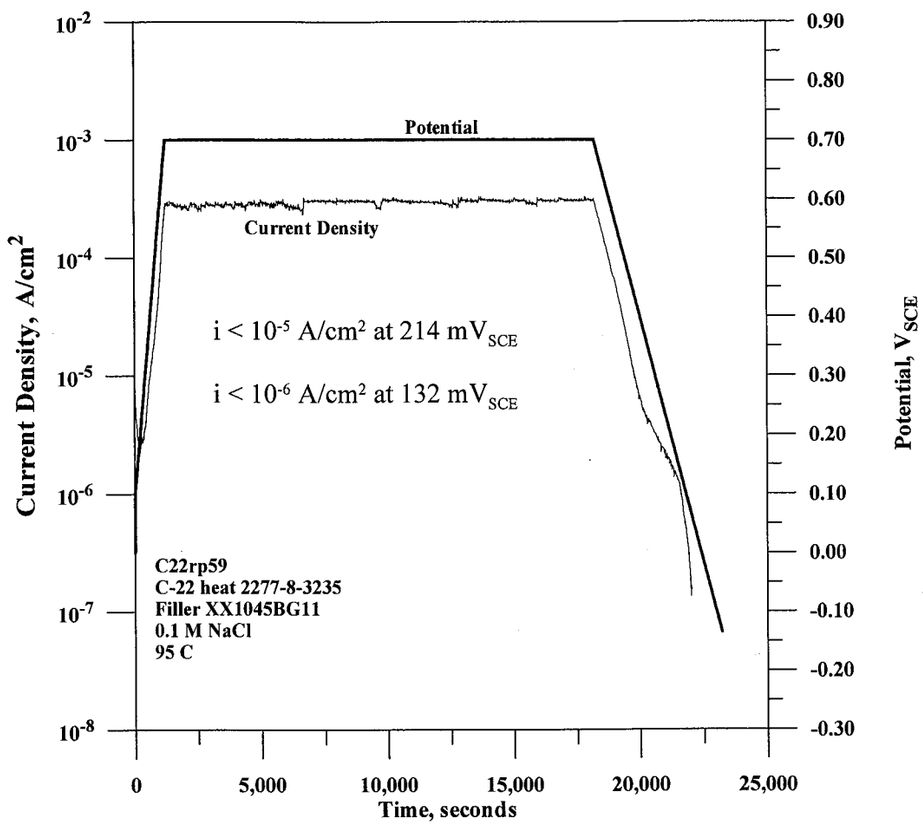
Solution Deaerated with 99.995% N_2

Specimen Examination : Crevice Corrosion on 1/24 feet
Gold tint staining on All surfaces of specimen - Staining
Is Darker on Both outside surfaces were welds Is Present

Graph Pg # 266

Data Saved As C22 RP 59

Bill Dod 8/31/01



B. K. [illegible] 8/31/01

Repassivation Potential of Alloy C-22

objective: See Pg #184

Specimen: Alloy C-22 welded sample 600 Grit Finish with 2 PTFE Crevice washer Attached At 50 In-Oz Using Proto 6104 SN# 314047 cal 6/4/01

start wt 38.86308g Sartorious SN#12809099 cal 6/22/01
End wt 38.84986g

Solution: .05m Cl
5.845g NaCl Lot# 015568
+ DI water To 2000 mls

Start PH 5.893g OKO 9 #01 Fisher Accumet 950 meter SN#3340 cal 7/20/01
End PH 6.702 Probe 13-620-296 SN# 1160208

Potentiostat: EG+G Model # 273 SN# 41108
Counter Electrode: PT Flag
Reference: Fisher 13-620-52 SN# 8203245
Temperature: 95°C Hg Thermometer SN# 115749 cal 1/29/01

Econn: -354 mV Keithley 617 SN# 0579628 cal 2/22/01
Ept: +19 mV

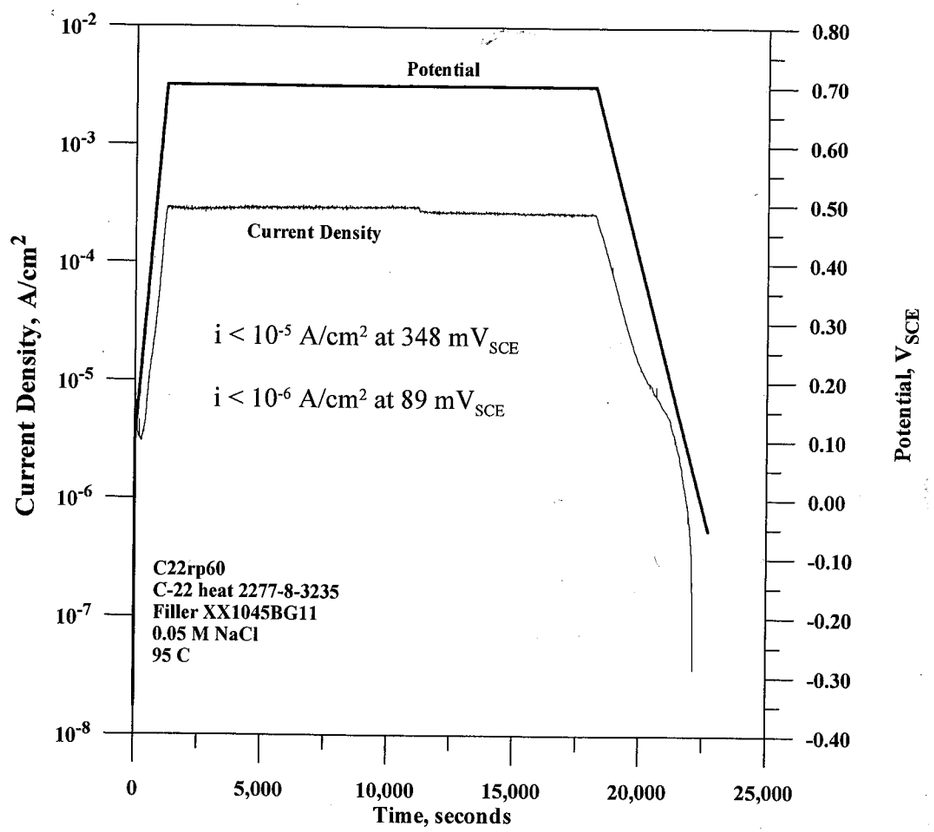
Solution Deaerated with 99.999% N_2

Specimen Examination: Crevice Corrosion on 11/24 feet Gold tint staining on All surfaces of Specimen. Staining Has Darker Tint were the weld Is located on outside surfaces of specimen

Graph Pg # 268

Data Saved As C22RP60

B. K. [illegible] 9-9-01



B. K. Dey 9/4/01

Repassivation Potential of Alloy C-22

objective : See Pg #184

Specimen : Alloy C-22 welded Sample 600 Grit Finish with 2 PTFE Crevice Washers Attached At 50 In-Oz Using Proto 6104 SN# 314047 cal 6/4/01

Start wt : 39.98582g Sartorious SN# 12809099 cal 6/22/01
End wt : 39.97934g

Solution : .5 m Cl
58.44g NaCl Lot# 015568
+ DI water To 2000mls

Start PH 6.522 Fishen Accumet 950 meter SN# 3340 cal 7/20/01
End PH 7.551 Probe 13-620-296 SN# 1100208

Potentiostat : EG&G model # 273 SN# 41108
Counter Electrode : PT Flag
Reference : Fishen 13-620-52 SN# 8203245
Temperature : 95°C Hg Thermometer SN# 115749 cal 1/29/01

Ecorr : -375 mv Keithley 617 SN# 0579628 cal 2/22/01
Ept : +119 mv

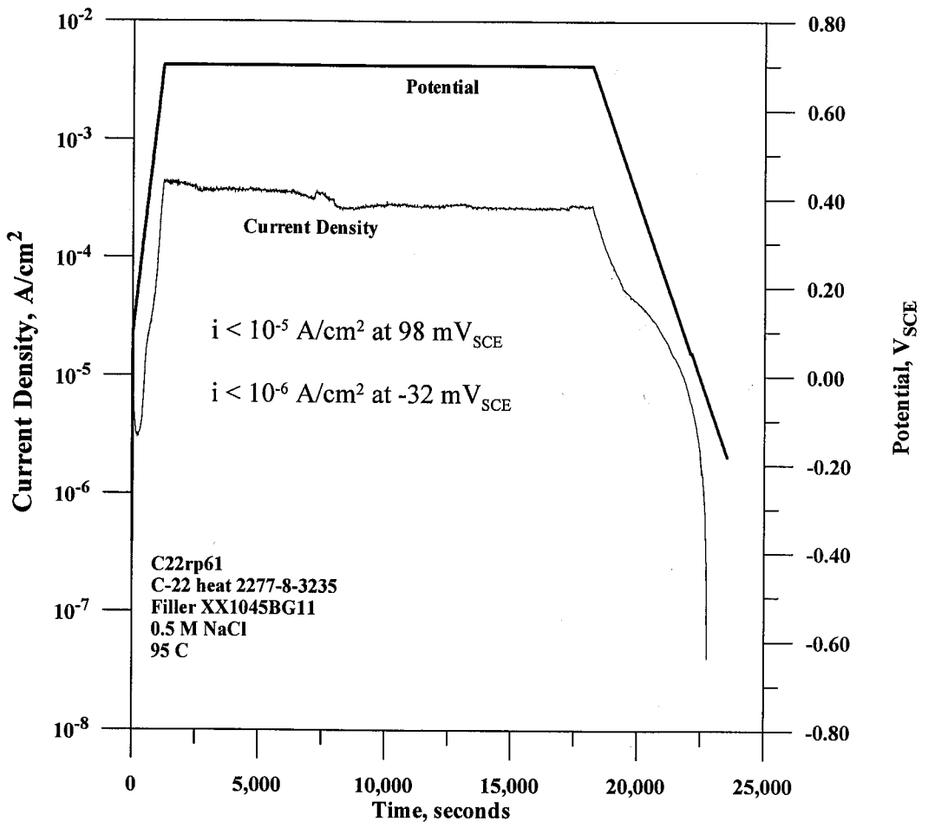
Solution Deaerated with 99.999% N_2

Specimen Examination : Crevice Corrosion on 7/24 feet Gold tint staining on All surfaces of specimen . Darker tint staining on outer surfaces were where Is present

Graph Pg #270 →

B. K. Dey 9/5/01

Data Saved As C-22 RP 61



9/5/01

Repassivation Potential of Alloy C-22

objective: See pg # 184

Specimen: Alloy C-22 welded Specimen 600 Grit Finish with 2 PTFE Crevice Washers Attached At 50 In-Oz Using Proto 6104 SN# 314047 cal 6/4/01

Start wt 40.18141g Sartorious SN# 12809099 cal 6/22/01
End wt 40.17768g

Solution .001 m Cl
.0588g NaCl Lot# 015568
+ DI water To 2000 mls

Start PH: 5.983 Fisher Accumet 950 meter SN# 3340 cal 7/20/01
End PH: 6.994 Probe 13-620-296 SN # 1100208

Potentiostat: EG+G model # 273 SN# 41108
Counter Electrode: PT Flag
Reference: Fisher 13-620-52 SN# 8203245
Temperature: 95°C Hg Thermometer SN# 115749 cal 1/29/01

Econ: ~~+361~~ -361 mv Keithley 617 SN# 0579628 cal 2/22/01
Ept = +159 mv

Solution Deaerated with 99.999% N_2

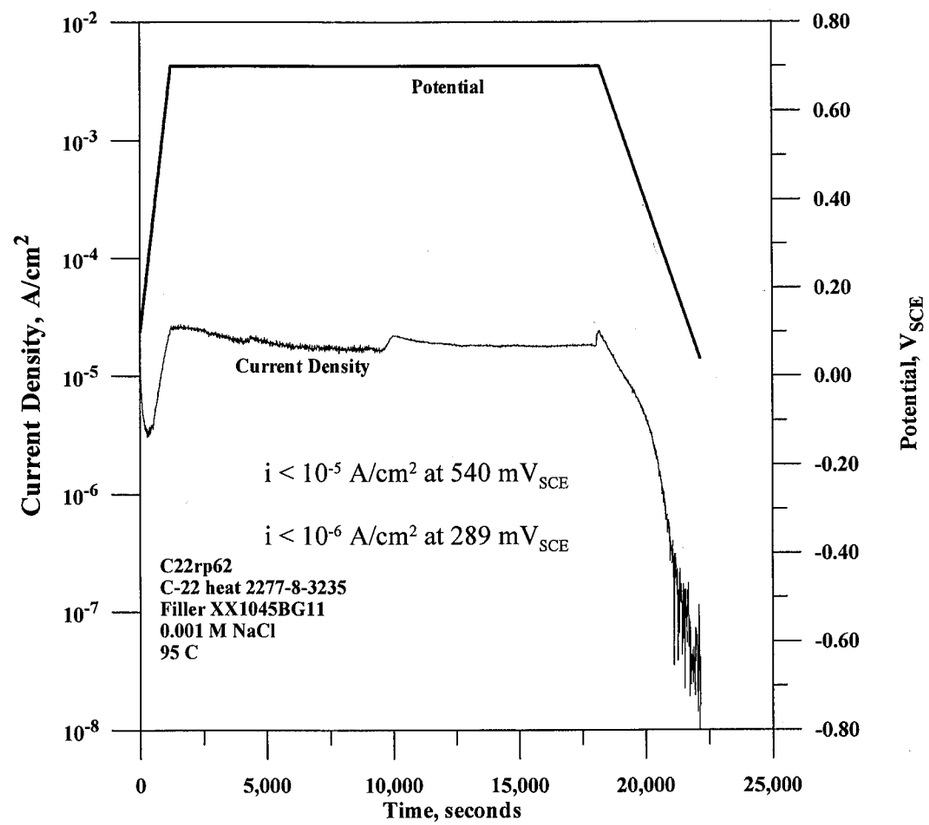
Specimen Examination: No Crevice Corrosion Noticed Under microscope examination Noticed 2 Spots on weld that were Not Crevice corrosion But were weld Inceptions

* Specimen Replished for further Testing

Graph Pg # 272 >

9-7-01

Data Saved As C22 Rp 62



9-7-01

Repassivation Potential of Alloy C-22

objective : See Pg #184

Specimen : Alloy C-22 welded specimen 600 Grit Finish with 2 PTFE Crevice Washers Attached At 50 In-Oz Using Proto 6104 SN# 314047 cal 6/4/01

Start wt 40.10445g Sartorious SN# 12809099 cal 6/27/01
End wt. 40.09831g

Solution : .005m Cl
.58491g NaCl Lot# 015568
+ DI water To 2000mls

Start PH 6.843 Fisher Accumet 950 meter SN# 3340 Cal 7/20/01
End PH 6.937 Probe 13-620-296 SN# 1100208

Potentiostat : EG+G model #273 SN# 41108
Counter Electrode : PT Flag
Reference : Fisher 13-620-52 SN# 8203245
Temperature : 95°C Hg Thermometer SN# 115749 cal 1/29/01

Ecorr ~~+344~~ -344 mv Keithley 617 SN# 0579628 cal 2/22/01
Ept + 170mv

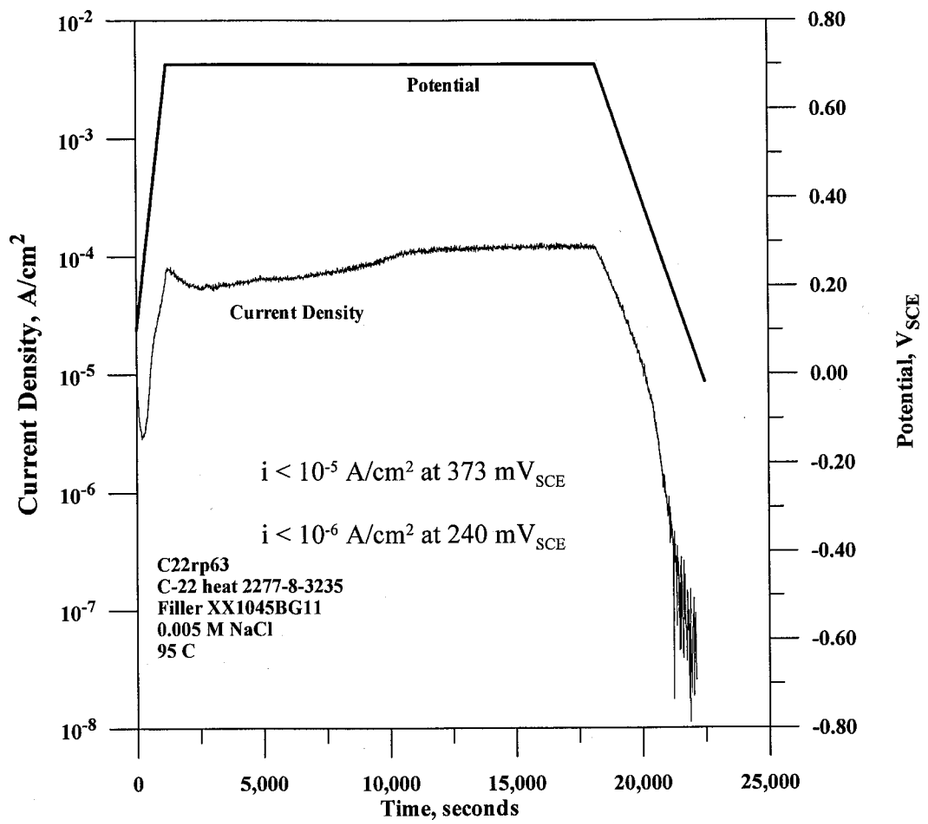
Solution Deaerated with 99.999% N_2

Specimen Examination : Crevice Corrosion on 2/24 feet
Gold tint staining on All surfaces of Specimen

Graph Pg # 2747

Data Saved As C22 RP 63

9/10/01



7/10/01

Repassivation Potential of Alloy C-22

objective : See pg #184

Specimen : Alloy C-22 welded Sample 600 Grit Finish
with 2 PTFE Crevice washers Attached At 50 In-Oz
Using Proto 6104 SN# 314047 cal 6/4/01

start wt 38.31806g Santorious SN# 12809099 cal 6/22/01
End wt 38.29822g

Solution : .5m NaCl + 2.0m $NaNO_3$
58.44g NaCl Lot # 015568
339.98g $NaNO_3$ Lot # 006604
+ DI water To 2000mls

Start PH 6.256 Fisher Accumet 950 meter SN# 3340 cal 7/20/01
End PH 7.971 Probe 13-620-296 SN# 1100208

Potentiostat : EG+G model #273 SN# 41108
Counter Electrode : PT Flag
Reference : Fisher 13-620-52 SN# 8203245
Temperature : 95°C Hg Thermometer SN# 115749 1/29/01

Econn: ~~+470~~ mv -470 Keithley 617 SN# 0579628 cal 2/22/01
Ept - +86 mv

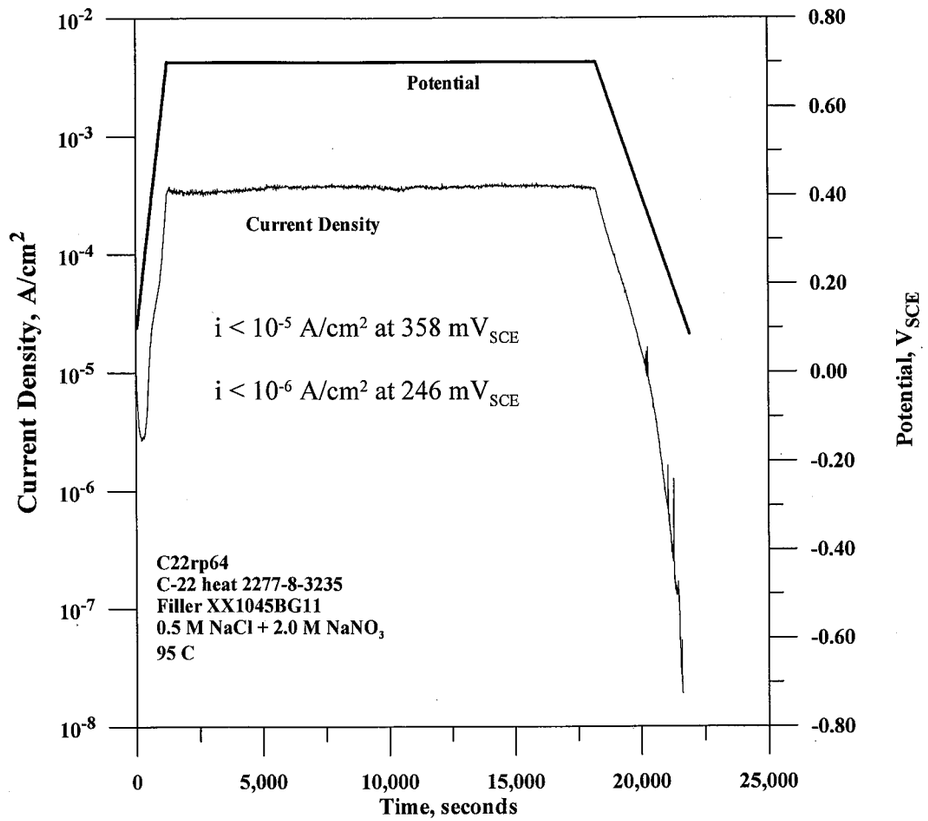
Solution Deaerated with 99.999% N_2

Specimen Examination : No Crevice Corrosion Noticed
Gold tint staining on All surfaces of specimen

* Specimen Not Saved Repolished for further Tests Graph Pg #276 →

9-11-01

Data Saved As C22 RP 64



9/11/01

Repassivation Potential of Alloy C-22

objective: See Pg #184

Specimen: Alloy C-22 welded Sample 600 Grit Finish with 2 PTFE Crevice Washer Attached At 50 In-Oz Using 6104 SN# 314047 cal 6/4/01

Start wt 38.01059g Sartorious SN# 12809099 cal 6/22/01
End wt 37.99021g

Solution: .5m NaCl + 1.0m $NaNO_3$
58.44g NaCl Lot # 015568
169.99g $NaNO_3$ Lot # 006604
+ DI water To 2000mls

Start PH 6.577 Fisher Accumet 950 meter SN# 3340 cal 7/20/01
End PH Probe 13-620-296 SN# 1100208

Potentiostat: EG+G model #273 SN# 41108
Counter Electrode: PT Flag
Reference: Fisher 13-620-52 SN# 8203245
Temperature: 95°C Hg Thermometer SN# 115749 Cal 1/29/01

Econn = ~~+277~~ 210 mv -271 Keithley 617 SN# 0579628 cal 2/22/01
Ept = +400 mv

Solution Deaerated with 99.999% N_2

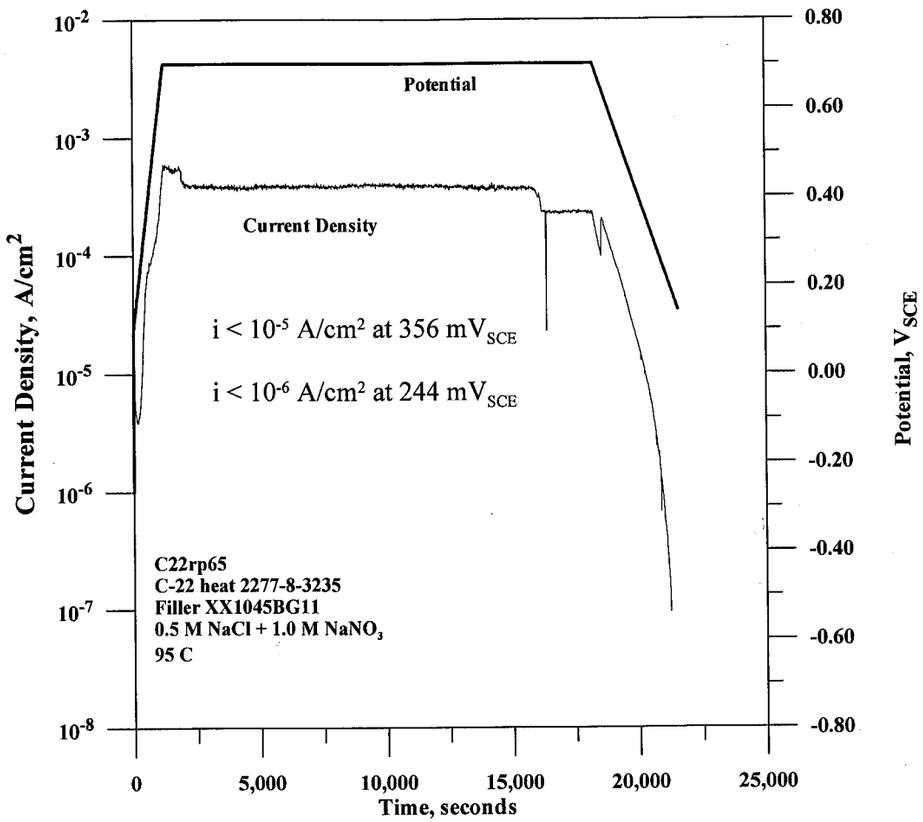
Specimen Examination: No Crevice Corrosion
Gold Tint staining on All surfaces of Specimen

* Specimen Not Saved Repolished for further Testing

Graph Pg #278 →

9/12/01

Data Saved As C22 RP 65



9/12/01

Repassivation Potential of Alloy C-22

objective : See Pg #184

Specimen : Alloy C-22 welded Sample 600 Grit Finish
with 2 PTFE Crevice washers Attached At 50 In-Oz
Using Proto 6104 SN#314047 cal 6/4/01

Start wt 38.25036 g Sartorious SN#12809099 cal 6/22/0
End wt 38.22686 g

Solution : .5 M NaCl + .5 M $NaNO_3$
58.44 g NaCl Lot # 00/5568
85.01 g $NaNO_3$ Lot # 006604
+ DI water To 2000mls

Start PH 7.016 Fisher Accumet 950 meter SN#3340 cal 7/20/0
End PH 7.768 Probe 13-620-296 SN#1100208

Potentiostat : EG+G model #273 SN#41108
Counter Electrode : PT Flag
Reference : Fisher 13-620-52 SN# 8203245
Temperature : 95°C Hg Thermometer SN# 115749 cal 1/29/01

Econn : ~330 mv Keithley 617 SN#0579628 cal 2/22/01
Ept : +34 mv

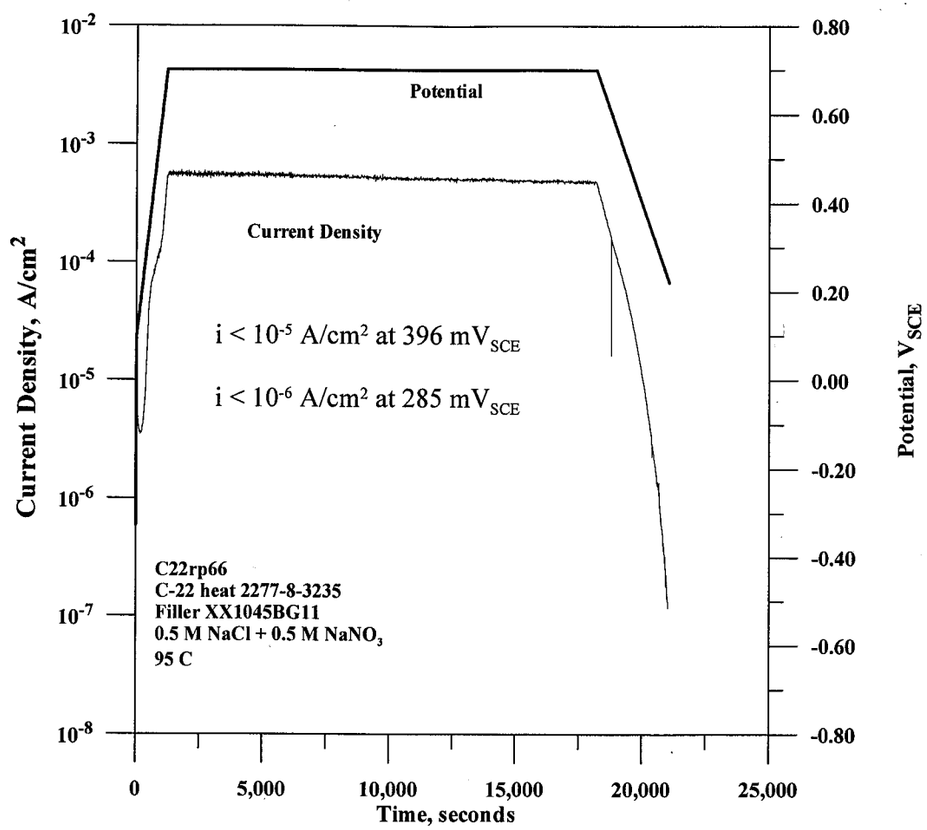
Solution Deaerated with 99.999% N_2

Specimen Examination : No Crevice Corrosion
Gold tint staining on All Surfaces of Specimen

* Specimen Not Saved Repolished for Further Tests Graph Pg #280 >

9/13/01

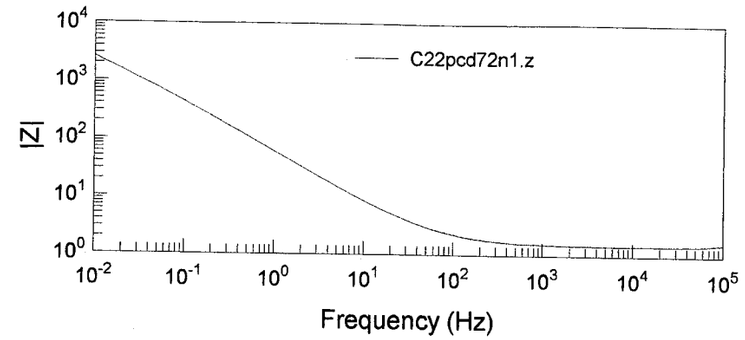
Data Saved As C22RP66

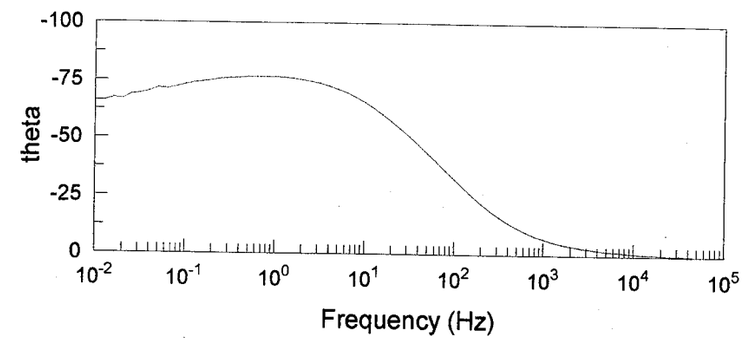


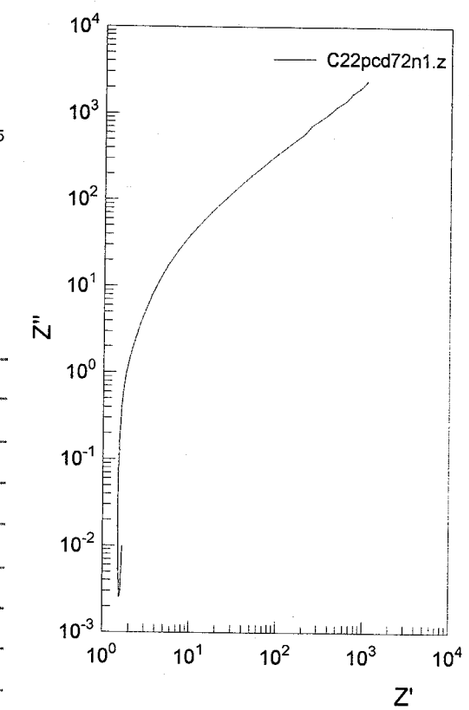
9/13/01

Impedence Testing on C-22 from Pg # 258

Prior To Starting Test



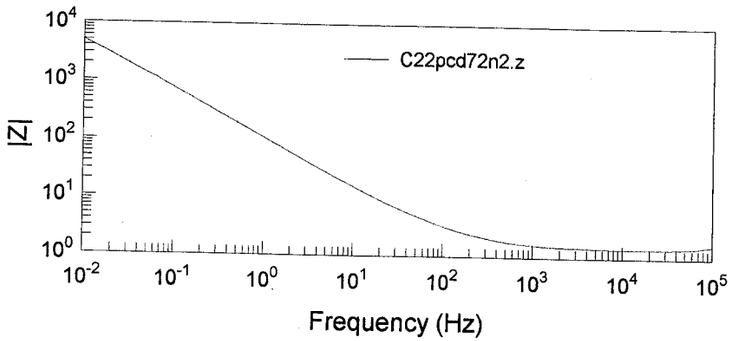


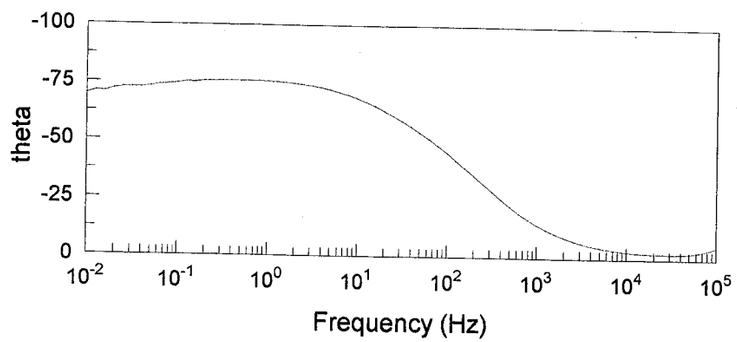


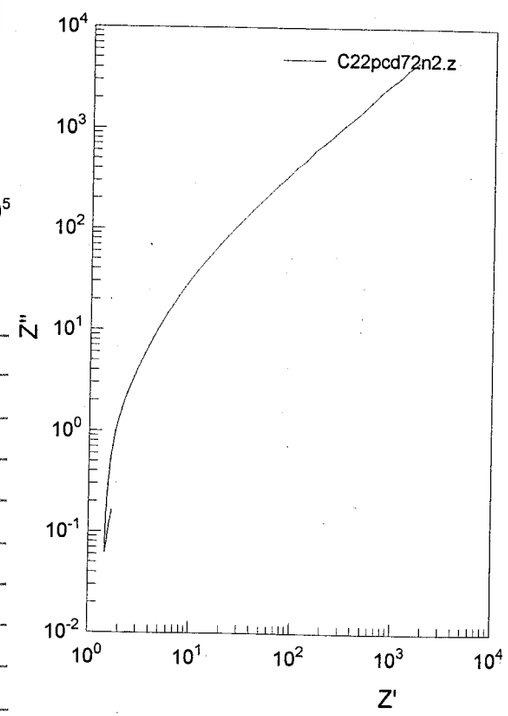
9/13/01

Impedance Testing on C-22 from Pg #258

After Test Run







9-13-01

Repassivation Potential of Alloy C-22

objective: See Pg #184

Specimen: Alloy C-22 welded specimen 600 Grit Finish with 2 PTFE Crevice Washers Attached At 50 In-Oz Using Proto 6104 SN# 314047 cal 6/4/01

Start wt: 40.18964g Sartorious SN# 12809099 cal 6/22/01
End wt: 40.16149g

Solution: .5m NaCl + .25m $NaNO_3$
58.44g NaCl Lot# 015568
42.49g $NaNO_3$ Lot# 006604
+ DI water To 2000 mls

Start PH 6.284 Fisher Accumet 950 meter SN# 3340 cal 7/20/01
End PH 6.727 Probe 13-620-296 SN# 1100208

Potentiostat: EG+G model #273 SN# 41108
Counter Electrode: PT Flag
Reference: Fisher 13-620-52 SN# 8-203245
Temperature: 95°C Hg Thermometer SN# 115749 cal 1/29/01

Ecorr = -456mv Keithley 617 SN# 0579628 cal 2/22/01
Ept = +408mv

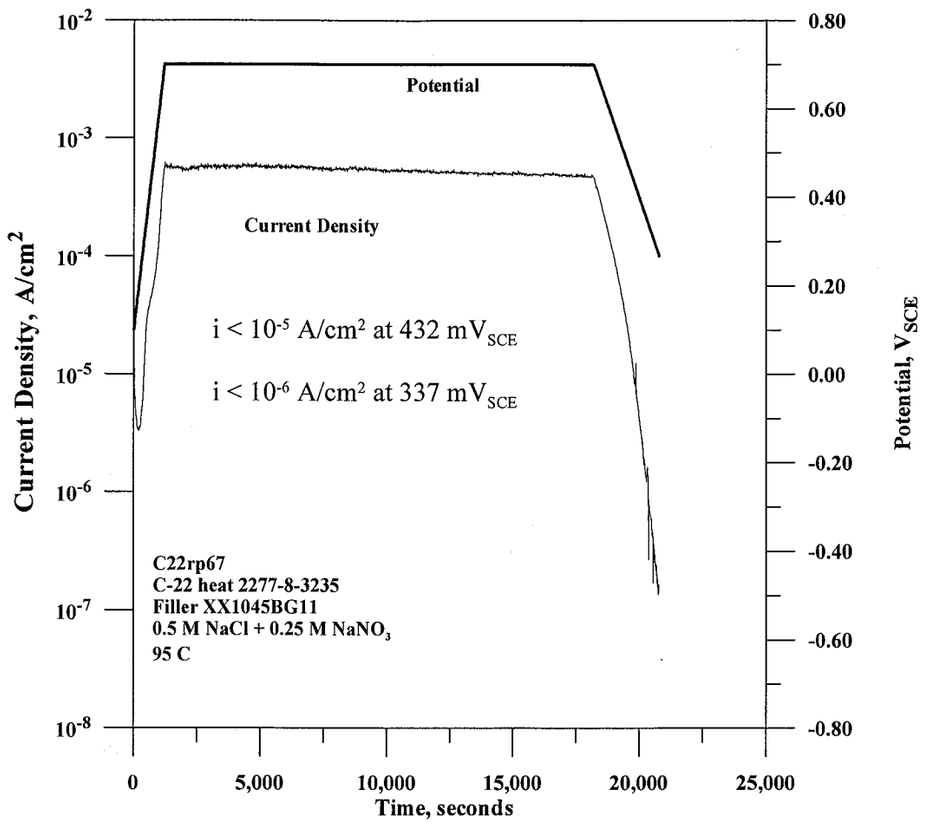
Solution Deaerated with 99.999% N_2

Specimen Examination: No Crevice Corrosion
Gold tint staining on All Surfaces of Specimen

* Specimen Not Saved Repolished for further Tests

Data Saved As C22RP 67

9/14/01



9/14/01

Repassivation Potential of Alloy C-22

Objective: See Pg #184

Specimen: Alloy C-22 welded Sample 600 Grit Finish with 2 PTFE Crevice Washer Attached At 50 In-Oz Using Proto 6104 SN# 314047 cal 6/4/01

Start wt 38.59933g Sartorious SN#12809099 cal 6/22/01
End wt 38.59052g

Solution: .5m NaCl + .1m $NaNO_3$
58.45g NaCl Lot #015568
16.999g $NaNO_3$ Lot #006604
+ DI water To 2000mls

Start PH 6.576 Fisher Accumet 950 meter SN#3340 cal 7/20/01
End PH 6.971 Probe 13-620-296 SN#1100205

Potentiostat: EG+G Model #273 SN# 41108
Counter Electrode: PT Flag
Reference: Fisher 13-620-52 SN# 5203245
Temperature: 95°C Hg Thermometer SN# 115749 cal 1/29/01

Econn -460mv Keithley 617 SN#0579628 cal 2/22/01
Ept +12mv

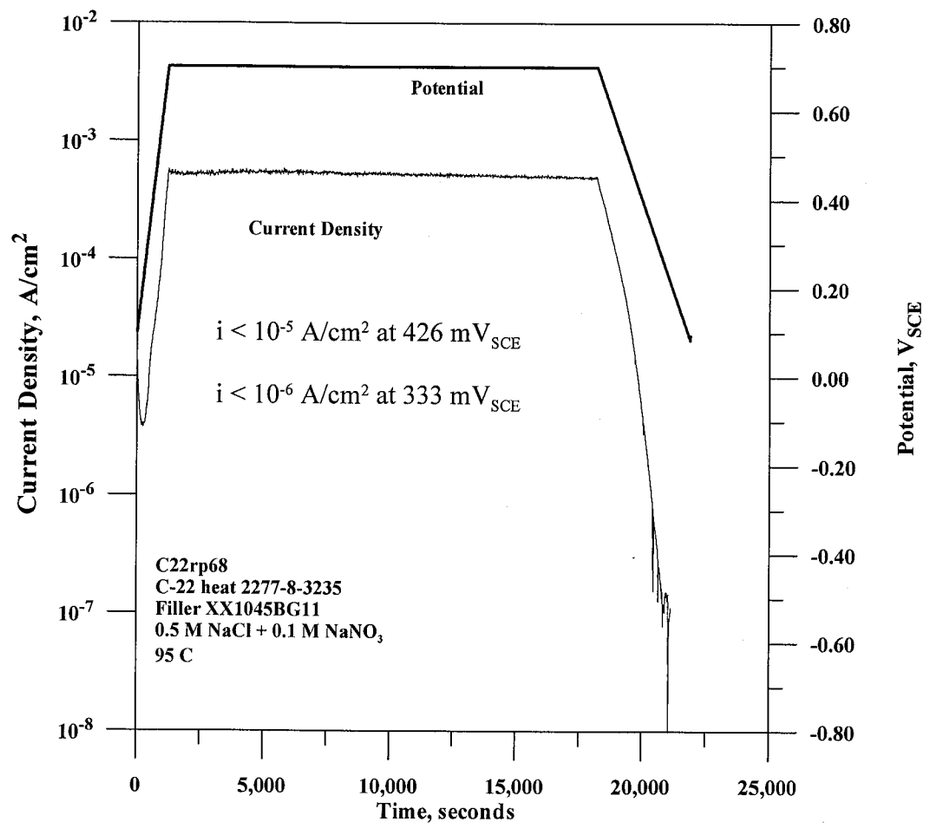
Solution Deaerated with 99.999% N_2

Specimen Examination: No Crevice Corrosion
Gold tint Staining on All Surfaces of Specimen

* Specimen Not Saved Repolished for further Tests

Data Saved As C22RP68

9/17/01



9/7/01

Repassivation Potential of Alloy C-22

objective: See Pg #184

Specimen: Alloy C-22 welded specimen 600 Grit Finish with 2 PTFE Crevice washers Attached At 50 In-Oz Using Proto 6104 SN#314047 cal 6/4/01

start wt 38.09135g Sartorious SN#12809099 cal 6/22/01
End wt 38.06259g

Solution: .5m NaCl + .05m $NaNO_3$
58.45g NaCl Lot# 015568
4.249g $NaNO_3$ Lot# 006604
+ DI water To 2000ml

Start PH 6.319 Fisher Accumet 950 meter SN#3340 cal 7/20/01
End PH 6.810 Probe 13-620-296 SN#1100208

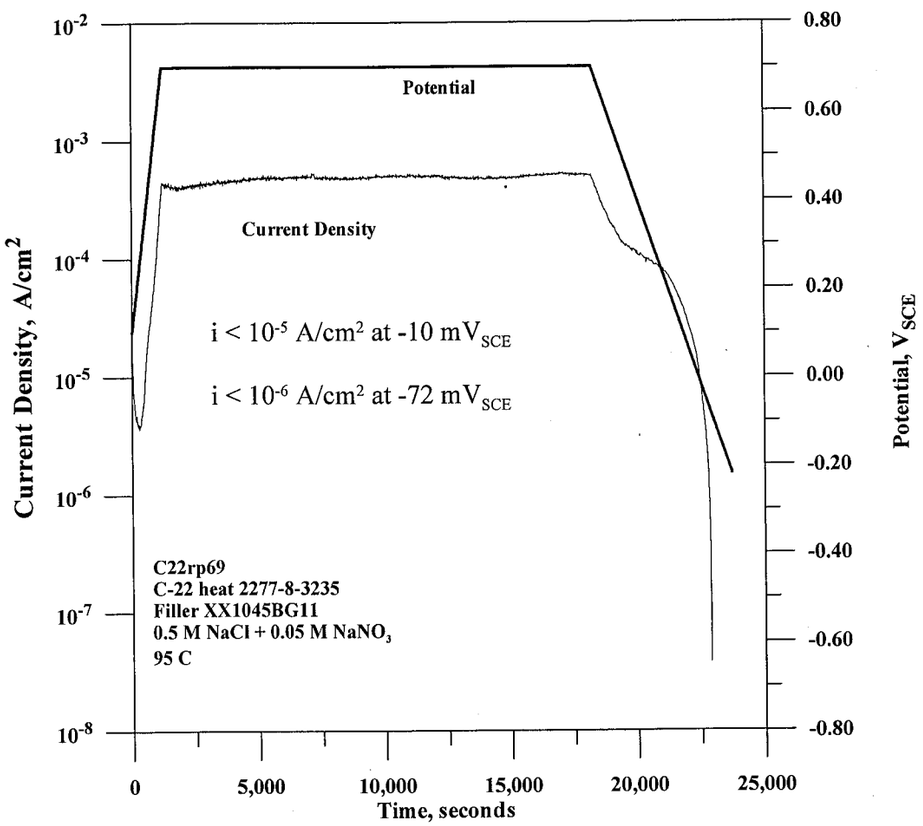
Potentiostat: EG+G model #273 SN#41108
Counter Electrode: PT Flag
Reference: Fisher 13-620-52 SN#8203245
Temperature: 95°C Hg Thermometer SN#115749 cal 1/29/01

Ecorr -398mv Keithley 617 SN#0579628 cal 2/22/01
Ept +137mv

Solution Deaerated with 99.999% N_2

Specimen Examination: Crevice Corrosion 21/24 feet
Gold tint Staining on All surfaces of Specimen

Saved Data As ~~C22RP68~~ 9/18/01 C22RP69 9/18/01



7/18/01

Repassivation Potential of Alloy C-22

objective: See Pg #184

Specimen: Alloy C-22 weldoo Sample 600 Grit Finish
with 2 PTFE Creuice Washer Attached At 50 In-Oz
Using Proto 6104 SN# 314047 Cal 6/4/01

Start wt 37.84851 g Sartorious SN# 12809099 cal 6/22/01
End wt 37.80164 g

Solution: .5m NaCl
58.46 g NaCl Lot# 015568
+ DI water To 2000 mls

Solution #2: 5m $NaNO_3$
42.495 g $NaNO_3$ Lot# 006604
+ DI water To 100 mls

Start PH 6.802 Solution #1 Fisher Accumet 950 meter SN# 3740 cal 7/20/01
End PH 7.237 Probe 13-620-296 SN# 1100208

Potentiostat: EG+G model # 273 SN# 41108
Counter Electrode: PT Flag
Reference: Fisher 13-620-52 SN# 8203245
Temperature: 95°C Hg Thermometer SN# 115749 cal 1/29/01

Ecorr: -275 mv Keithley 617 SN# 0579628 cal 2/22/01
Ept = +199 mv

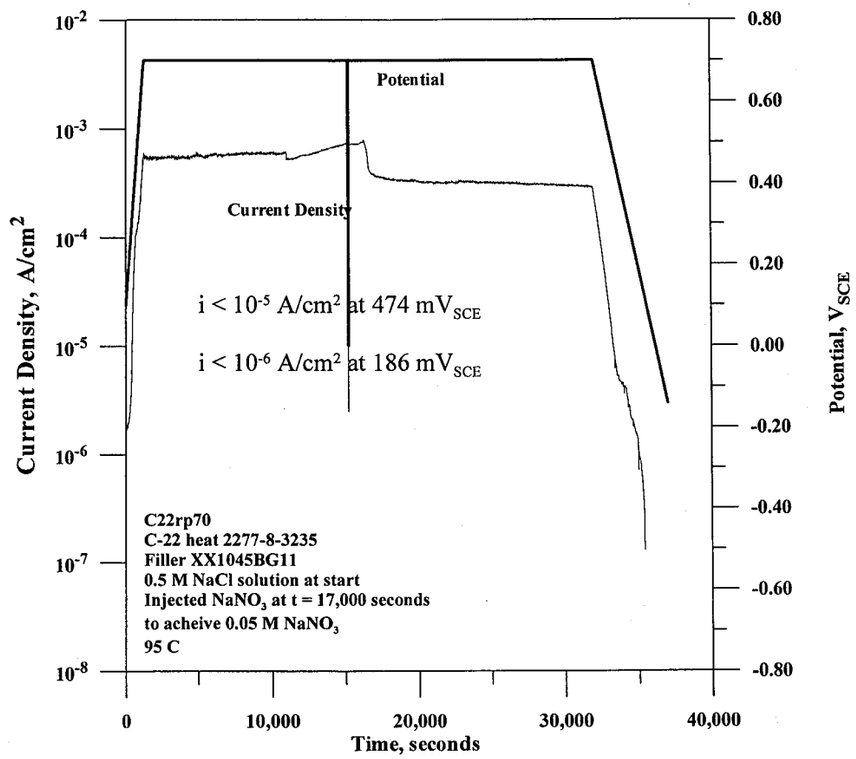
Solution Deaerates with 99.999% N_2

will Hold Potential @ 700 for 30,000 sec
will Spike Solution #1 with 40 mls Solution #2 @ 15,000 sec
Into Testing Procedure

Specimen Examination Creuice Corrosion on 10/24 feet
Gold Tint Staining on All Surfaces of Specimen

Data Exists As C22PP70

9/19/01



9/19/01

Passive Current Density

Specimen : C-22 Block
Polished Specimen To 2000 Grit Finish

No Specimen weight Taken

Solution 1000 ppm Cl
3.292g NaCl Lot# 015568
+ DI water To 2000mls

Start PH 6.022 Fisher Accumet 950 meter sn# 3340 cal 7/29/01
End PH 7.083 PH Probe 13-620-296 sn# 1100208

Temperature : 95°C Hg Thermometer sn# C96-377 cal 7/16/01

Potentiostat : Solartron 1287

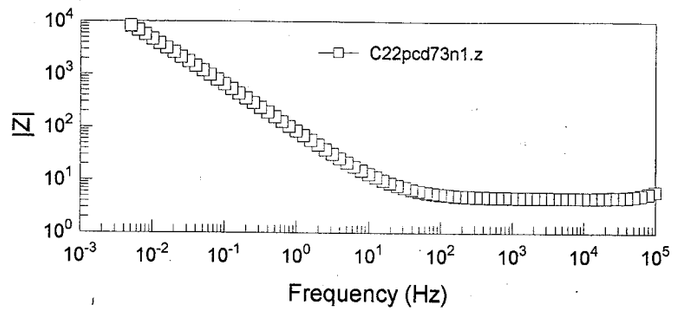
Reference : Fisher 13-620-52 sn# 0089765

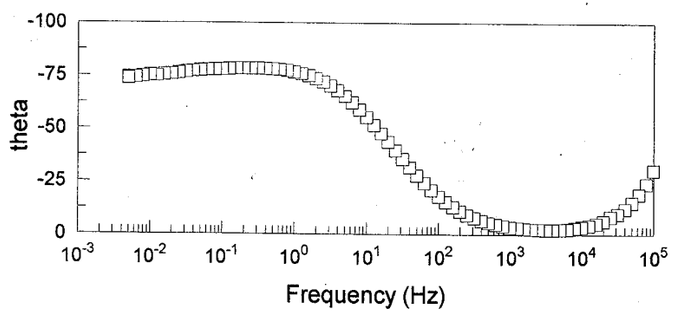
Econ = -265 mv Keithley 617 sn# 537418 cal 2/22/01
Ept = +134 mv

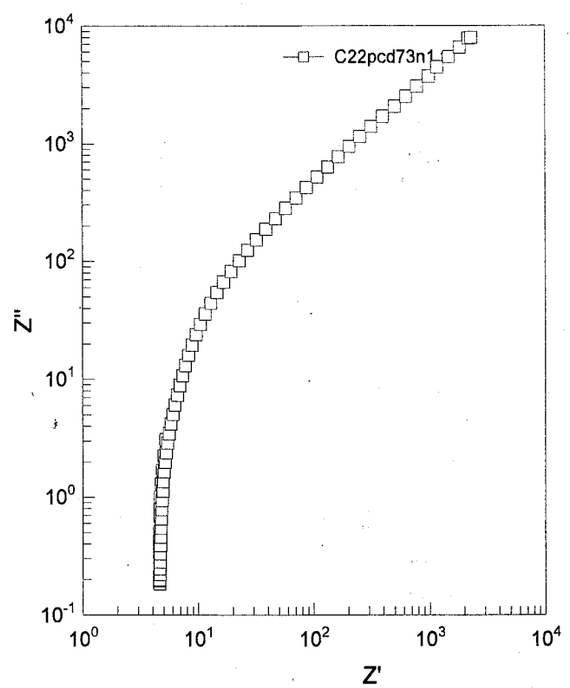
Bubbles with 99.999% N_2 with O_2 Trap
* Measure Passive Current Density @ 20°C - 40°C - 60°C - 80°C - 95°C
At Each Temp for 6 days for Both Increasing And Decreasing Temp.
Specimen Examination - Milo staining on Specimen
No Sign of Corrosion

Test started 9/20/01
Test ended - 10/25/01 Possible Specimen Pad Corrosion stopped Test.

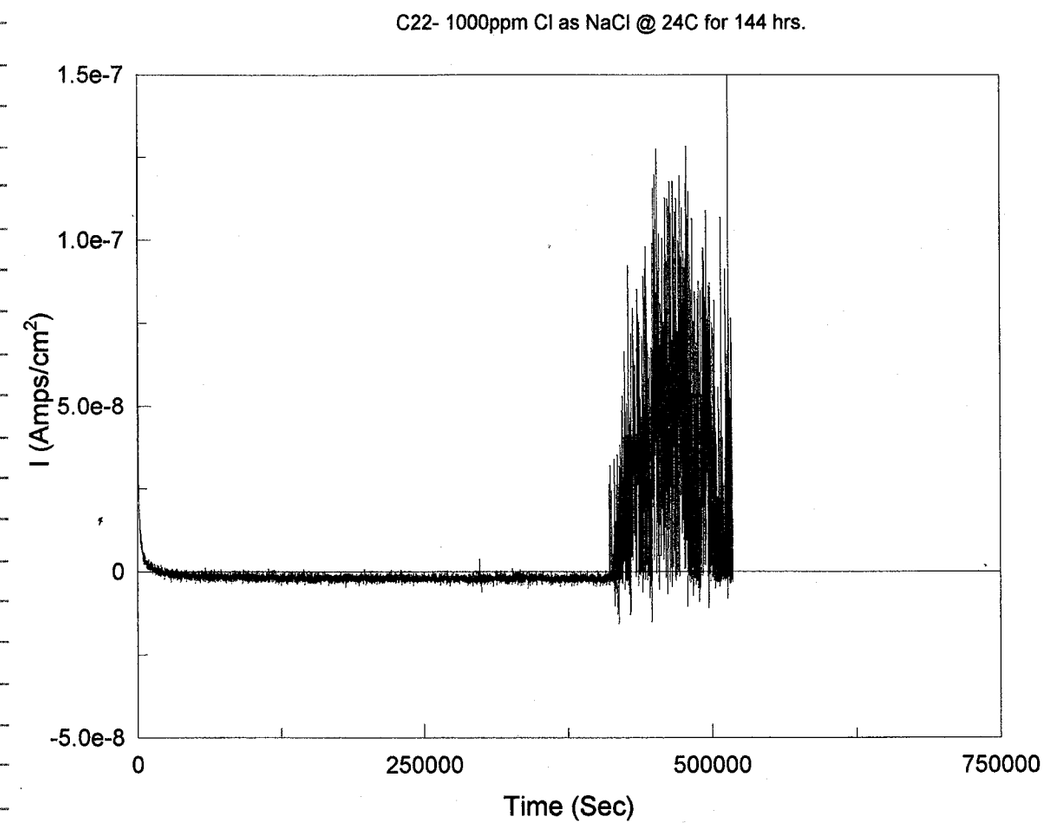
9/20/01







10/25/01



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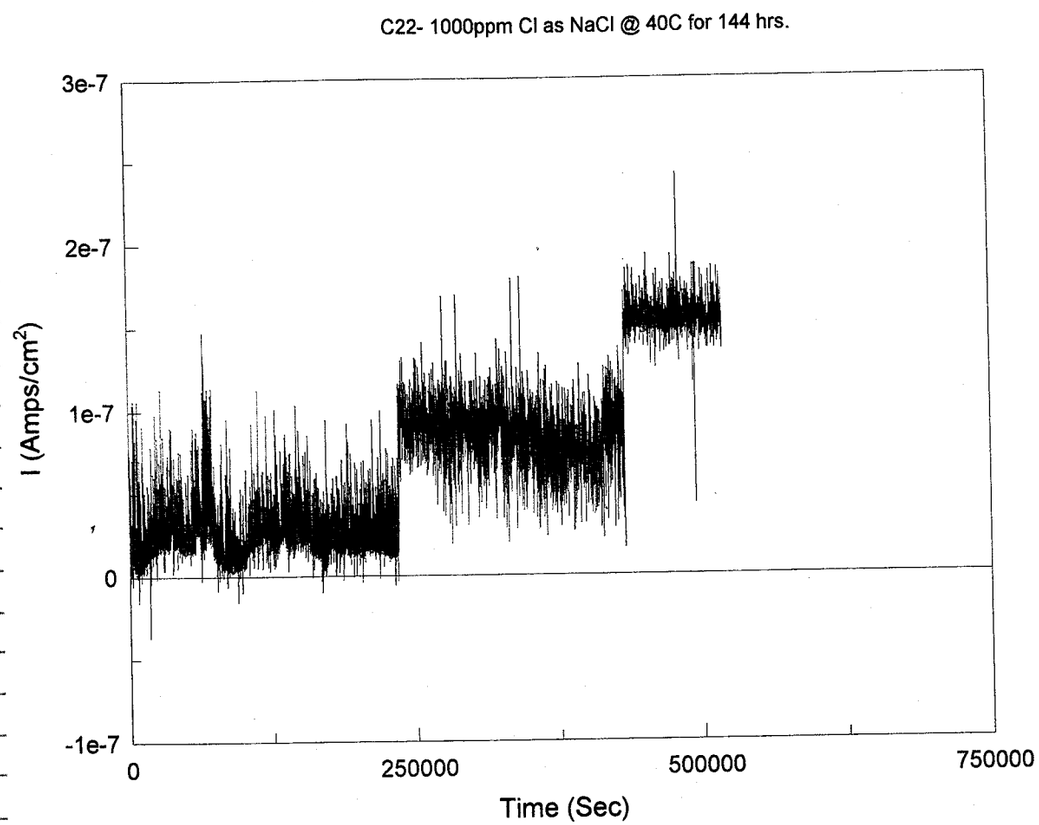
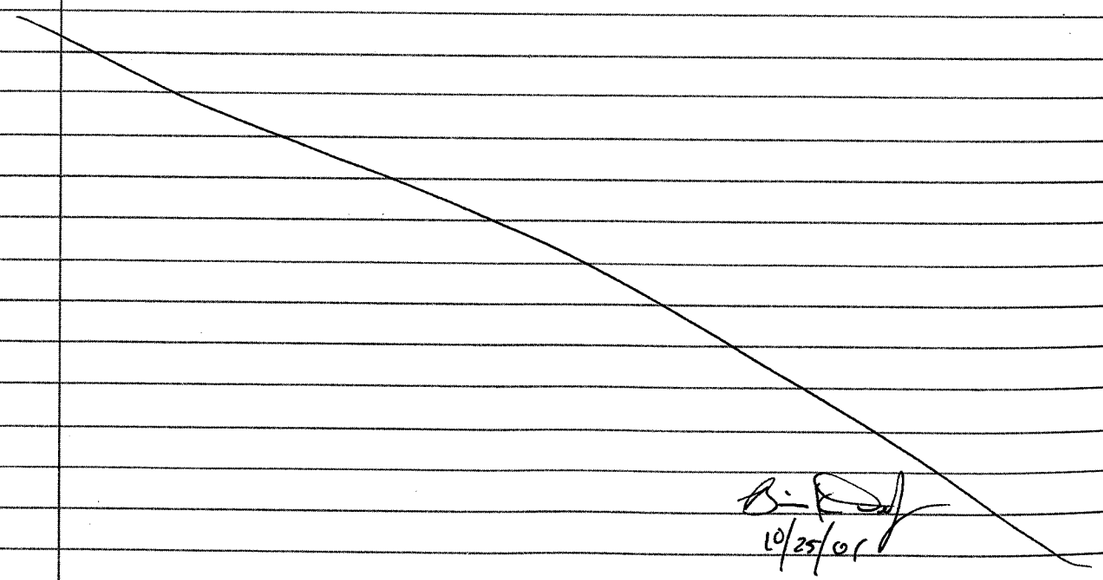
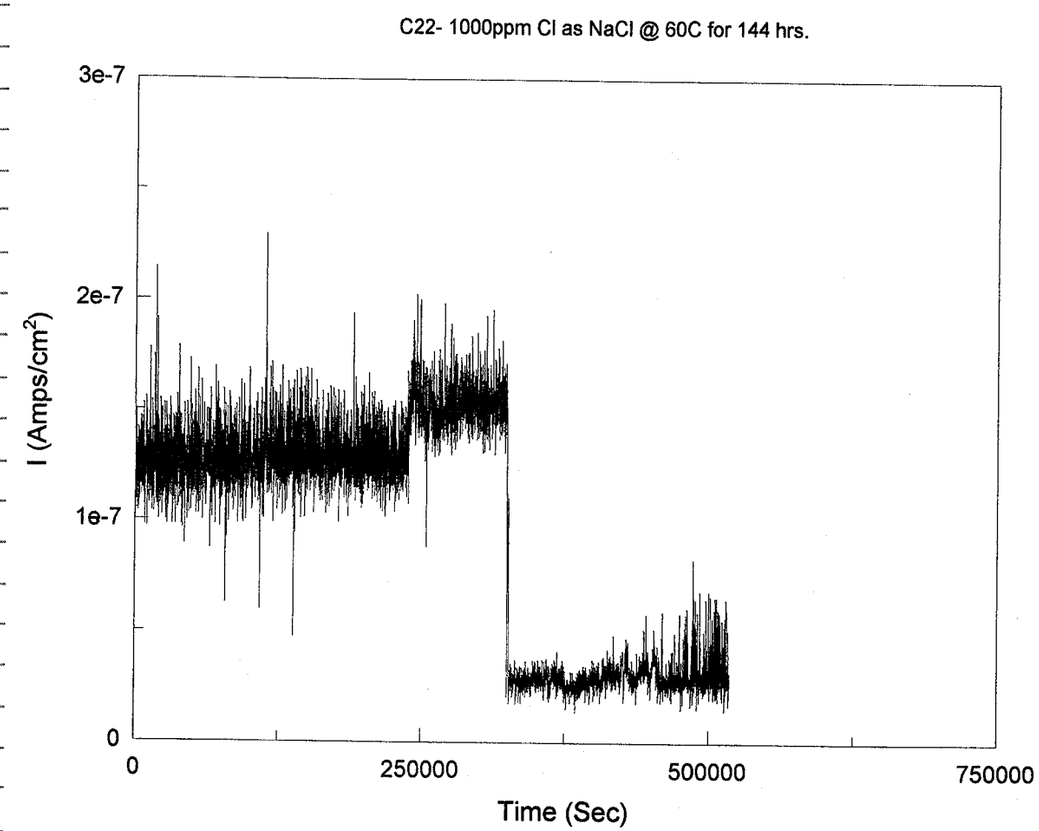
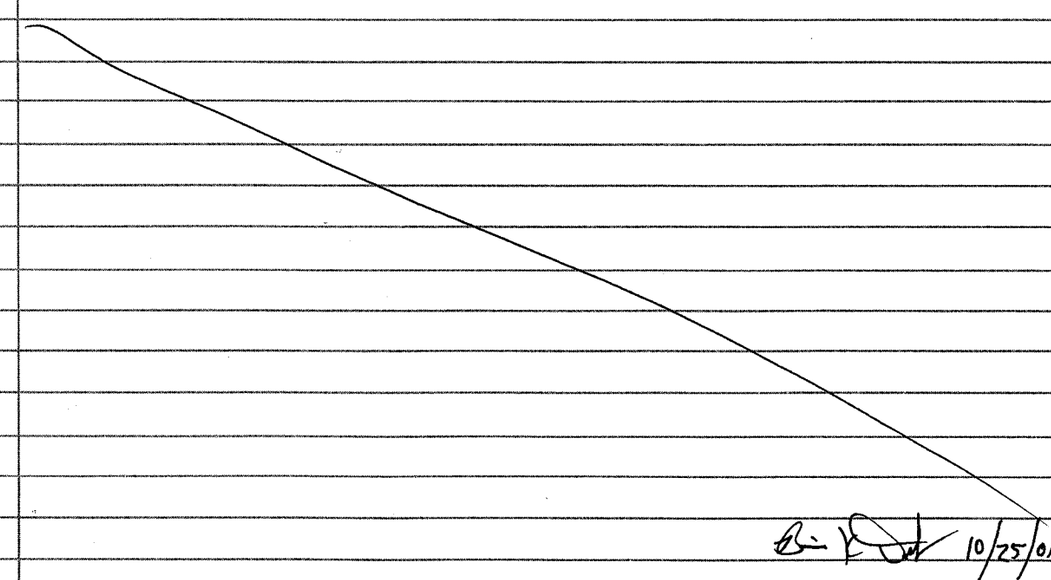


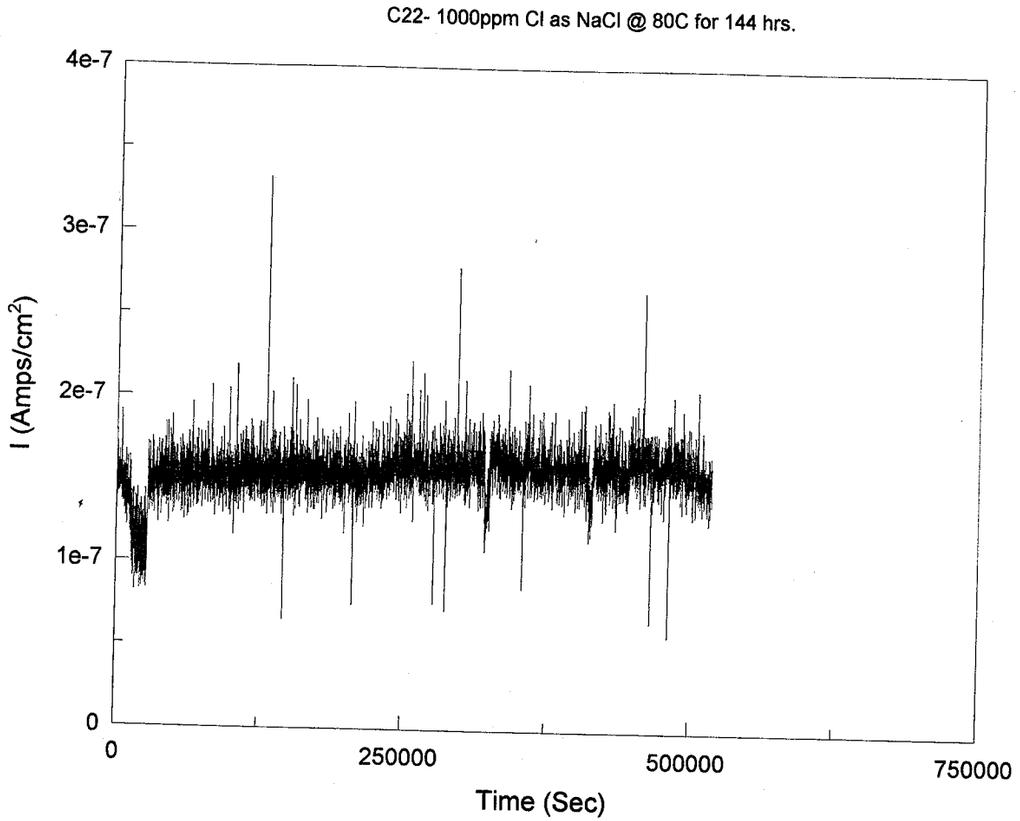


10/25/01

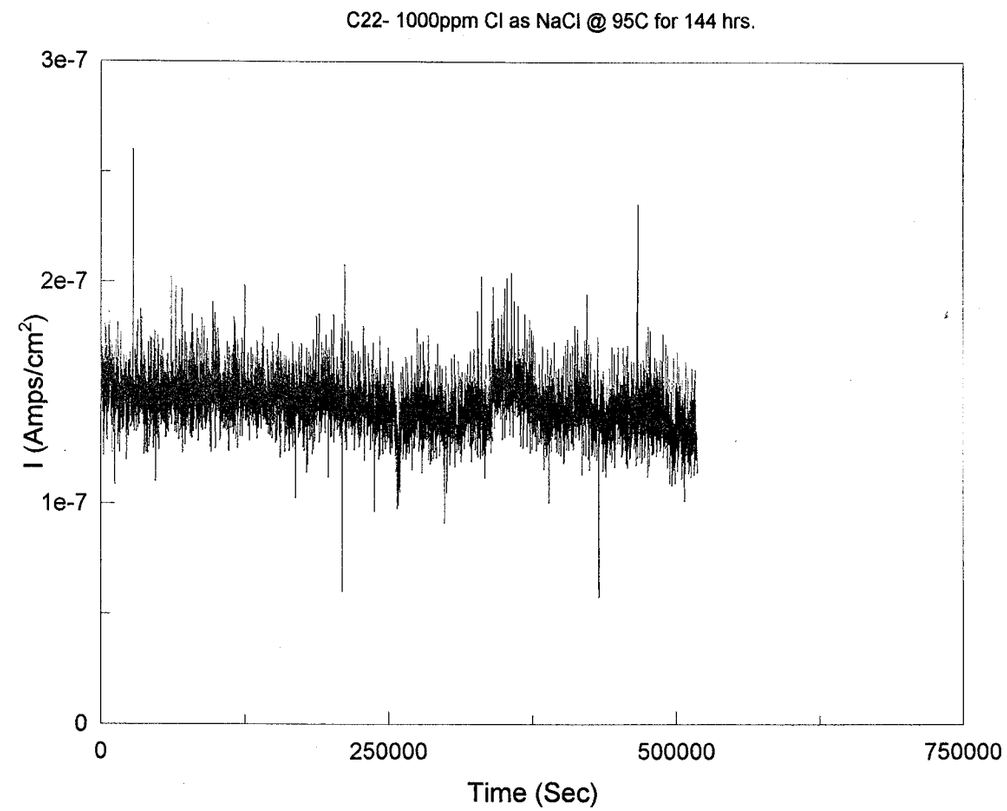




10/25/01



10/25/01



10/25/01

10/30/01

10/30/01

10/30/01

Thermal Ageing of C-22 Alloy Specimens

Thermal Ages 3 C-22 specimens for 5 min

Useing thermal Couple SN# 326 Cal 6/13/01
Thermal Couple Meter Omega H22 SN# T94140 cal 8/23/01

start Procedure
Oven Temperature Thermal Couple 879°C
Oven Set Point Temperature 880°C

Places Specimens In Oven All 3 specimens Simultaneously

@ 2:00 min Into Procedure = Thermal Couple 876°C
Oven Set Point Temperature 875°C

Removes Specimens @ 5:00 min - will Use In Testing To follow

specimen Dimensions And Drawing on Pg #189 #20.01402.571.006

10/15/01

10/30/01

10/30/01

Continue Testing In

Notebook # 485

I have reviewed this scientific notebook and find it in compliance with QAP-001. There is sufficient information regarding procedures used for conducting tests, acquiring and analyzing data so that another qualified individual could repeat the activity.

ADDITIONAL INFORMATION FOR SCIENTIFIC NOTEBOOK #: 366

Document Date:	08/19/1999
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:	07/29/1999
Operating System: (including version number)	Windows
Application Used: (including version number)	NA
Media Type: (CDs, 3 1/2, 5 1/4 disks, etc.)	1 CD
File Types: (.exe, .bat, .zip, etc.)	dat, cor
Remarks: (computer runs, etc.)	Media contains: data files for electrochemical tests