

308 --- Q200311210006
Scientific Notebook # 085: Crevice Corrosion
Chemistry of 304 and 316L Stainless Steels
and Alloys 825 and C22 (07/30/1993 through
02/14/1997)



SOUTHWEST RESEARCH INSTITUTE

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IWPC NOTEBOOK 085

TASK 1

7/30/93 16

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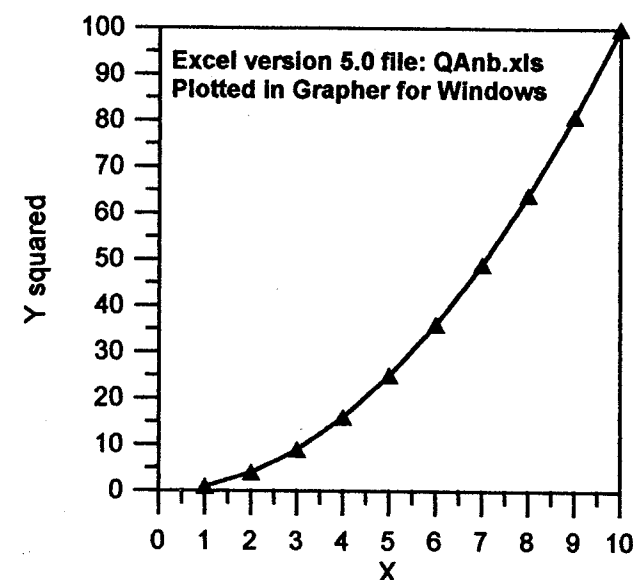
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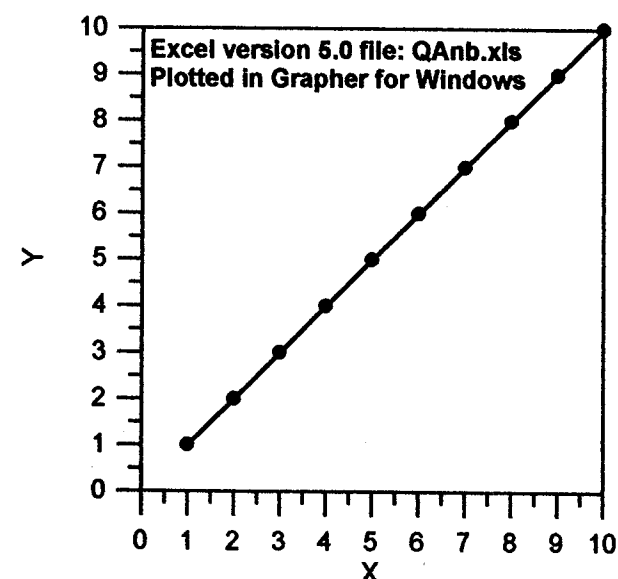
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INSTALLATION TEST DOCUMENTATION FOR MICROSOFT EXCEL VERSION 5.0 AND GRAPHER FOR WINDOWS VERSION 1.23



X	Y	Ysquared
1	1	1
2	2	4
3	3	9
4	4	16
5	5	25
6	6	36
7	7	49
8	8	64
9	9	81
10	10	100

Dund 4/1/97



Dund 4/1/97

Dund 4/1/97

7/30/93

CREVICE CORROSION 304L-8

OBJECTIVE MEASURE CREVICE CORROSION CHEMISTRY.

SPECIMEN 304L- NT # T0954 600 S.C

CLEANED IN ULTRASONIC BATH RINSED

IN DI WATER, ACETONE AND DRIED

 $l = 2.501$ $w = 0.498$ $t = 0.124$

AREA = 20.87

START WT. 21.19381g

END WT. 21.19323g

SOLUTION 1000 PPM Cl^- 85PPM HCO_3^- 20PPM SO_4^{2-} 10 PPM NO_3^- 2PPM F^- 1000 ml AS FOLLOWS1.64897g $NaCl$ LOT 926368A0.11899g $NaHCO_3$ LOT 89778920ml SO_4 - 7/93 STOCK SOLUTIONS10ml NO_3 - 7/93 "2ml F^- - 7/93 "

+ DI WATER TO 1000 ml STOCK SOLUTIONS

P287 IWPE-025

START PH: 8.204

END PH: 7.981

SETUP SPECIMEN PLACED IN PLEXIGLASS CELL

USING TWO PORTS AND TORQUED TO 20 IN-OZ

USING PROTO 6103 CAL DUG 1/23/94

PORT #1 AT TIP

MI 200 FLEXIBLE Cl ISE # 47228MI 403 DOUBLE JUNCTION $Ag/AgCl$ # 44629

MI 506 GLASS PH # 43720

MI 403 DOUBLE JUNCTION $Ag/AgCl$ # 41436MI 403 DOUBLE JUNCTION $Ag/AgCl$ # 41402

PORT #2 AT MOUTH

MI 200 Cl ISE FLEXIBLE # 47226MI 403 DOUBLE JUNCTION $Ag/AgCl$ # 44671

MI 506 GLASS PH # 43717

MI 403 DOUBLE JUNCTION $Ag/AgCl$ # 44628MI 403 DOUBLE JUNCTION $Ag/AgCl$ # 41432

David D. 7/30/93

7/30/93

CREVICE 304L-8

BULK ELECTRODES

MI 200 CI ISE # 42998

MI 402 Ag/AgCl REF # 43647

MI 506 GLASS PH # 44817

MI 402 Ag/AgCl REF # 45860FISHER 13-620-53 SN 8118182 Ag/AgCl

CI ISE AT TIP, # 47228 AND CITIP REFERENCE # 44629
TO ORION EA920 SN 5001A CHANNEL #1 AND TO
ABB SE120 # 0515265 CHART RECORDER.

CI ISE AT MOUTH # 47226 AND CI MOUTH REFERENCE # 44671
TO ORION 720A # 5885 CHANNEL #1 AND TO
ABB SE120 # 0049616 CHART RECORDER.

CI ISE AT BULK # 42998 AND CI BULK REFERENCE # 43647
TO ORION EA920 CHANNEL #2 AND TO
ABB SE120 # 0515265 CHART RECORDER.

PH TIP # 43720 AND PH TIP REFERENCE # 41436 TO
ORION EA940 SN 2330 ^{QD 8/31/94} CHANNEL #1 AND TO
ABB SE120 # 0515265 CHART RECORDER.

PH MOUTH # 43717 AND ^{QD 8/31/94} PH TIP REFERENCE # 44628
TO ORION 720A 003368 AND ABB SE 120
0049616 CHART RECORDER.

PH BULK # 44817 AND PH BULK REFERENCE # 45860
TO ORION EA940 SN 2330 CHANNEL #2 AND TO
ABB SE120 # 0515265 CHART RECORDER.

FISHER 13-620-53 SN 8118182 TO CHANNEL
#1 OF ESC 440 #2 USED AS SPECIMEN REFERENCE.

James D. 7/30/93

7/30/93

CREVICE 304L-8

TIP REFERENCE MI 403 # 41402 TO CHANNEL
#3 OF ESC 440 #2

MOUTH REFERENCE MI 403 # 41432 TO CHANNEL
#2 OF ESC 440 #2

304L SPECIMEN CONNECTED TO ESC 440 #2 CHANNEL #1
AS WORKING ELECTRODE PT COUNTER ELECTRODE
CONNECTED TO ESC 440 #2 CHANNEL #1 AS COUNTER
ELECTRODE

PLEXIGLASS CELL PLACED IN FARADAY CAGE
ON 7/30/93 AFTER 1 HR V_{SET} CHANGED
FROM OPEN CIRCUIT TO $+0.100 \text{ V}_{\text{Ag}/\text{AgCl}}$
8/4/93 V_{SET} TO $200 \text{ mV}_{\text{Ag}/\text{AgCl}}$ TIMER AT
411900 SEC
8/6/93 $V_{\text{SET}} = 0.0 \text{ V}_{\text{Ag}/\text{AgCl}}$ TIMER AT 595135 SEC

PRIOR TO ASSEMBLY ELECTRODES WERE CALIBRATED
IN PH BUFFERS FOR PH ELECTRODE AND
CI STOCK SOLUTIONS PAGE 287 IUPAC-025
FOR CI ELECTRODES

PH TIP MI 506 # 43720 / Ag/AgCl REF # 41436
 $\text{pH} = -18.5(\text{V}) + 6.98$
PH MOUTH MI 506 # 43717 / Ag/AgCl REF # 44628
 $\text{pH} = -17.4(\text{V}) + 7.04$
PH BULK MI 506 # 44817 / Ag/AgCl REF # 45860
 $\text{pH} = -17.6(\text{V}) + 6.47$
CI TIP MI 200 # 47228 / Ag/AgCl REF # 44629
 $\text{PPM CI}^- = \text{EXP}[-0.0494(\text{mV}) + 12.69]$
CI MOUTH MI 200 # 47226 / Ag/AgCl REF # 44671
 $\text{PPM CI}^- = \text{EXP}[-0.0499(\text{mV}) + 12.38]$

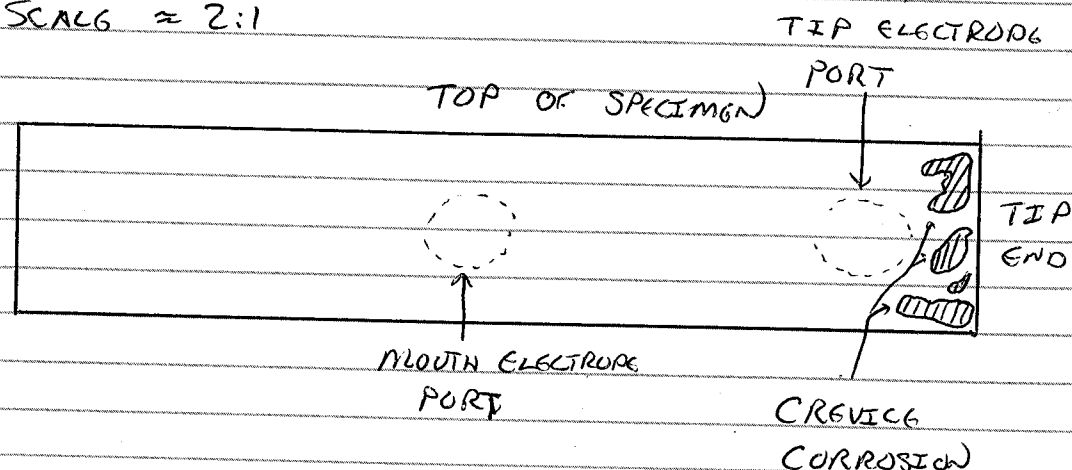
James D. 7/30/93

CREVIC 304L-8

CI BULK MIZDO # 42998 / A₁/ACI REF # 43647
 ppm Cl⁻ = EXP [-0.0447(mV) + 11.93]

AT THE CONCLUSION OF TEST SPECIMEN WAS
 OBSERVED TO HAVE SMALL REGIONS OF
 CREVIC CORROSION ON THE TOP SURFACE
 (ELECTRODE SIDE) NEAR THE TIP ELECTRODE
 LOCATION. NO CREVIC CORROSION WAS
 OBSERVED ON THE BOTTOM SURFACE OF
 THE SPECIMEN.

SCALE ≈ 2:1



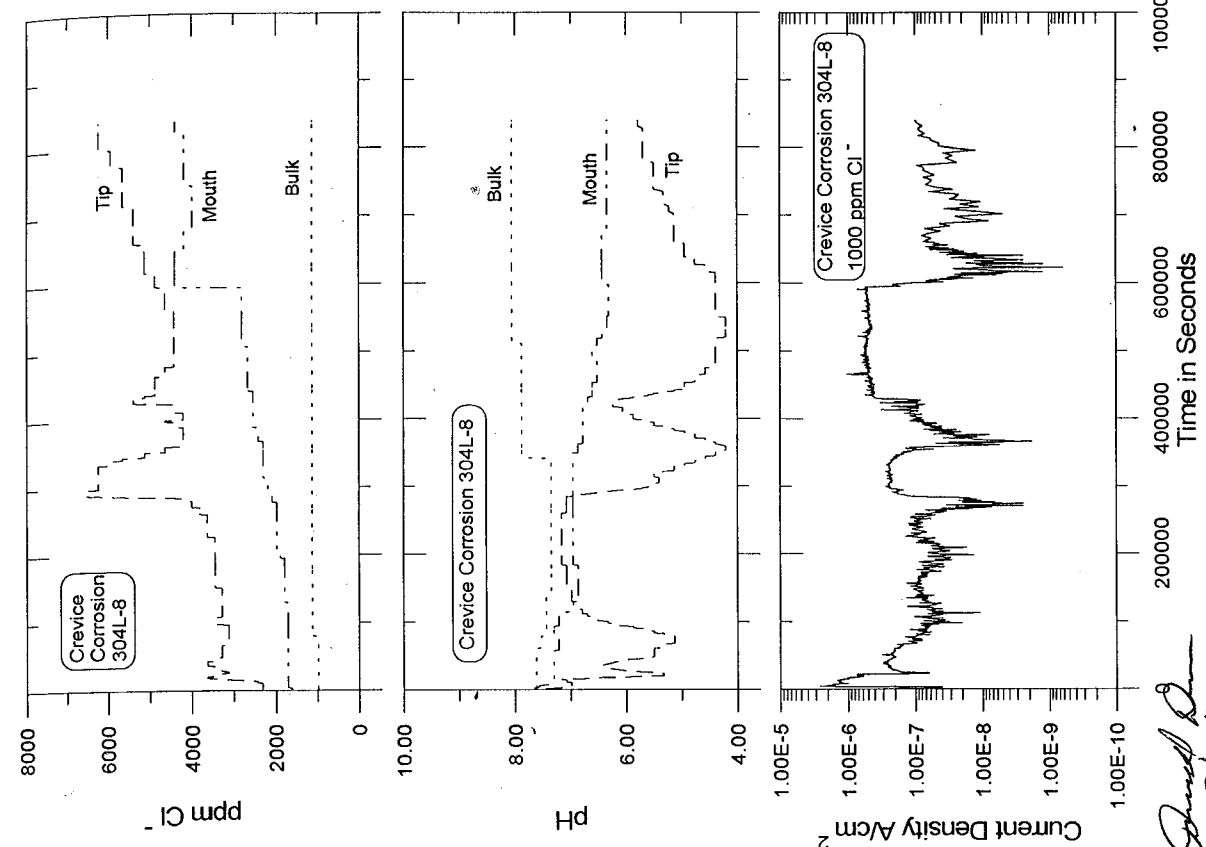
CURRENT AND POTENTIAL DATA WRITTEN
 DIRECTLY TO DISC TO FILE 304L-8.DAT
 USING CREVIC.WBB PH AND PPM Cl⁻
 DATA WERE INPUT TO FILE FROM CHART
 RECORDER TRACES

PLOTS OF POTENTIAL CURRENT PH AND
 PPM Cl⁻ DATA ON P H & IZ

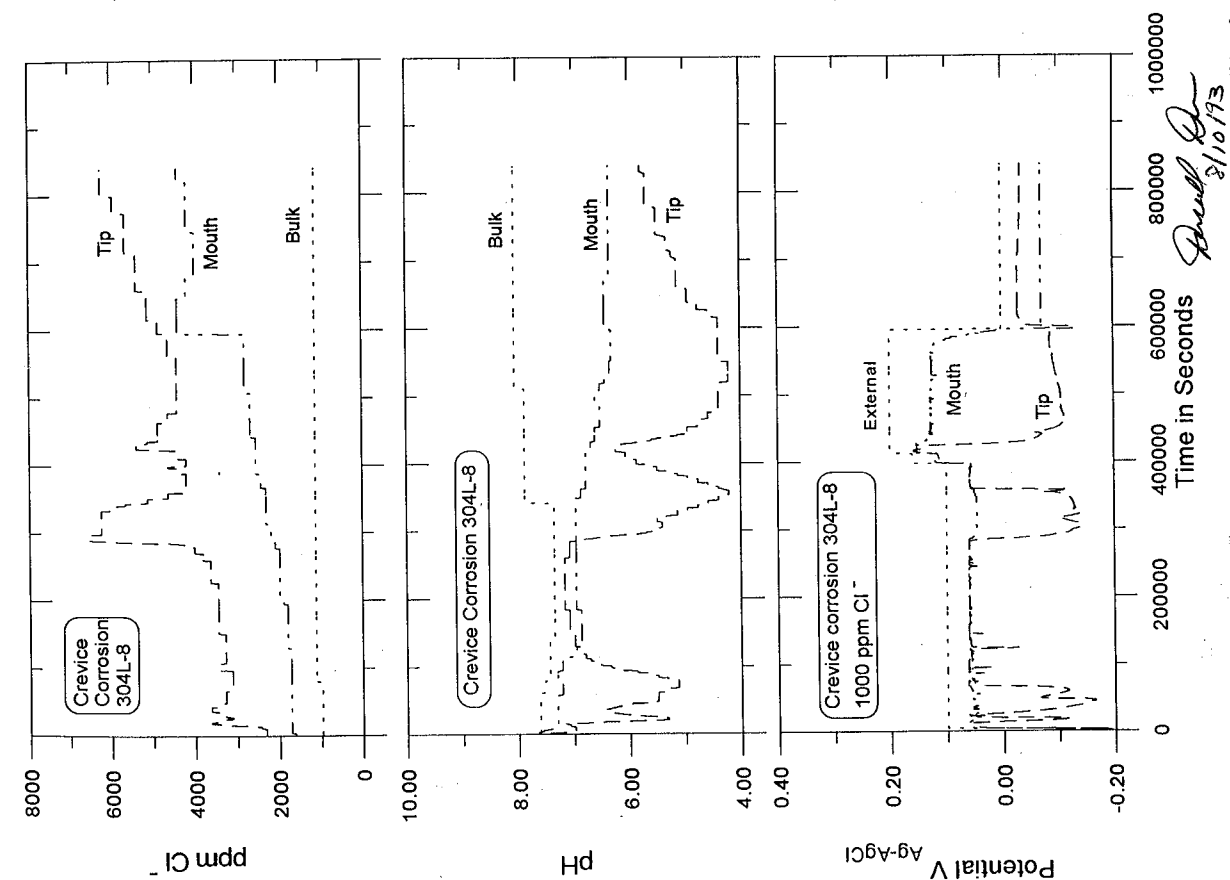
David D.
 8/10/93

PH AND Cl⁻ ISE CALIBRATION DATA IN 304L8CAL.DAT ON IWP6085

David D. 4/25/94



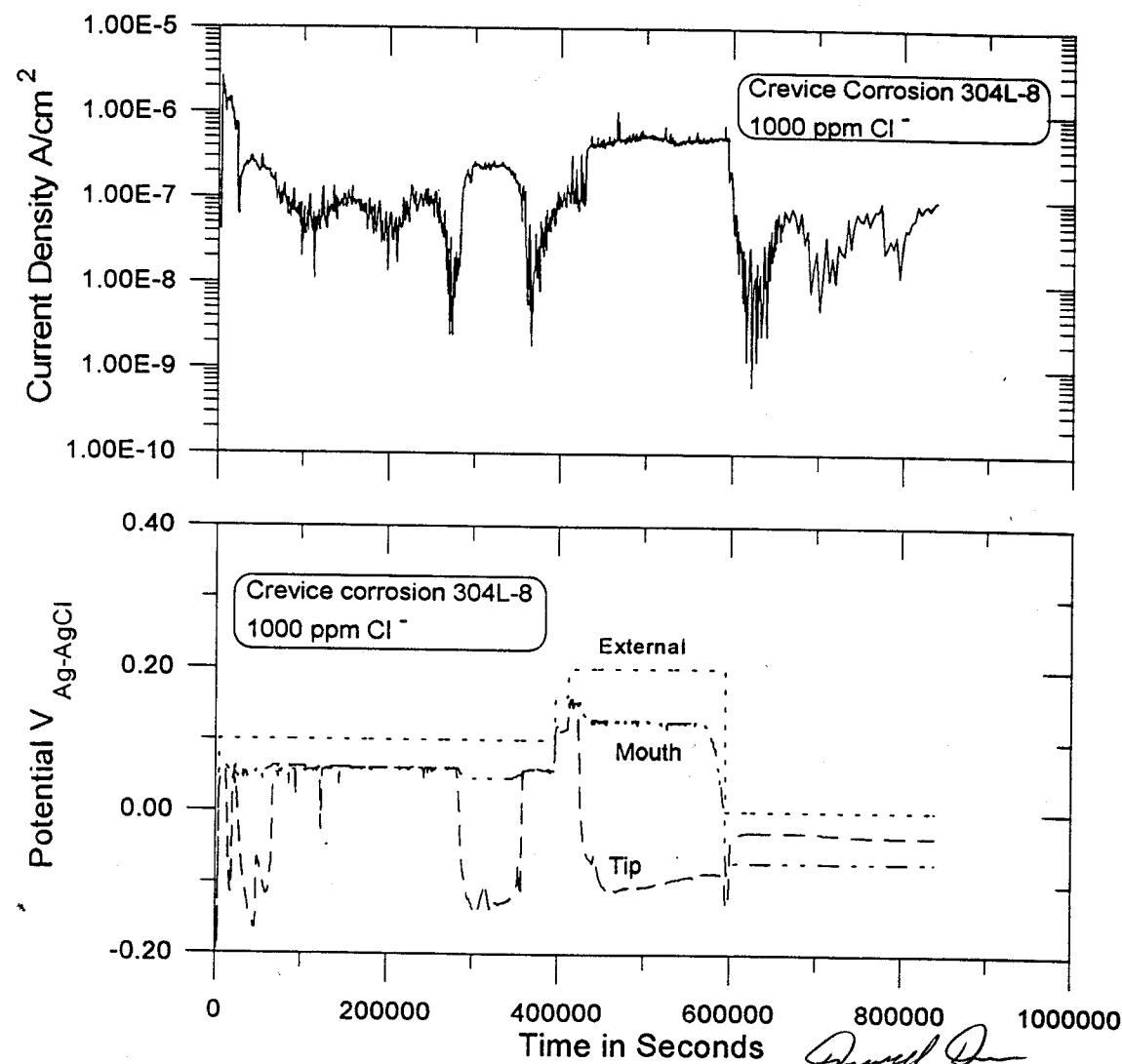
David D.
 8/10/93



David D.
 8/10/93

12
8/10/93

CREVICE 304L-8



[Signature] 8/31/94

13

7/30/93

LONG TERM POTENTIOSTATIC TEST LT82SP1

SPECIMEN ALLOY 825 H4371FG MILL FINISHED
SURFACES - CLEANED IN ULTRASONIC WITH
DETERGENT, WATER, ACETONE AND DRIED

START WT 29.58784g AREA = 15 cm²
END WT 29.58993g

SOLUTION 1000 PPM Cl⁻ 85 PPM NaCO₃ 20 PPM SO₄²⁻
10 PPM NO₃ 2 PPM F⁻ 2000 ml AS FOLLOWS.
3.29645g NaCl LOT 926368A
0.23716g NaHCO₃ LOT 897789
40 ml SO₄ - 7/93 STOCK SOLUTION
20 ml NO₃ - 7/93 "
4 ml F - 7/93 "

+ DI WATER TO 2000 ml STOCK SOLUTIONS

P 287 IWP6-025 T=95°C N₂ THERMO

183301 CAL DOG 2 JAN 94

POTENTIOSTAT ESC 440 #1 CHANNEL #1 DATA
SAVED AS LT82SP1.DAT USING LONGTM.WAB.

LISTING OF LONGTM.WAB ON PAGE

REFERENCE SC6 FISHER 13-620-51 SN 0165403

E_{CORR} -211 mV KEITNEY 614

E_{PT} +157 mV

E_{APPLIED} +200 mV

SPECIMEN STARTED 7/30/93

SPECIMEN STOPPED 8/27/93 2414000 SEC

RUNTIME 2414000 SEC

CHARGE DENSITY NOT RECORDED

START PN 8.269

END PN 9.004

[Signature] 8/27/93

7/30/93

LONG TERM POTENTIOSTATIC TEST LT82SP2

SPECIMEN ALLOY 82S MILL FINISHED SURFACES

CLEANED AS LT82SP1 P13.

START WT 30.83801 g

END WT 30.83626 g

AREA = 15 cm²SOLUTION 1000 PPM Cl⁻ 85 PPM NO₃⁻ 20 PPM SO₄²⁻
10 PPM NO₃⁻ 2 PPM F⁻ 2000 ml AS FOLLOWS

3.29787 g NaCl LOT 926368A

0.23594 g NaHCO₃ LOT 89778940 ml SO₄ - 7/93 STOCK SOLUTION20 ml NO₃ - 7/93 "

4 ml F - 7/93 "

+ DI WATER TO 2000 ml STOCK SOLUTIONS

P287 IWP6 -025 T=95°C N₂ THERMO

183305 CAL DUG 2 JAN 94

START pH 8.085

END pH 9.036

POTENTIOSTAT ESC440 #1 CHANNEL #2 DATA

SAVED AS LT82SP2.DAT USING CONCTM.WBB

REFERENCE 13-620-51 9214083 FISHER SCE


E_{CORR} -0.235 V KEITHLEY 614E_{PT} +0.124 V "E_{APPLIED} 0.0 V

SPECIMEN STARTED 7/30/93

SPECIMEN STOPPED 8/27/93 2414000 SEC

RUNTIME 2414000 SEC

CHARGE DENSITY NOT RECORDED

 8/27/93

8/10/93

STOCK SOLUTIONS.

SO₄ - 8/93 1000 PPM SO₄²⁻ AS Na₂SO₄1.48535 g Na₂SO₄ LOT 901213STOCK SOLUTION SO₄ - 8/93 EXP 9/7/93NO₃ - 8/93 1000 PPM NO₃⁻ AS NaNO₃1.37530 g NaNO₃ LOT 897183

EXP 9/7/93

F - 8/93 1000 PPM F⁻ AS NaF

2.21045 g NaF LOT 896405

EXP 9/7/93

2 M Cl⁻ - 8/93 2 MOLES / LITER Cl⁻ AS NaCl

116.89033 g NaCl LOT 926368A

EXP 9/7/93

1 M Cl⁻ - 8/93 1 MORG / LITER Cl⁻ AS NaCl

58.44532 g NaCl LOT 926368A

EXP 9/7/93

0.5 M Cl⁻ - 8/93 0.5 MOLES / LITER Cl⁻ AS NaCl

29.22138 g NaCl LOT 926368A

EXP 9/7/93

1000 Cl⁻ - 8/93 1000 PPM Cl⁻ AS NaCl

3.30210 g NaCl LOT 926368A

EXP 9/7/93

100 Cl⁻ - 8/93 100 PPM Cl⁻ AS NaCl100 ml 1000 Cl⁻ - 8/93 + 900 ml DI WATER

EXP 9/7/93

 8/10/93

8/12/93

CREVIC 825-9, DAT

OBJECTIVE DETERMINE CREVIC CORROSION CHEMISTRY.

SPECIMEN ALLOY 825 HEAT #: J208

MILL FINISHED SURFACE FROM METAL SAMPLES

U BEND SPECIMEN CLEANED SAME AS

304L-8 P.7 S/31/94

 $l = 2.498$ $w = 0.499$ $b = 0.115$ AREA = 20.53 cm^2

START WT. 21.04205g

END WT 20.97775g

SOLUTION 0.5 M Cl^- 85ppm NaCO_3 20ppm SO_4^{2-}
10ppm NO_3^- 2ppm F^- 1000ml AS FOLLOWS

29.22143 g NaCl LOT 926368A

0.12104 g NaHCO_3 LOT 89778920ml SO_4^{2-} 8/93 STOCK SOLUTION10ml NO_3^- 8/93 "2ml F^- 8/93 "

+ DI WATER TO 1000 ml STOCK

SOLUTIONS p 15

START PN 8.031

END PN 7.968

SETUP SPECIMEN PLACED IN PLEXI GLASS CELL

8/12/93 AT 10:00 AM AND TORQUED TO 20 IN OZ
USING PROTO 6103

ELECTRODE SETUP TO PORT #1, PORT #2

AND BULK SAME AS 304L-8 P7

SETUP OF METERS AND CHART RECORDERS

SAME AS 304L-8. P7

SPECIMEN CONNECTED TO ESC 440 #2 CHANNEL

#1 AS WORKING ELECTRODE Pt ELECTRODE

USED AS COUNTER ELECTRODE TIP AND

MOUTH REFERENCE ELECTRODES CONNECTED TO

CHANNELS #3 AND #2 RESPECTIVELY

PLEXI GLASS CELL AND GLASS VESSEL PLACED

IN FARADAY CAGE

Daniel D 8/31/94

8/12/93

CREVIC 825-9, DAT

INITIAL CONDITIONS AT 11:00 AM 8/12/93

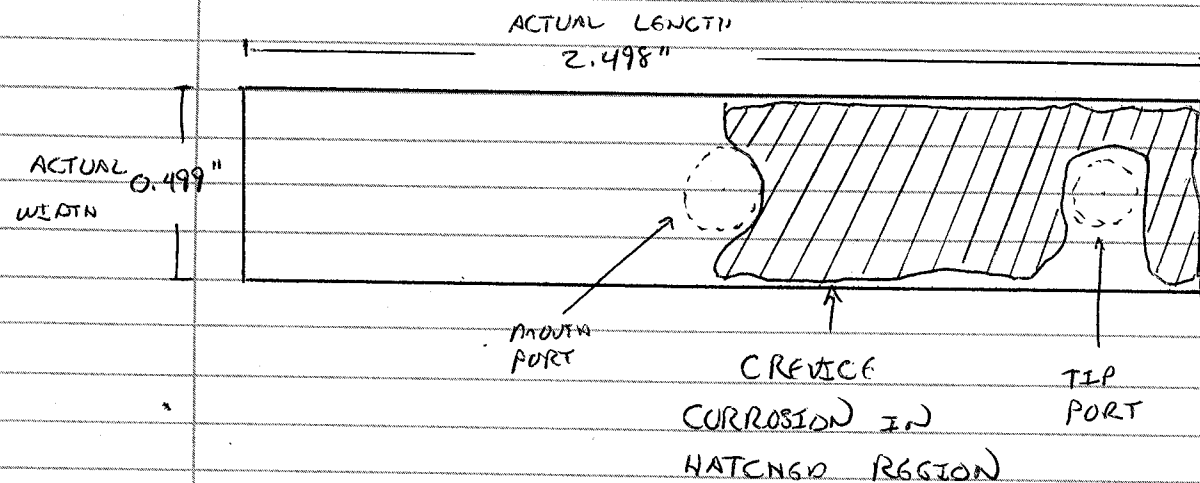
TIP $\text{Cl}^- = 41.6 \text{ mV}$ TIP PN = -23.1 mV MOUTH $\text{Cl}^- = 39.3 \text{ mV}$ MOUTH PN = -53.1 mV BULK $\text{Cl}^- = 37.2 \text{ mV}$ BULK PN = -82.7 mV $E_{\text{CORR}} = -102 \text{ mV}$ $E_{\text{TIP}} = -116 \text{ mV}$ $E_{\text{MOUTH}} = -111 \text{ mV}$ $E_{\text{PT COUNTER}} = +489 \text{ mV}$ TIMER RESET TO 0 SEC AT 11:00 AM V_{SET} TO $300 \text{ mV}_{\text{N/A/C}}$ PRIOR TO ASSEMBLY ELECTRODES WERE CALIBRATED
USING STANDARD BUFFERS 1.00, 4.00, 7.00, 10.00 FOR
PN ELECTRODES AND STOCK Cl^- SOLUTIONS
ON PAGE 15 FOR Cl^- ELECTRODESPN TIP MISOC # 43720 / Ag/AgCl REF # 41436PN = $-18.0(\text{V}) + 7.09$ PN MOUTH MISOC # 43717 / Ag/AgCl REF # 44628PN = $-17.2(\text{V}) + 7.01$ PN BULK MISOC # 44817 / Ag/AgCl REF # 45860PN = $-17.3(\text{V}) + 6.65$ Cl TIP MI200 # 47228 / Ag/AgCl REF # 44629 $\text{ppm Cl}^- = \text{EXP}[-0.0468(\text{mV}) + 12.17]$ Cl MOUTH MI200 # 47226 / Ag/AgCl REF # 44671 $\text{ppm Cl}^- = \text{EXP}[-0.0495(\text{mV}) + 12.00]$ Cl BULK MI200 # 42998 / Ag/AgCl REF # 43647 $\text{ppm Cl}^- = \text{EXP}[-0.0503(\text{mV}) + 11.54]$

Daniel D 8/12/93

8/20/93

CREVICE 825-9, DAT

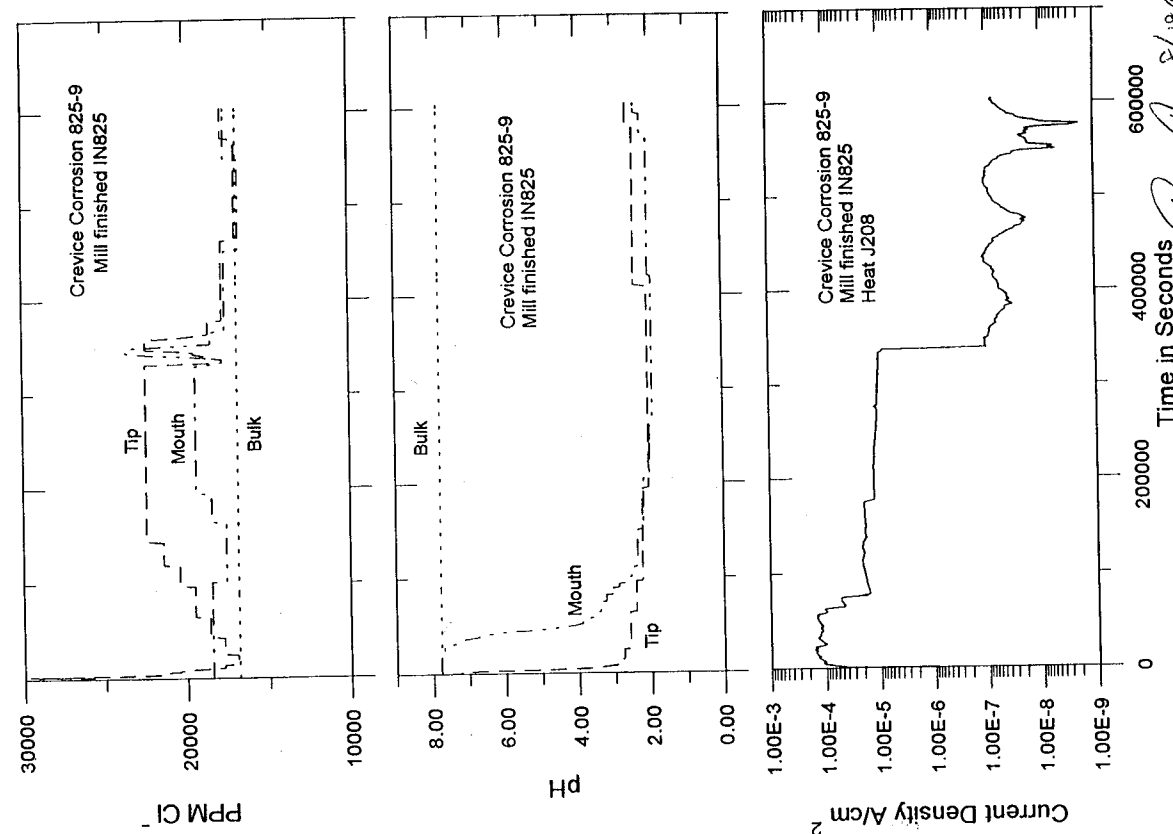
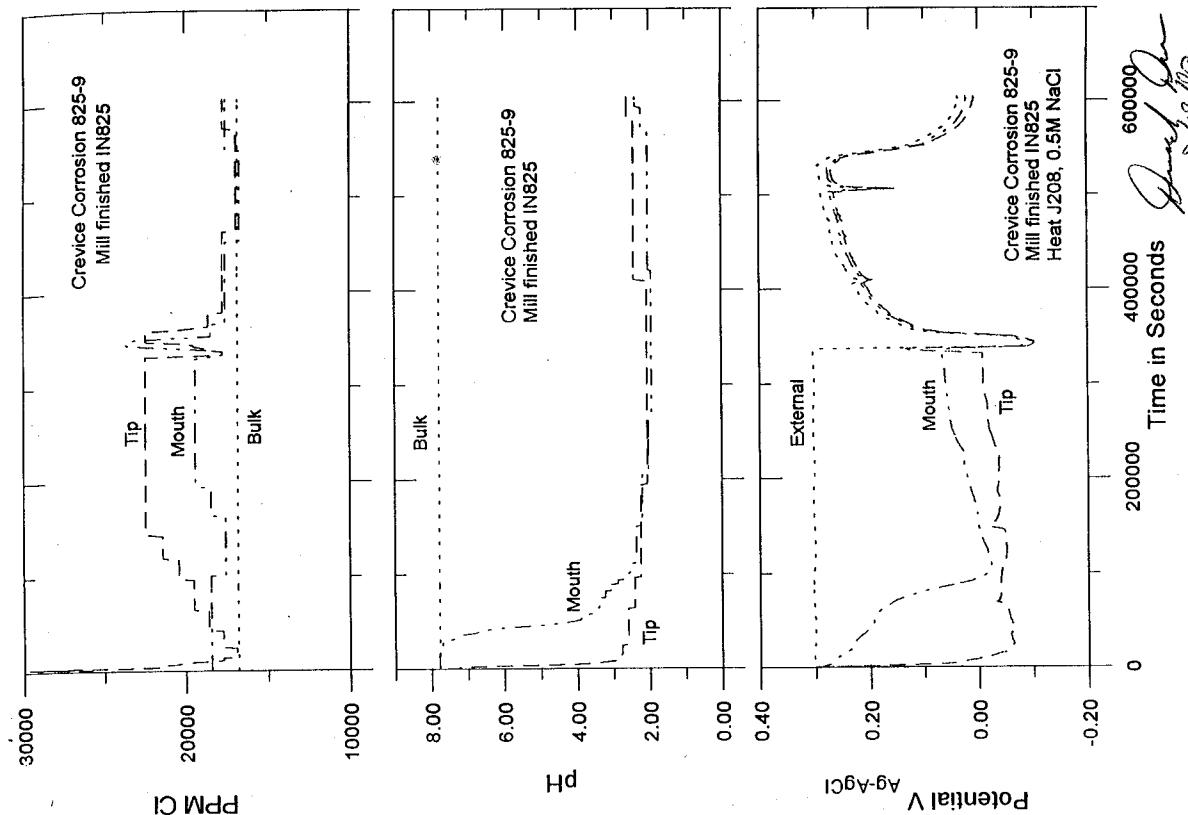
AT THE CONCLUSION OF THE TEST THE SPECIMEN WAS OBSERVED TO HAVE SMALL REGIONS OF DISCOLORATION AROUND ELECTRODE PORTS. CREVICE CORROSION WAS VISIBLE ALONG ENTIRE LENGTH OF THE SPECIMEN FROM MOUTH PORT TO END OF SPECIMEN ON TOP SIDE. LOWER SIDE WHICH WAS FINISHED TO 400 SIC TO REMOVE CR DEPLETED LAYER DID NOT HAVE ANY CREVICE CORROSION. DRAWING OF TOP OF SPECIMEN BELOW AT 2:1 SCALE

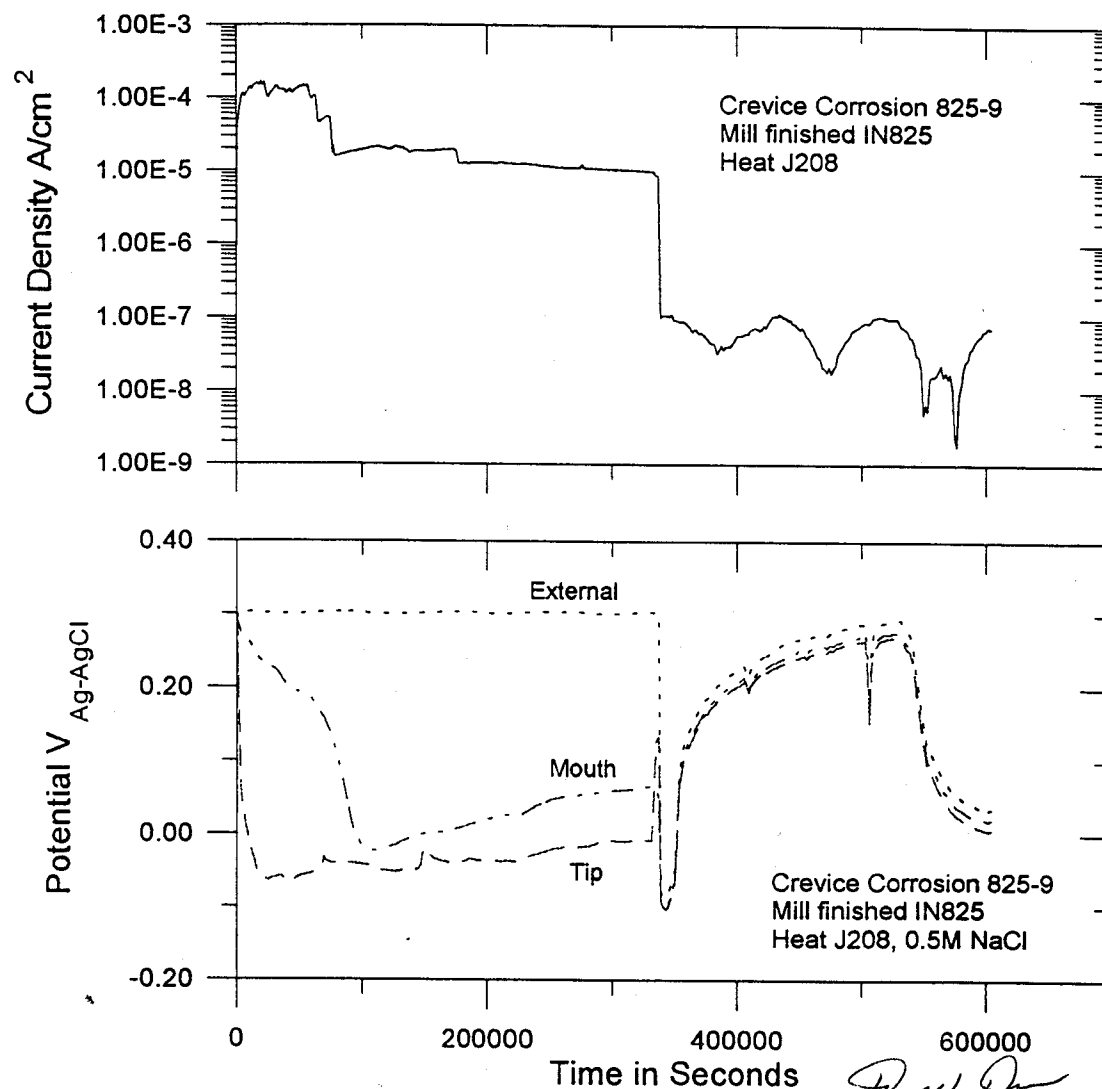


SPECIMEN POTENTIAL TIP POTENTIAL MOUTH POTENTIAL AND CURRENT DENSITY WERE WRITTEN DIRECTLY TO DISC TO FILE 825-9.DAT USING CREVICE.WBS PH AND CI DATA ADDED FROM CHART RECORDER TRACES. PH AT TIP WAS ERRATIC DURING A SIGNIFICANT PORTION OF THE TEST.

Paul D. 8/19/93

PH AND CI ISE CALIBRATION DATA SAVED AS 8259CAL.DAT ON IWE OPS DISK *Paul D.* 4/28/94





David R 8/31/93

8/20/93

CREVICE 825-10

OBJECTIVE: DETERMINE CREVICE CORROSION CHEMISTRY

SPECIMEN ALLOY 825 HN437IFG 600 S.C

SPECIMEN CLEANED SAME AS 304L-8.P7

$\rho = 2.490$ $w = 0.495$ $t = 0.122$

AREA 20.60 cm^2

START WT 21.98595g

END WT NOT RECORDED

SOLUTION 0.5 M NaCl 85PPM NO_3^- 20PPM SO_4^{2-}

10PPM NO_3^- 2PPM F^- 1000ml AS FOLLOWS

29.22304 g NaCl LOT 926368A

0.12043 g NaHCO_3 LOT 897789

20ml SO_4^{2-} - 8/93 STOCK SOLUTION

10ml NO_3^- - 8/93 "

2ml F^- - 8/93 "

+ DI WATER TO 1000 ml STOCK SOLUTIONS

P 15

START PH 7.841

END PH 6.195

SETUP SPECIMEN PLACED IN PLEXIGLASS

CELL 8/20/93 3:00PM AND TORQUED TO

20 in - oz USING PROTO 6103

ELECTRODE SETUP TO PORT #1, PORT #2

AND BULK SAME AS 304L-8 P.7

SETUP OF PH METERS AND CHART RECORDERS

SAME AS 304L-8 P.7

SPECIMEN CONNECTED TO ESC 440 #2

CHANNEL #1 AS WORKING ELECTRODE

PC COUNTER ELECTRODE CONNECTED TO CHANNEL

#1 TIP REFERENCE ELECTRODE CONNECTED

TO CHANNEL #3 MOUTH REFERENCE ELECTRODE

CONNECTED TO CHANNEL #2. PLEXIGLASS CELL

AND GLASS VESSEL PLACED IN FARADAY CAGE

AT 3:00 PM 8/20/93

David R 8/20/93

8/20/93

CREVICE 825-10

INITIAL CONDITIONS AT ^{DD 8/31/94} ~~5:00 PM~~ 8/20/93 4:00 PM

TIP CI	42.3 mV
TIP PH	-38.1 mV
MOUTH CI	35.6 mV
MOUTH PH	-12.3 mV
BULK CI	34.9 mV
BULK PH	-79 mV
E _{CORR}	-86 mV
E _{TIP}	-108 mV
E _{MOUTH}	-101 mV
E _{PT}	+471 mV

TIMER = 3600 SEC

AT 3600 SEC V_{SET} TO 300 mV $Ag/AgCl$

PRIOR TO ASSEMBLY ELECTRODES WERE CALIBRATED USING STANDARD BUFFERS 1.00, 4.00 7.00 AND 10.00 FOR PH ELECTRODES AND CI STOCK SOLUTIONS FOR CI ELECTRODES. STOCK SOLUTIONS P15

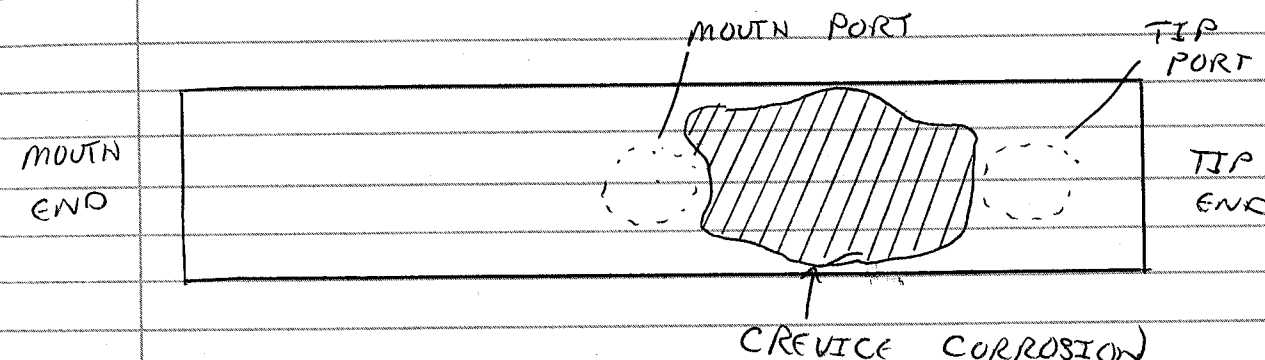
PH TIP	MI 506 # 43720 / $Ag/AgCl$ REF # 41436
PH =	-17.2 (V) + 6.68
PH MOUTH	MI 506 # 43717 / $Ag/AgCl$ REF # 44628
PH =	-17.7 (V) + 6.92
PH BULK	MI 506 # 44817 / $Ag/AgCl$ REF # 45860
PH =	-17.2 (V) + 6.63
CI TIP	MI 200 # 47228 / $Ag/AgCl$ REF # 44629
ppm Cl^- =	Exp [-0.0665 (mV) + 12.97]
CI MOUTH	MI 200 # 47226 / $Ag/AgCl$ REF # 44671
ppm Cl^- =	Exp [-0.0741 (mV) + 12.45]
CI BULK	MI 200 # 42998 / $Ag/AgCl$ REF 43647
ppm Cl^- =	Exp [-0.0564 (mV) + 12.05]

Paul D 8/20/93

9/2/93

CREVICE 825-10

AT THE CONCLUSION OF THE TEST THE SPECIMEN WAS OBSERVED TO HAVE A LARGE REGION OF CREVICE CORROSION BETWEEN THE TWO ELECTRODE PORTS. SOME DISCOLORATION AROUND CREVICE CORROSION REGION WAS ALSO VISIBLE. DEEPEST PENETRATION WAS MEASURED TO BE 37 μm BY SURFACE PROFILOMETER TAYLOR HOBSON SURTRONIC 3P WITH ^{DD 8/31/94} ~~THINK~~ MAC COMPUTER SEM EDX ANALYSIS INDICATED MATERIAL WAS ALLOY 825 AND ALL COMPOSITIONAL VALUES WERE CONSISTANT WITH BULK MATERIAL NO CREVICE CORROSION WAS VISIBLE AT BOTTOM OF SPECIMEN. DRAWING OF TOP SIDE OF SPECIMEN BELOW AT 2:1 SCALE.

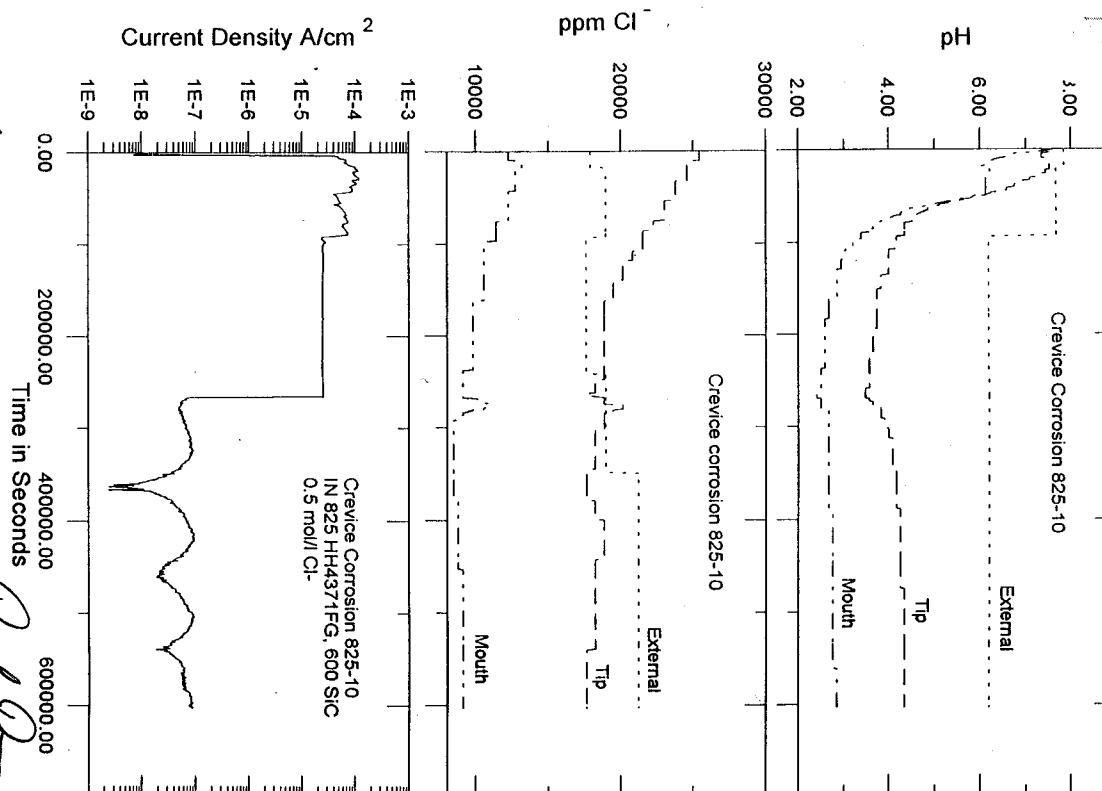
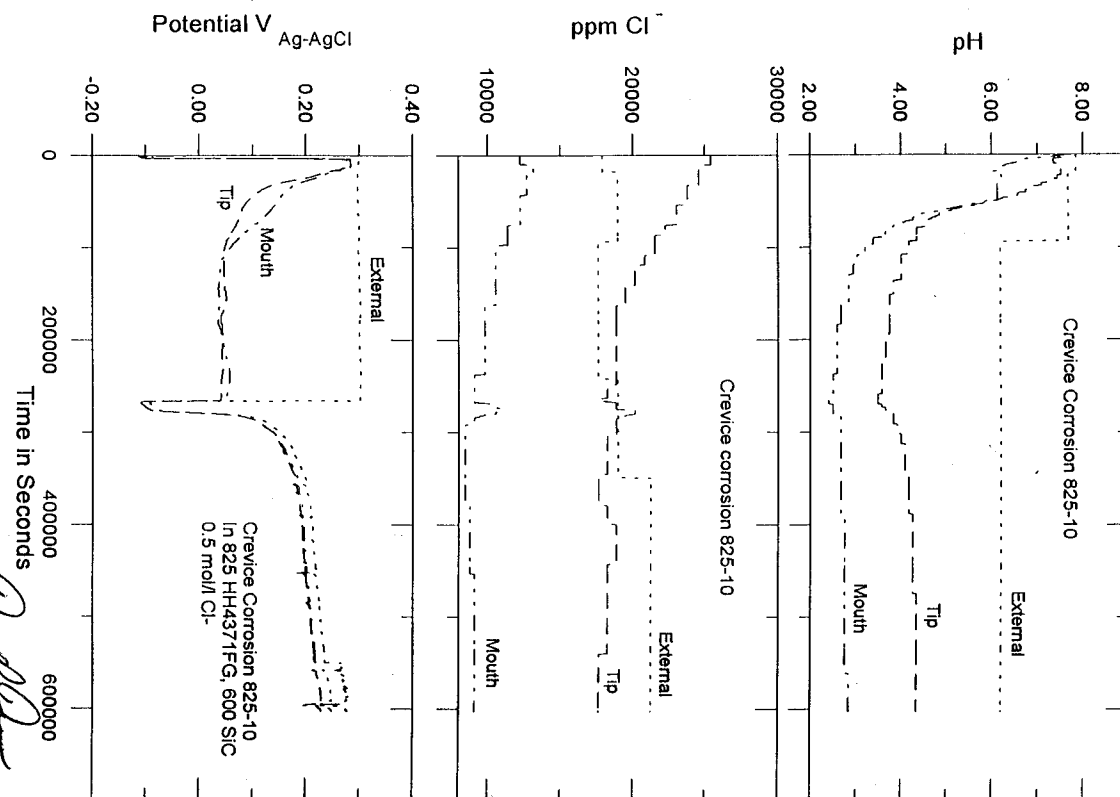


DEIMENSIONS OF CREVICE CORROSION REGION
 $l = 1.9$ cm $w = 0.7 - 1.0$ ^{DD 8/31/94} ~~mm~~ cm

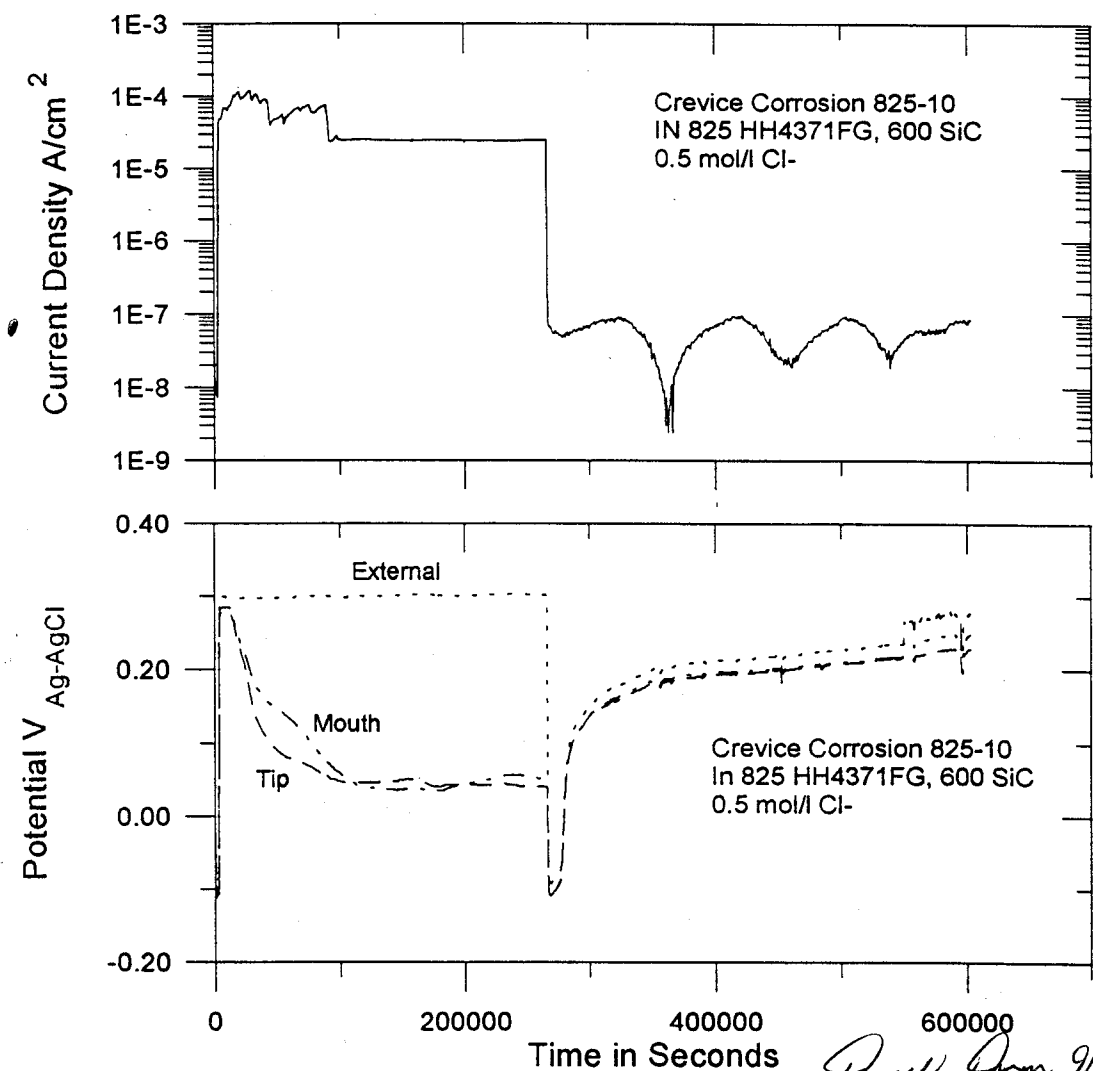
SPECIMEN POTENTIAL TIP POTENTIAL MOUTH POTENTIAL AND CURRENT DENSITY WERE WRITTEN DIRECTLY TO DISC TO FILE 825-10.DAT USING CREVICE.WBB PH AND CI DATA WERE ADDED FROM CHART RECORDER TRACES COMPLETE DATA FILE 825-10.WK1

Paul D 9/2/93

CREVICE 825-10



CREVICE 825-10



PH AND Cl⁻ ISE CALIBRATION
DATA SAVED AS 82510CAL.DAT
ON IUPUI 085 DISK

9/25/94

9/2/93

8/31/93

CREVICE 825-11

OBJECTIVE MEASURE CREVICE CORROSION CHEMISTRY

SPECIMEN ALLOY 825 HN4371FG 6003.L

SPECIMEN PREPARED AND CLEANED SAME

AS 304L-8 P7

AREA = 20.62 CM²

L = 2.502" W = 0.495 t = 0.120"

START WT 21.55092

END WT 21.54305

SOLUTION 1000 PPM Cl⁻ 85 PPM NaCl 20 PPM SO₄²⁻
10 PPM NO₃⁻ 2 PPM F⁻ 1000 ml AS FOLLOWS

1.64807 g NaCl LOT 926368A

0.11786 g NaNO₃ LOT 89778920 ml SO₄ - 8/93 STOCK SOLUTION10 ml NO₃ - 8/93 "

2 ml F - 8/93 "

+ DI WATER TO 1000 ml STOCK SOLUTIONS
P15

START PH 8.48

END PH 8.26

SETUP SPECIMEN PLACED IN PLEXIGLASS CELL

8/31/93 AT 2:00 PM AND TORQUED TO 20 IN OZ

USING PROTO 6103 ELECTRODE SETUP TO

PORT 1 AND PORT 2 AND ~~AT~~ BULK SAME

AS 304L-8 P7 SETUP OF METERS AND

CHART RECORDERS SAME AS 304L-8 P7.

ELECTRODE MODEL AND SERIAL NUMBERS GIVEN
ON P 27 WITH CALIBRATION.

SPECIMEN CONNECTED TO ESC 440 #2 CHANNEL

#1 AS WORKING ELECTRODE. ~~PLATINUM~~ PLATINUM

ELECTRODE CONNECTED AS COUNTER ELECTRODE

ON CHANNEL #1 TIP REFERENCE TO CHANNEL #3

MOUTH REFERENCE TO CHANNEL #2 PLEXIGLASS CELL

AND GLASS VESSEL PLACED IN FARADAY CAGE

AT 2:00 PM 8/31/93

D. M. 8/31/93

8/31/93

CREVICE 825-11

INITIAL CONDITIONS AT 2:00 PM 8/31/93

TIP Cl⁻ = 104 mV = 1653 PPM

TIP PH = -70 mV = 7.72

MOUTH Cl⁻ = +102 mV = 770 PPM

MOUTH PH = -45 mV = 7.79

BULK Cl⁻ = 96 mV = 1108 PPM

BULK PH = -92 mV = 8.48

E_{CELL} = -119 mVE_{TIP} = -139 mVE_{MOUTH} = -137 mVE_{PT} = NOT RECORDEDAT t = 3600 SEC 8/31/93 3:00 PM V_{SET} TO 300 mV_{A₁/A₂Cl}PRIOR TO ASSEMBLY ELECTRODES WERE CALIBRATED
USING STANDARD BUFFERS 1.00 4.00 7.00 10.00
FOR PH ELECTRODES AND Cl⁻ STOCK SOLUTIONS
ON PAGE 15 FOR Cl ELECTRODES.PH TIP MI506 #45147 / A₁ A₁ClREF MI403 #45867

PH = -17.25 (V) + 6.52

PH MOUTH MI506 #43717 / A₁ A₁ClREF MI403 #44628

PH = -17.81 (V) + 6.99

PH BULK MI506 #44817 / A₁ A₁ClREF MI402 #44817

PH = -17.38 (V) + 6.89

Cl TIP MI200 #47228 / MI403 #44629

ppm Cl⁻ = EXP[-0.0548 (mV) + 3.11]

Cl MOUTH MI200 #44671 / MI403 #44671

ppm Cl⁻ = EXP[-0.0564 (mV) + 12.40]

Cl BULK MI200 #42992 / MI402 #43647

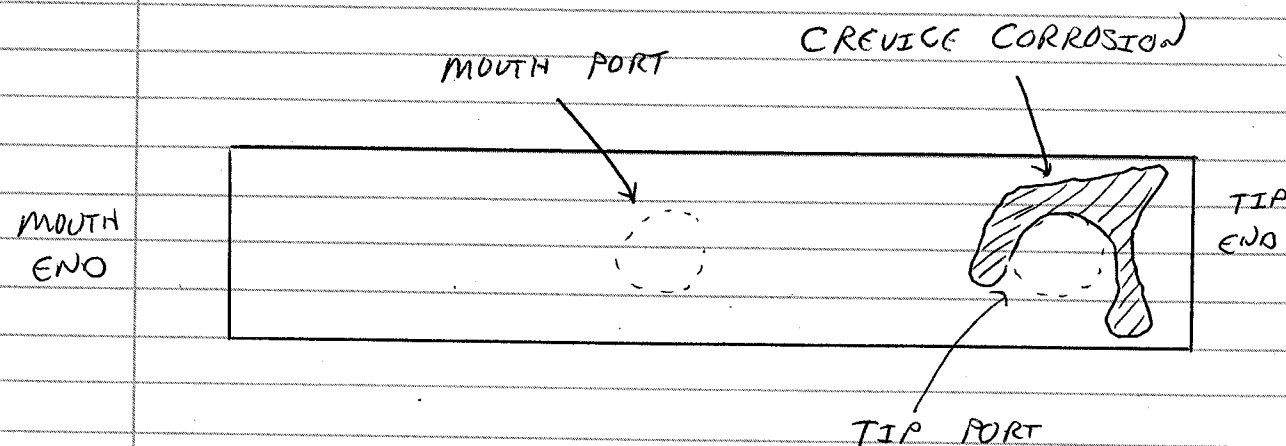
ppm Cl⁻ = EXP[-0.0503 (mV) + 11.84]

D. M. 8/31/93

9/13/93

CREVICE CORROSION 825-11

AT THE CONCLUSION OF THE TEST THE SPECIMEN WAS OBSERVED TO HAVE A REGION OF CREVICE CORROSION AROUND THE TIP ELECTRODE PORT. DISCOLORATION OF THE SPECIMEN WAS ALSO OBSERVED IN THIS REGION. NO CREVICE CORROSION WAS OBSERVED ON THE BOTTOM OR ANY OTHER REGION OF THE SPECIMEN. DRAWING OF TOP SIDE OF SPECIMEN AT 2:1 SCALE BELOW

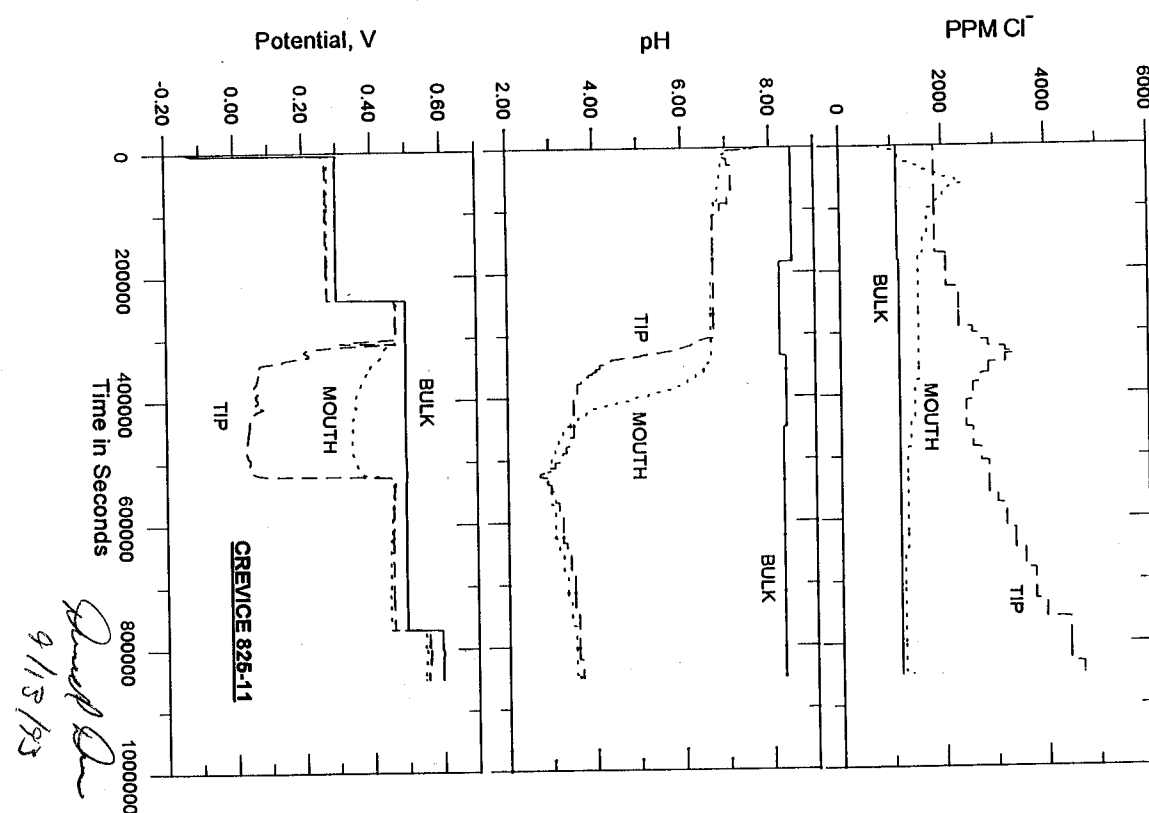
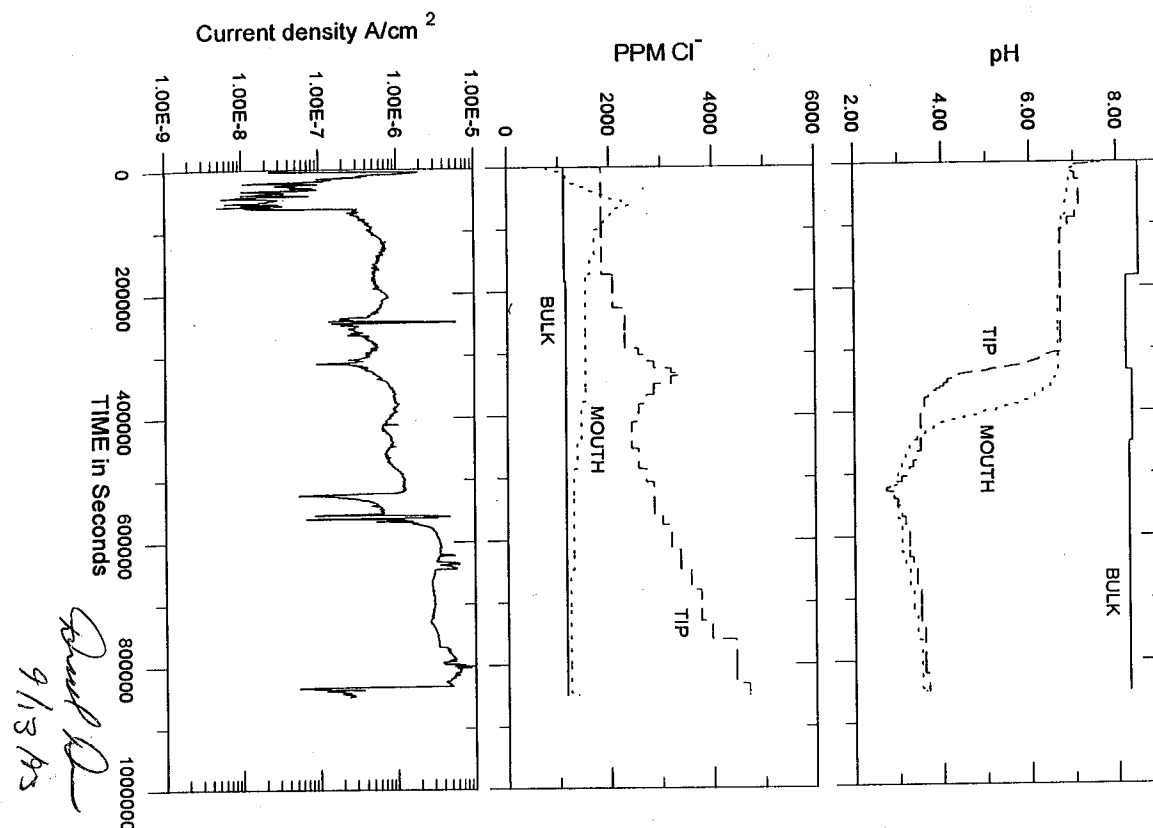


SPECIMEN POTENTIAL, TIP POTENTIAL, MOUTH POTENTIAL AND CURRENT DENSITY WERE WRITTEN DIRECTLY TO DISC TO FILE 825-11.DAT USING CREVICE.WBB PH AND CI ELECTRODE DATA WERE ADDED FROM CNART RECORDER TRACES COMPLETE DATA FILE 825-11M.WK1. DATA BEYOND 848700 SEC WERE ~~OMITTED~~ ^{OP 513144} OMITTED DUE TO PROBLEMS WITH REFERENCE ELECTRODES. PLOTS OF DATA P 29-30

PH AND CI ISF CALIBRATION DATA SAVED AS 82511CAL.DAT ON IWP085 DISK
9/13/93
4/28/94

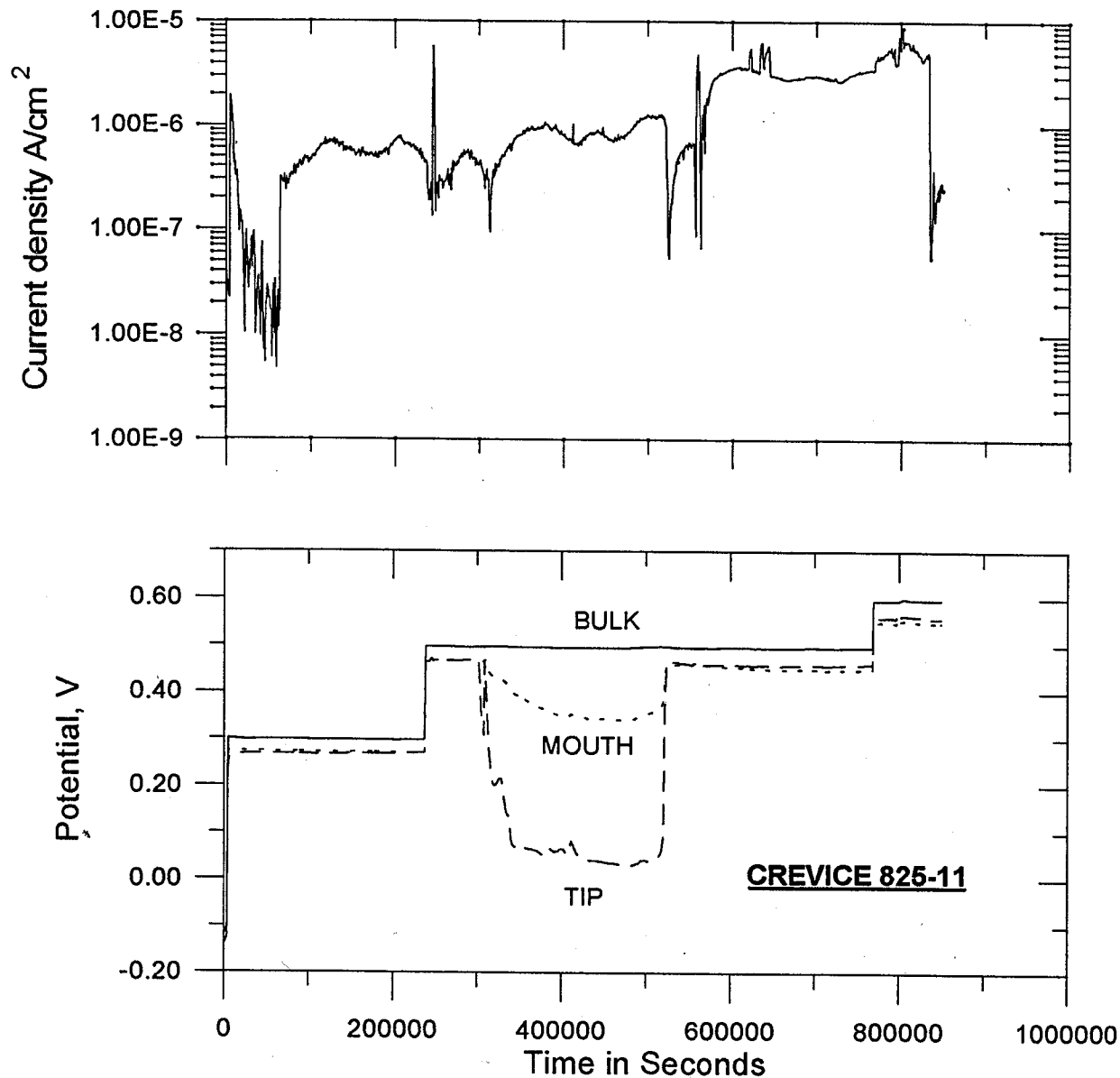
9/13/93

CREVICE CORROSION 825-11



9/13/93

CREVICE 825-11



David D
9/13/93

David D
9/13/93

9/2/93

POTENTIOSTATIC POLARIZATION 36GRIT1

SPECIMEN ALLOY P25 NH4371FG CUBE SPECIMEN
WITH CYLINDRICAL POST. CUBE DIMENSIONS
12.5 x 12.5 x 17 mm POST: 17mm LONG x 6mm DIA
SURFACE AREA 15 cm² WITH POST HALFWAY
IMMERSED IN SOLUTION. MILL FINISHED
SURFACES REMOVED WITH 36 GRIT
PAPER.

START WT: 29.90891 g

END WT 28.95831 g

SOLUTION 1000 PPM Cl⁻ 85 PPM HCO₃⁻ 20 PPM SO₄²⁻
10 PPM NO₃⁻ 2 PPM F⁻ 2000 ml AS FOLLOWS.

3.29906 g NaCl LOT 926368A

8/31/94 0.23646 g NaHCO₃ LOT 89778940 20 ml SO₄ - 8/93 STOCK SOLUTION20 ml NO₃ - 8/934 2 ml F⁻ - 8/93

+ DI WATER TO 2000 ml STOCK SOLUTIONS

P15 T=95°C N₂ THERMO 0323007 N₂ PURGED

POTENTIOSTAT ESC 440 #1 CHANNEL #1

DATA SAVED AS 36GRIT1.DAT USING LONGTM, WBB

REFERENCE SCE FISHER 13-620-51 SN

E_{CORR} -662 mV

KEITNEY 614

E_{PT} -242 mVE_{APP} +500 mV

SPECIMEN STARTED 9/2/93

SPECIMEN STOPPED 9/5/93 10:08 PM

RUNTIME 3,19988 SEC

CHARGE DENSITY 246 C/cm²

START PH 7.984

END PH 9.210

SPECIMEN HAS PITS ON 36 GRIT FINISHED SURFACES
AND ON LATHE TURNED STEM (CYLINDRICAL REGION)
AND ON RADII TO CUBIC PORTION OF SPECIMEN.
MAJORITY OF PITS ON 36 GRIT FINISHED SURFACE.

David D
9/10/93

9/2/93

POTENTIOSTATIC POLARIZATION 36GRIT2

SPECIMEN ALLOY 825 NN4371FC PREPARED

SAME AS 36GRIT PAGG 31

START WT 28.55621g

END WT 28.55587g

SOLUTION 1000 PPM Cl^- 85PPM NaCO_3 20PPM SO_4^{2-} 10PPM NO_3^- 2PPM F^- 2000 ml AS FOLLOWS3.29783 g NaCl LOT 926368A0.23724 g Na_2CO_3 LOT 89778940 ml SO_4 - 8/9320 ml NO_3 - 8/934 ml F^- - 8/93

+ DI WATER TO 2000 ml STOCK SOLUTIONS

P15 $T = 95^\circ\text{C}$ N_2 THERMO # 0323005 N_2 PURGED

POTENTIOSTAT ESC440 #1 CHANNEL #2

DATA SAVED AS 36GRIT2.DAT USING LONGTM.WBB

REFERENCE SCE FISHER 13-620-51 SN

 $E_{\text{CERR}} - 698 \text{ mV}$ REFERENCE 614 $E_{\text{PT}} - 258 \text{ mV}$ $E_{\text{APP}} + 300 \text{ mV}$

SPECIMEN STARTED 9/2/93

SPECIMEN STOPPED 9/5/93 8:08 AM

RUNTIME 269057 S6L

CHARGE DENSITY, $-2.8 \times 10^{-3} \text{ C/cm}^2$

START pH = 8.194

END pH = 9.276

NO PITS ANYWHERE ON SPECIMEN. SOME

SHALLOW CORROSION LOOKING SIMILAR TO ETCHING

ON CYLINDRICAL STEM BOTH ABOVE AND

BELOW THE SOLUTION/VAPOR INTERFACE.

9/10/93

9/7/93

STOCK SOLUTIONS 9/93

 SO_4 - 9/93 1000 PPM SO_4^{2-} 1.48322 g Na_2SO_4 LOT 901213 +

DI WATER TO 1000 ml EXP 10/7/93

 NO_3 - 9/93 1000 PPM NO_3^- 1.37603 g NaNO_3 LOT 897183 +

DI WATER TO 1000 ml EXP 10/7/93

 F^- - 9/93 1000 PPM F^- 2.21173 g NaF LOT 896405 +

DI WATER TO 1000 ml EXP 10/7/93

100 Cl^- - 9/93

8/31/94

~~1000~~ 100 PPM Cl^- 100 ml OF 1000 Cl^- - 9/93 + 900 ml DI WATER

EXP 10/7/93

1000 Cl^- - 9/93 ~~PPM~~ 1000 PPM Cl^- 3.29653 g NaCl LOT 926368A +

DI WATER TO 1000 ml EXP 10/7/93

0.5 M Cl^- - 9/93 0.5 M Cl^- 29.22461 g NaCl LOT 926368A +

DI WATER TO 1000 ml EXP 10/7/93

1.0 M Cl^- - 9/93 1.0 M Cl^- 58.44103 g NaCl LOT 926368A +

DI WATER TO 1000 ml EXP 10/7/93

2.0 M Cl^- - 9/93 2.0 M Cl^- 116.89525 g NaCl LOT 926368A +

DI WATER TO 1000 ml EXP 10/7/93

9/7/93

9/9/93

LONG TERM POTENTIOSTATIC TEST LT825P1B

SPECIMEN SAME AS LT825P1B P 13

AREA = 15 cm²

START WT = 29.58483g

END WT 29.57585g

SOLUTION 1000 PPM Cl⁻ 85 PPM NaCO₃ 20 PPM SO₄²⁻10 PPM NO₃⁻ 2 PPM F⁻ 2000 ml AS FOLLOWS.3.30093g NaCl LOT ~~926931~~ 926368A0.24019g NaHCO₃ LOT 89778940 ml SO₄ - 9/9320 ml NO₃ - 9/934 ml F⁻ - 9/93

+ DI WATER TO 2000 ml STOCK SOLUTIONS

P 33 T = 95°C N₂ THERMO 183305

POTENTIOSTAT ESC 440 #1 CHANNEL #1

DATA SAVED AS LT825P1B.DAT USING

LONGTM.WRB

REFERENCE SCE FISHER 13-620-SI SN 9214083

E_{CORR} -179 mVE_{PT} +151 mVE_{APPLIED} 200 mV

SPECIMEN STARTED 6:10 PM 9/9/93

RUNTIME 28 DAYS

CHARGE DENSITY

START PH 8.306

END PH 8.752

SPECIMEN STOPPED 5:30 PM 10/7/93

END Cl CONC 1112 PPM

10/7/93

9/9/93

LONG TERM POTENTIOSTATIC TEST LT825P2B

SPECIMEN SAME AS LT825P2 P 14

AREA = 15 cm²

START WT 30.82444g

END WT 30.82270g

SOLUTION 1000 PPM Cl⁻ 85 PPM NaCO₃ 20 PPM SO₄²⁻10 PPM NO₃⁻ 2 PPM F⁻ 2000 ml PREPARED AS FOLLOWS

3.29853g NaCl LOT 926368A

0.24198g NaHCO₃ LOT 89778940 ml SO₄ - 9/93 STOCK SOLUTION20 ml NO₃ - 9/934 ml F⁻ - 9/93

+ DI WATER TO 2000 ml STOCK SOLUTIONS

P 33 T = 95°C N₂ THERMO 183301

POTENTIOSTAT ESC 440 #1 CHANNEL #2

DATA SAVED AS LT825P2B.DAT USING

LONGTM.WRB.

REFERENCE SCE FISHER 13-620-SI SN 8211163

E_{CORR} -87 mVE_{PT} +178 mVE_{APPLIED} 0.0 mV

SPECIMEN STARTED 6:10 PM 9/9/93

RUNTIME 28 DAYS

CHARGE DENSITY

START PH 8.264

END PH 8.873

SPECIMEN STOPPED 10/7/93 5:30 PM

END Cl CONCENTRATION 1170 PPM

10/7/93

10/11/93

CREVICE 825-12

OBJECTIVE DETERMINE CREVICE CORROSION CHEMISTRY

SPECIMEN ALLOY 825 MILL FINISHED

SPECIMEN PREPARATION AND CLEANED SAME

AS 304L-8 P7

AREA = 20.57 cm² $\lambda = 2.499$ $w = 0.499$ $b = 0.116$

START WT 20.83416

END WT 20.83403

SOLUTION 1000 ppm Cl⁻ 85 ppm NaCO₃ 20 ppm SO₄²⁻10 ppm NO₃⁻ 2 ppm F⁻ 1000 ml AS FOLLOWS

1.64893 g NaCl LOT 926448A

0.11847 g NaHCO₃ LOT 89778920 ml SO₄ - 9/93 STOCK SOLUTIONS10 ml NO₃ - 9/932 ml F⁻ - 9/93

+ DI WATER TO 1000 ml STOCK SOLUTIONS

P 33 T = 25°C

START PH 8.084

END PH 8.171

SETUP SPECIMEN PLACED IN PLEXIGLASS

CELL 9/13/93 5:10 PM AND TORQUED TO

20 IN OZ USING PROTO 6103 ELECTRODE

SETUP TO PORT 1 AND PORT 2 SAME AS

304L-8 P7 SETUP OF METERS AND

CHART RECORDERS SAME AS 304L-8 P7

ELECTRODE MODEL AND SERIAL NUMBERS

GIVEN ON PAGE 37 WITH CALIBRATION.

SPECIMEN CONNECTED TO ESC 440 #2 CHANNEL #1

AS WORKING ELECTRODE Pt COUNTER ELECTRODE

ALSO CONNECTED TO CHANNEL #1 TIP REFERENCE

CONNECTED TO CHANNEL #3 MOUTH REFERENCE

CONNECTED TO CHANNEL #2 PLEXIGLASS CELL

AND GLASS VESSEL PLACED IN FARADAY CAGE

AT 5:15 PM 9/13/93

Duff 10/11/93

10/11/93

CREVICE 825-12

INITIAL CONDITIONS 5:15 PM

8/31/94
10/11/93 9/13/93

TIP CI = 98 mV

TIP PH = -190 mV

MOUTH CI = 112 mV

MOUTH PH = -85 mV

BULK CI = ~~88~~ 91 mV

BULK PH = -88 mV

E_{corr} = -299 mV

AT 6:00 PM

E_{TIP} = -442 mVE_{MOUTH} = -373 mVE_{PT} = +538 mVAT t = 3600 SEC 9/13/93 6:10 PM V_{SET} = 300 mV

PRIOR TO ASSEMBLY ELECTRODES WERE CALIBRATED

USING STANDARD BUFFERS 1.00 4.00 7.00 & 10.00

FOR PH ELECTRODES AND Cl⁻ STOCK SOLUTIONSON PAGE 33 FOR Cl⁻ ELECTRODES.8/31/94
45147
45867
PH TIP MI 506 #44817 / Ag/AgCl REF MI 403 #45860

PH = -17.66(V) + 6.59

PH MOUTH MI 506 #43717 / Ag/AgCl REF MI 403 #44628

PH = -18.68(V) + 6.89

PH BULK MI 506 #44817 / Ag/AgCl REF MI 403 #45860

PH = -17.38(V) + 6.52

CI TIP MI 200 #47228 / Ag/AgCl REF MI 403 #44692

PPM Cl⁻ EXP [-0.0633(mV) + 13.68]

CI MOUTH MI 200 #47226 / Ag/AgCl REF MI 403 #44671

PPM Cl⁻ EXP [-0.0630(mV) + 13.41]

CI BULK MI 200 #42992 / Ag/AgCl REF MI 402 #43647

PPM Cl⁻ EXP [-0.0465(mV) + 11.37]

BULK Ag/AgCl REF = FISHER 13-620-53

SN 8118182

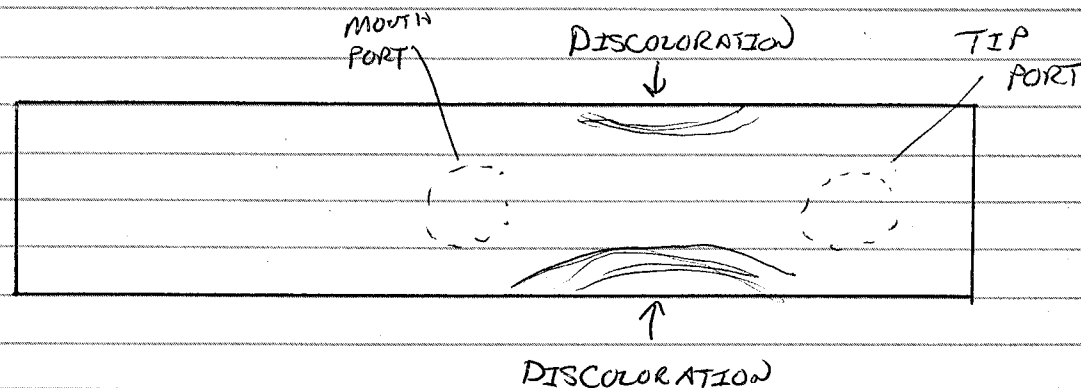
Duff 10/11/93

10/11/93

CREVIC 825-12

DD 8/31/94

POST TEST OBSERVATION OF THE SPECIMEN REVEALED NO INDICATION OF CREVIC CORROSION ON THE TOP OR BOTTOM OF THE SPECIMEN. SOME DISCOLORATION OF THE SPECIMEN ON BOTH THE TOP AND BOTTOM SINGS WERE OBSERVED. DRAWING OF TOP SIDE OF SPECIMEN GIVEN BELOW AT 2:1 SCALE

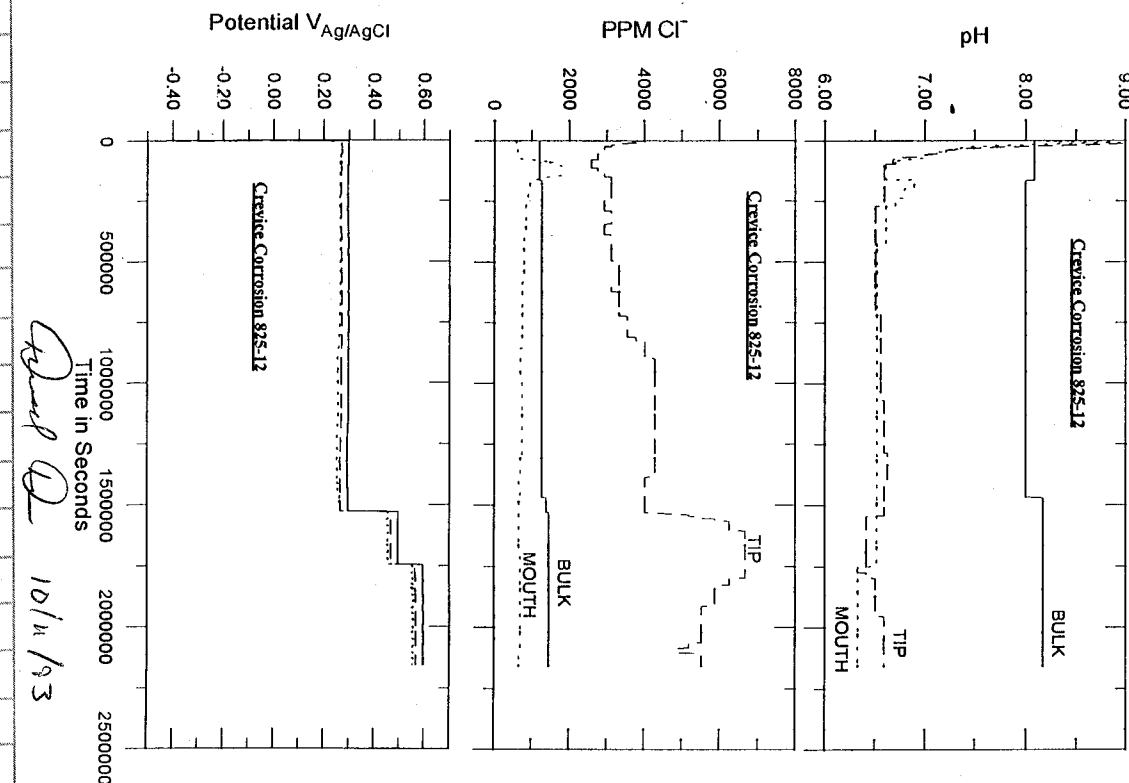


SPECIMEN POTENTIAL, TIP POTENTIAL, MOUTH POTENTIAL AND CURRENT DENSITY WERE WRITTEN DIRECTLY TO DISC TO FILE 825-12.DAT USING CREVIC.WRB. DATA FROM PN AND CI ELECTRODES WERE ADDED FROM CHART RECORDER TRACES. COMPLETE DATA FILE 825-12.WK1 CONTAINS ALL DATA FROM ELECTRODES. DATA FROM TIP REFERENCE ELECTRODE WERE CORRECTED DUE TO LOSS OF SOLUTION FROM THE INNER BARREL OF THIS ELECTRODE. CORRECTION WAS MADE FOR DATA FROM 1,475,000 SEC TO 1,531,000 SEC

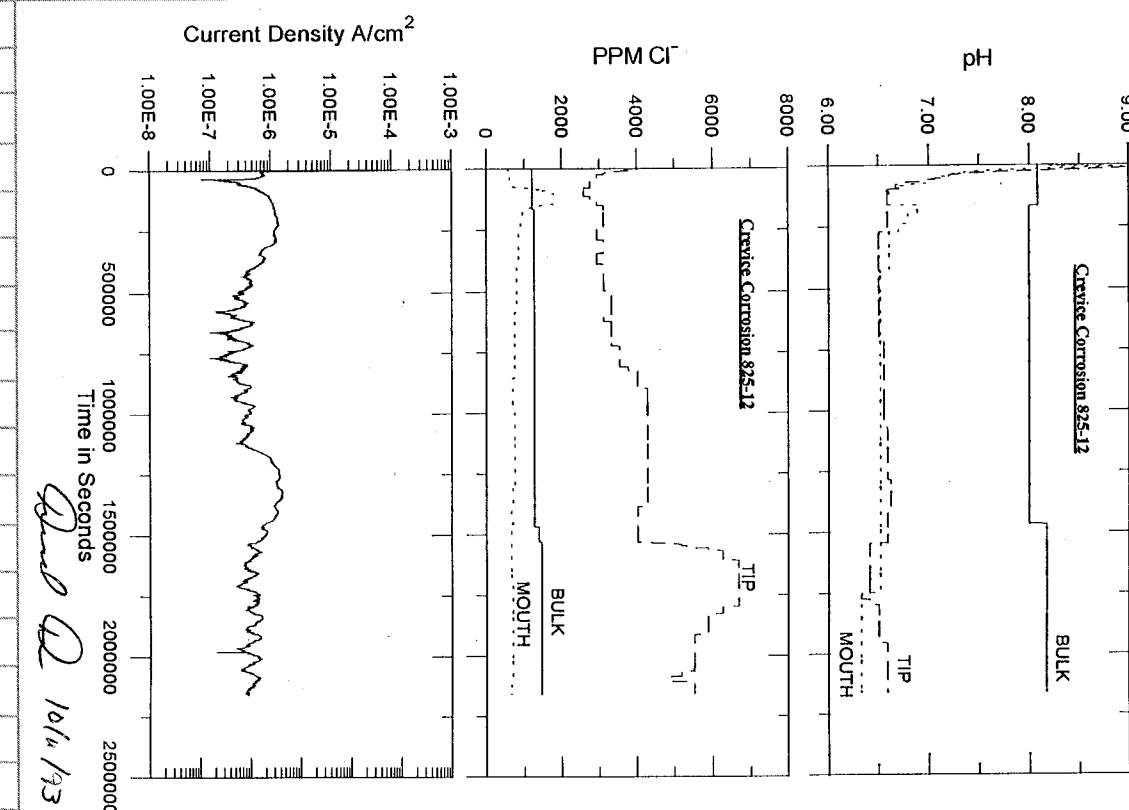
Quill 10/11/93

10/11/93

CREVIC 825-12



Quill 10/11/93

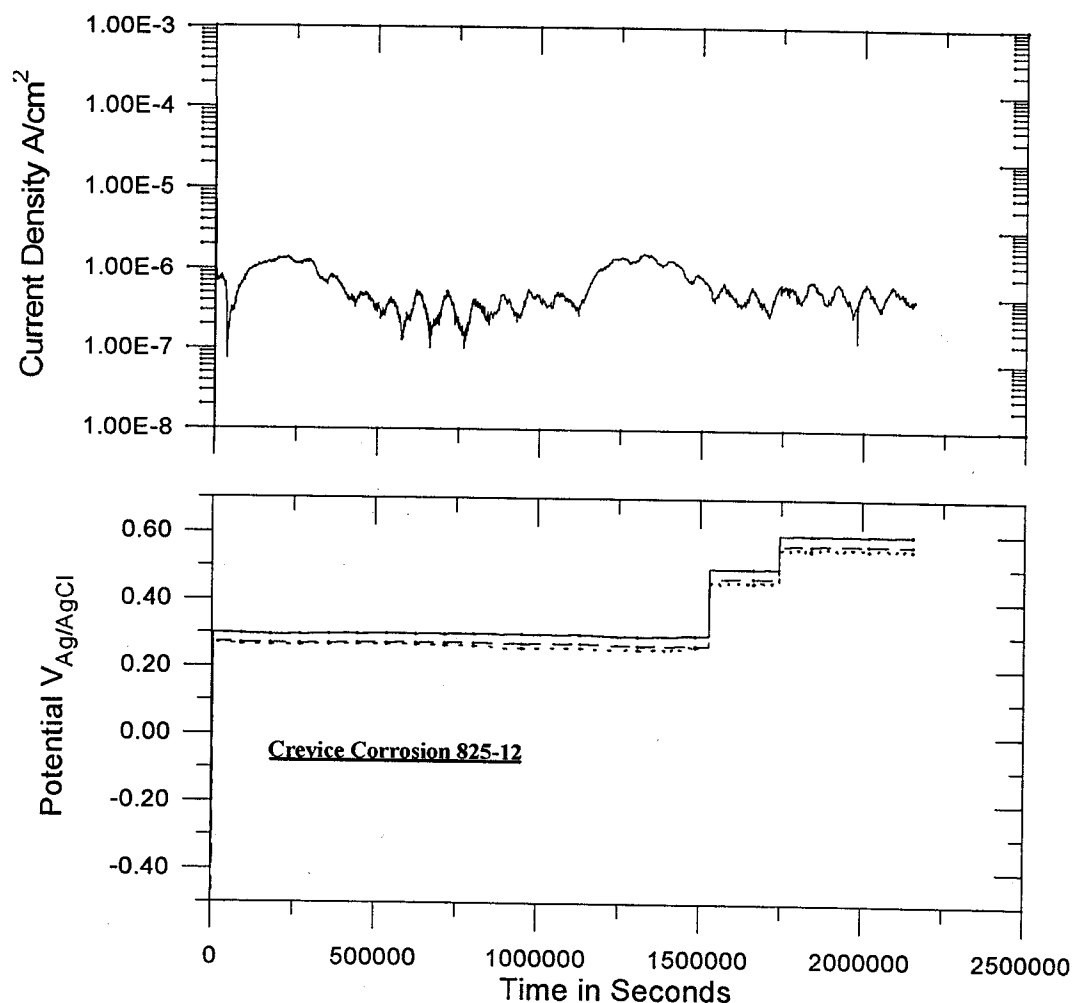


Quill 10/11/93

Quill 10/11/93

10/11/93

CREVICE 825-12



D. L. 10/11/93

D. L. 10/11/93

PA AND Cl⁻ ISE CALIBRATION DATA SAVED
AS 82512CAL.DAT USING IUPAC OBS DISK

D. L. 4/28/94

10/11/93

STOCK SOLUTIONS 10/93

1000 ppm SO₄ AS Na₂SO₄
STOCK SOLUTION SO₄-10/93
1.48222 g Na₂SO₄ LOT 901213 + WATER
TO 1000 ml EXP 11/8/93

NO₃-10/93 1000 ppm NO₃⁻ AS NaNO₃
1.37474 g NaNO₃ LOT 897183 +
DI WATER TO 1000 ml EXP 11/8/93

F⁻-10/93 1000 ppm F⁻ AS NaF
2.21329 g NaF LOT 896405 + DI WATER
TO 1000 ml EXP 11/8/93

2mCl-10/93 2 mol/L Cl⁻ AS NaCl
116.87695 g NaCl LOT 926448A
+ DI WATER TO 1000 ml EXP 11/8/93

1mCl-10/93 1 mol/L Cl⁻ AS NaCl
58.44825 g NaCl LOT 926448A
+ DI WATER TO 1000 ml EXP 11/8/93

0.5mCl-10/93 0.5 mol/L Cl⁻ AS NaCl
29.22937 g NaCl LOT 926448A
+ DI WATER TO 1000 ml EXP 11/8/93

1000 Cl-10/93 1000 ppm Cl⁻ AS NaCl
3.29967 g NaCl LOT 926448A + DI
WATER TO 2000 ml EXP 11/8/93

100 Cl-10/93 100 ppm Cl⁻ AS NaCl
100 ml 1000 Cl-10/93 + 900 ml DI WATER
EXP 11/8/93

D. L. 10/11/93

10/11/93

LONG TERM POTENTIOSTATIC TEST LT825P1C

SPECIMEN SAME AS LT825P1 & LT825P1B P13 & P34

AREA = 15 cm²

START WT: 29.57585g

SOLUTION 1000 PPM Cl⁻ 85 PPM NaCO₃ 20 PPM SO₄²⁻10 PPM NO₃⁻ 2 PPM F⁻ 2000 ml AS FOLLOWS

3.30298 g NaCl LOT 926448A

0.24388 g NaHCO₃ LOT 89778940 ml SO₄ - 10/93 STOCK SOLUTION20 ml NO₃ - 10/93 "4 ml F⁻ - 10/93 "

+ DI WATER TO 2000 ml STOCK SOLUTIONS

P41 T=95°C H₂ THERMO 183305

POTENTIOSTAT ESC 440 #1 CHANNEL #1 DATA

SAVED AS LT825P1C.DAT USING

LONGTM.WBB

REFERENCE SCE FISHER 13-620-SI SN 8211163

E_{CORR} = 166 mVE_{PT} + 440 mVE_{APP} 200 mV

SPECIMEN STARTED 10/11/93 5:30 pm

RUNTIME

SPECIMEN STOPPED 11/8/93 4:30 pm

START pH 8.178

END pH 8.928

END Cl CONC. 1046 ppm

END WT 29.57613g

 11/9/93

 8/31/94

10/11/93

LONG TERM POTENTIOSTATIC TEST LT825P2C

SPECIMEN SAME AS LT825P2, P14 & LT825P2B, P35

AREA = 15 cm²START WT ~~30.82444g~~ 30.82270g ^{8/31/94}

END WT 30.82235g

SOLUTION 1000 PPM Cl⁻ 85 PPM NaCO₃ 20 PPM SO₄²⁻10 PPM NO₃⁻ 2 PPM F⁻ 2000 ml AS FOLLOWS.

3.30050 g NaCl LOT 926448A

0.24229 g NaHCO₃ LOT 89778940 ml SO₄ - 10/93 STOCK SOLUTION20 ml NO₃ - 10/93 "4 ml F⁻ - 10/93 "

+ DI WATER TO 2000 ml STOCK SOLUTIONS

P41 T=95°C H₂ THERMO 183301

POTENTIOSTAT ESC 440 #1 CHANNEL #2 DATA

SAVED AS LT825P2C.DAT USING LONGTM.WBB

REFERENCE SCE FISHER 13-620-SI SN 9214083

E_{CORR} - 92 mVE_{PT} + 173 mVE_{APP} 0 mV

SPECIMEN STARTED 10/11/93 5:30 pm

RUNTIME

SPECIMEN STOPPED 11/8/93 4:30 pm

START pH 8.261

END pH 9.190

END Cl CONC. 1241 ppm

 11/9/93

 8/31/94

11/3/93

CREVICE 304L-9

OBJECTIVE DETERMINE CREVICE CORROSION CHEMISTRY.

SPECIMEN 304L HT # T0954 600 SiC

SPECIMEN CLEANED AND PREPARED SAME
AS 304L-8 P7

L = 2.504 W = 0.499 t = 0.116

AREA = 20.61 cm²SOLUTION 1000 PPM Cl⁻ 858 PPM HCO₃⁻ 20 PPM SO₄²⁻10 PPM NO₃⁻ 2 PPM F⁻

1.64831 g NaCl LOT 926448A

0.12046 g NaHCO₃ LOT 89778920 ml SO₄ 10/9310 ml NO₃ 10/932 ml F⁻ 10/93

+ DI WATER TO 1000 ml STOCK SOLUTIONS

pH 41 T = 25 °C

START pH 8.140

END pH 7.968

SETUP SPECIMEN PLACED IN NEW PLEXIGLASS

CELL MACHINING 11/93 WITH PLEXIGLASS

ELECTRODE INSERTS TO REDUCE TRAPPED VOLUME

IN CELL AROUND ELECTRODES. SPECIMEN

TORQUED IN CELL 11/3/93 AT 3:30 PM

USING PROTO 6103. ELECTRODE SETUP

TO PORT 1 AND PORT 2 SAME AS 304L-8 P7

SETUP OF METERS AND CHART RECORDERS SAME

AS 304L-8 P7 ELECTRODE MODEL AND SERIAL

NUMBERS GIVEN ON PAGE WITH CALIBRATION

SPECIMEN CONNECTED TO ESC 446 #2 CHANNEL #2

AS WORKING ELECTRODE. Pt COUNTER ELECTRODE

ALSO CONNECTED TO CHANNEL #1 TIP

REFERENCE CONNECTED TO CHANNEL #3

MOUTH REFERENCE CONNECTED TO CHANNEL #2

PLEXIGLASS CELL AND GLASS VESSEL PLACED

IN FARADAY CAGE 11/3/93

D. J. 11/3/93

11/3/93

CREVICE 304L-9

INITIAL CONDITIONS 4:30 PM 11/3/93 t = 3600 SEC

E_{EXT} -263 mV Ag/AgCl REFERENCE 614E_{TIP} -276 mV Ag/AgCl "E_{MOUTH} -276 mV Ag/AgCl "

pH TIP -131 mV

pH MOUTH -109 mV

pH BULK -81.5 mV

Cl⁻ TIP 88.5 mVCl⁻ MOUTH 104.9 mVCl⁻ BULK 115.6 mVE_{PT} +341 mV Ag/AgCl REFERENCE 614AT t = 3600 SEC 11/3/93 V_{SET} = 100 mV

PRIOR TO ASSEMBLY ELECTRODES WERE CALIBRATED

USING STANDARD BUFFERS 1.00 4.00 7.00 & 10.00

FOR pH ELECTRODES AND Cl⁻ STOCKSOLUTIONS ON PAGE 41 FOR Cl⁻ ELECTRODESDO 8/31/94
pH TIP MISO 45147 / Ag/AgCl REF MI 403 # 45867

pH = -17.26 (V) + 6.98

pH MOUTH MISO # 43717 / Ag/AgCl REF MI 403 # 44628

pH = -17.33 (V) + 7.21

pH BULK MISO # 44817 / Ag/AgCl REF MI 402 45860

pH = -17.26 (V) + 6.76

Cl⁻ TIP MI 200 47228 / Ag/AgCl REF MI 403 44692Cl⁻ (ppm) = EXP [-0.0482 (mV) + 12.11]Cl⁻ MOUTH MI 200 47226 / Ag/AgCl REF MI 403 44671Cl⁻ (ppm) = EXP [-0.0494 (mV) + 12.16]Cl⁻ BULK MI 200 42992 / Ag/AgCl REF MI 402 43647Cl⁻ (ppm) = EXP [-0.0386 (mV) + 11.78]

BULK Ag/AgCl REF - FISHER 13-620-53

SW 8118182

D. J. 11/3/93

A hand-drawn diagram of a rectangular component, likely a dental crown or bridge, illustrating crevice corrosion. The diagram is oriented horizontally. The left end is labeled "MOUTH END" and the right end is labeled "TIP END". Inside the rectangle, there are two dashed circles representing areas of corrosion. The left dashed circle is labeled "MOUTH PART" above it. The right dashed circle is labeled "TIP PORT" above it and "CREVICE CORROSION" below it. The area of the right dashed circle is filled with diagonal hatching lines, indicating the extent of the corrosion.

11/10/43

Paul D. 4/28/94

ELECTRODE INSERT

Technical drawing of an electrode insert. The side view shows a cylindrical part with a total length of 2.00", a central section of 1.75", and a diameter of 0.125". The top view shows a circular face with a diameter of 0.300" and six holes arranged in a hexagonal pattern. The distance between the centers of two opposite holes is 0.275". The diameter of each hole is 0.090". The distance from the center of the face to the center of a hole is 0.075". The text "EQUALLY SPACED HOLE CENTERS." is written near the top view.

2.00"

1.75"

0.125"

0.300"

0.275"

0.090"

0.075"

0.090"

0.090"

0.075"

0.075"

EQUALLY SPACED HOLE CENTERS.

11/10/93

Technical drawing of a mechanical part, showing top and side views with dimensions.

Top View Dimensions:

- Overall width: 3.00"
- Overall height: 2.10"
- Distance from left edge to center of first hole: 0.50"
- Distance between centers of first and second holes: 1.00"
- Distance between centers of second and third holes: 1.00"
- Distance from center of third hole to right edge: 0.50"
- Radius of the central semi-circular feature: $R \frac{25}{32}$
- Distance from left edge to center of first hole: DRILL TO CLEAR 10-24 BOLT

Side View Dimensions:

- Overall height: 0.400"
- Distance from top edge to top of first step: 0.375"
- Distance from top of first step to top of second step: 0.500"
- Distance from top of second step to top of third step: 0.375"

Technical drawing of a mechanical part, likely a shaft or axle, with dimensions and a signature.

Dimensions and features:

- Overall length: 5.400"
- Left end diameter: 0.290"
- Left end feature: 0.215" (width of a step or hole)
- Left end feature: 0.300" DIA (diameter of a hole or feature)
- Left end feature: 0.215" (width of a step or hole)
- Left end feature: 0.190" (width of a step or hole)
- Left end feature: 0.375" (width of a step or hole)
- Right end feature: 1/4" NPT (National Pipe Thread)
- Right end feature: 0.375" DEEP (depth of a feature)

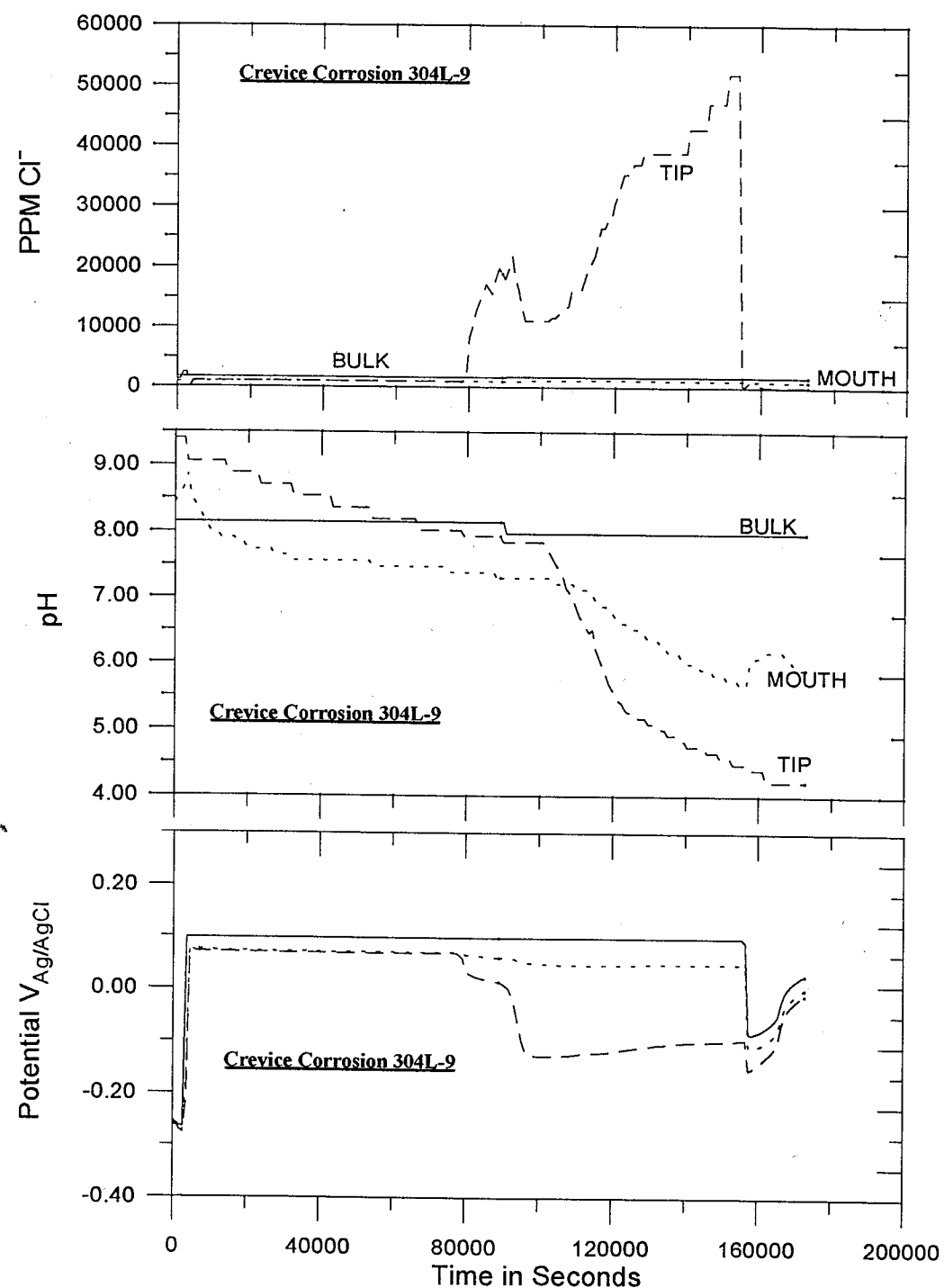
Signature: [Handwritten signature]

11/10/93

11/10/93

11/29/93

CR6UICK 304L-9 RESULTS

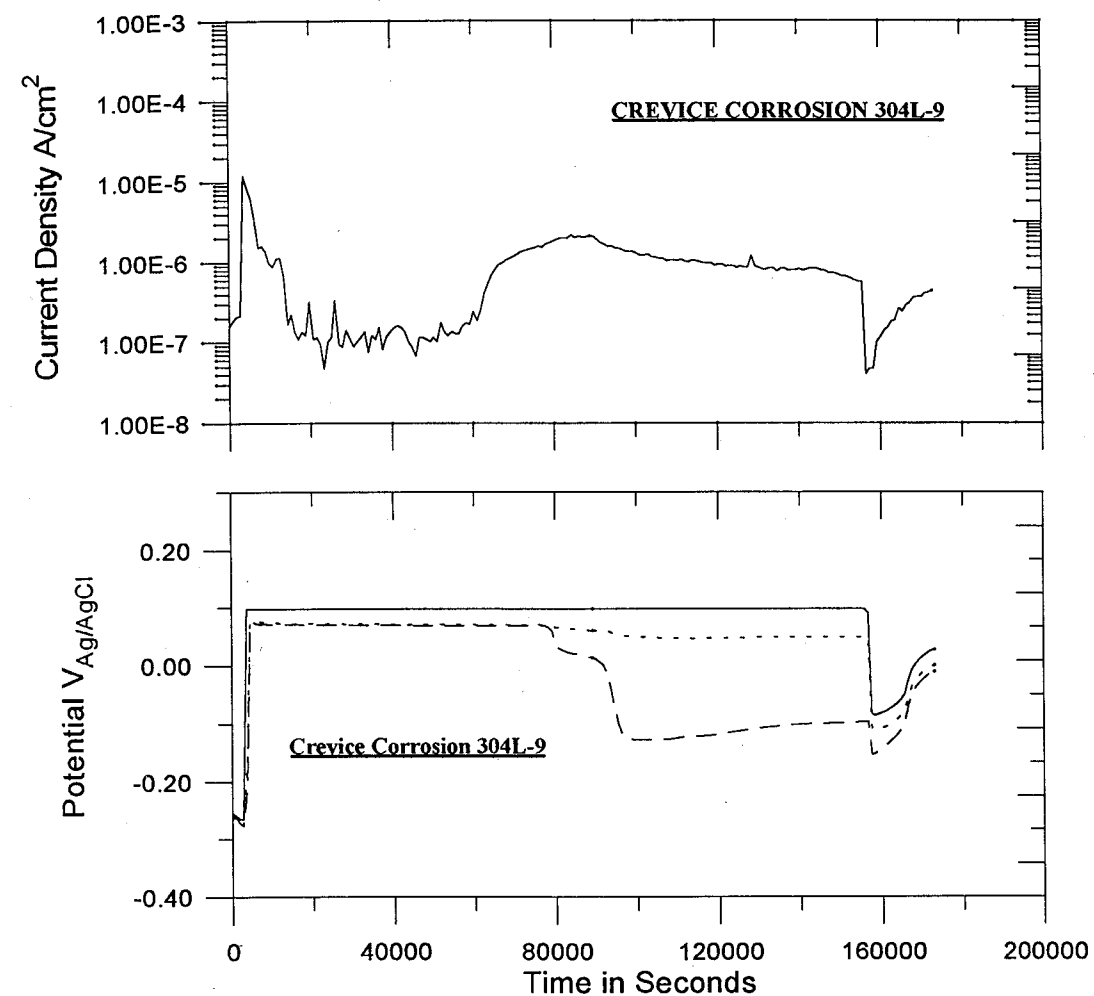


[Signature] 11/29/93

[Signature] 11/29/93

11/29/93

CR6UICK 304L-9 RESULTS



[Signature] 11/29/93

[Signature] 11/29/93

11/10/93

STOCK SOLUTIONS 11/93

SO₄ - 11/93 1000 ppm SO₄²⁻ AS Na₂SO₄
 1.48254 g Na₂SO₃ LOT 901213
 + DI WATER TO 1000 ml EXP 12/8/93

NO₃ - 11/93 1000 ppm NaNO₃ NO₃⁻ AS NaNO₃
 1.37539 g NaNO₃ LOT 897183
 + DI WATER TO 1000 ml EXP 12/8/93

F⁻ 11/93 1000 ppm F⁻ AS NaF
 2.21361 g NaF LOT 896405
 + DI WATER TO 1000 ml EXP 12/8/93

2MCl - 11/93 2 mol/LITER Cl⁻ AS NaCl
 116.88599 g NaCl LOT 926448A +
 DI WATER TO 1000 ml EXP 12/10/93

1MCl - 11/93 1 mol/LITER Cl⁻ AS NaCl
 58.45130 g NaCl LOT 926448A +
 DI WATER TO 1000 ml EXP 12/10/93

0.5MCl - 11/93 0.5 mol/LITER Cl⁻ AS NaCl
 29.22166 g NaCl LOT 926448A +
 DI WATER TO 1000 ml EXP 12/10/93

1000Cl - 11/93 1000 ppm Cl⁻ AS NaCl
 3.30190 g NaCl LOT 926448A +
 DI WATER TO 1000 ml EXP 12/10/93

100Cl - 11/93 100 ml 1000Cl - 11/93 + 900 ml
 DI WATER - 100 ppm Cl⁻ AS NaCl
 EXP 12/10/93

Paul D 12/8/93

11/10/93

LONG TERM POTENTIOSTATIC TEST

LT825P1D

~~LT825P2D~~

8/31/94

SPECIMEN SAME AS LT825P1, LT825P1B & LT825P1C
 P 13, 34 & 42

START WT 29.57613g
 SOLUTION 1000 ppm Cl⁻ 85 ppm NaCO₃ 20 ppm SO₄²⁻
 10 ppm NO₃⁻ 2 ppm F⁻ 2000 ml AS FOLLOWS:

3.29720 g NaCl LOT 926448A

0.24915 g NaHCO₃ LOT 897789

40 ml SO₄ - 11/93 STOCK SOLUTION

20 ml NO₃ - 11/93

4 ml F⁻ - 11/93

+ DI WATER TO 2000 ml STOCK SOLUTIONS

P 50 T = 95°C H₂ THERM 183305

POTENTIOSTAT ESC 440 #1 CHANNEL #1 DATA

SAVED AS LT825P1D.DAT USING LONGTM.WBS

REFERENCE SCE FISHER 13-620-SI SN 9214083

E_{CORR} +153 mV - 85 mV

E_{PT} + 153 mV 8/31/94

E_{APP} 200 mV_{SEC}

SPECIMEN STARTED 11/10/93 4:55 pm

RUNTIME 2,419,400 sec

SPECIMEN STOPPED 12/8/93 4:55 pm

START pH 8.299

END pH 8.843

END Cl CONC 1142 ppm

END WT 29.57395g

CHARGE DENSITY 1.289 C/cm²

Paul D 12/8/93

11/10/93

LONG TERM POTENTIOSTATIC TEST LT82SP2D

SPECIMEN SAME AS LT82SP2 LT82SP2B LT82SP2C

P 14, 35, 43

START WT 30.82235g

END WT 30.82166g

SOLUTION 1000 PPM Cl^- 85 PPM NaCO_3 20 PPM SO_4^{2-} 10 PPM NO_3^- 2 PPM F^- 2000 ml AS FOLLOWS.3.30153g NaCl LOT 926448A0.24800g NaHCO_3 LOT 89778940 ml SO_4 - 11/9320 ml NO_3 - 11/934 ml F^- - 11/93+ DI WATER TO 2000 ml STOCK SOLUTIONS
P 50 $T = 95^\circ\text{C}$ N_2 TNGRMD 183301

POTENTIOSTAT ESC 440 #1 CHANNEL #2 DATA

SAVED AS LT82SP2D.DAT USING LONGTM.WRB
REFERENCE SCE FISHER 13-620-S1 SN 8211163E_{CORR} -148mVE_{PT} +163mVE_{APP} 0. mV

SPECIMEN STARTED 11/10/93 4:55 pm

SPECIMEN STOPPED 12/8/93 4:55 pm

RUNTIME 2.419400 sec

START pH 8.251

END pH 9.016

END Cl^- CONC. 1144 ppmCHARGE DENSITY 0.095 C/cm²

12/8/93

11/11/93

CREVICE 304L-10

OBJECTIVE DETERMINE CREVICE CORROSION CHEMISTRY

SPECIMEN 304L HT# T0954 600S.C

SPECIMEN CLEANED AND PREPARED SAME AS
304L-8 P7

L = 2.500" W = 0.498" t = 0.121"

AREA = 3.21 IN² OR 20.74 cm²

START WT 20.82777g

END WT 20.81781g

SOLUTION 1000 PPM Cl^- 85 PPM HCO_3^- 20 PPM SO_4^{2-} 10 PPM NO_3^- 2 PPM F^- 1000 ml AS FOLLOWS.1.64839g NaCl LOT 926448A0.11790g NaHCO_3 LOT 89778920 ml SO_4 - 11/93 STOCK SOLUTION10 ml NO_3 - 11/932 ml F^- - 11/93

+ DI WATER TO 1000 ml STOCK SOLUTIONS

P 50 $T = 25^\circ\text{C}$

START pH 8.170

END pH 8.080

SETUP SPECIMEN PLACED IN PLEXIGLASS
WITH ELECTRODE INSERTS (P.47) AND BOLTS
WERE TORQUED TO 20 IN-OZ USING PRUTO 6103

ELECTRODE SETUP TO PORT 1 AND PORT 2

SAME AS 304L-8 P7 SETUP OF METERS

AND CHART RECORDERS SAME AS 304L-8 P7

ELECTRODE MODEL AND SERIAL NUMBERS
GIVEN ON PAGE 54 WITH CALIBRATION.SPECIMEN CONNECTED TO ESC 440 #2 CHANNEL #1
AS WORKING ELECTRODE. PE COUNTER

ELECTRODE. ALSO CONNECTED TO CHANNEL #1

TIP REFERENCE CONNECTED TO CHANNEL #3

MOUTH REFERENCE CONNECTED TO CHANNEL #2

PLEXIGLASS CELL AND GLASS VESSEL PLACED IN

FARADAY CAGE AT 3:35 pm 11/11/93

11/11/93

CREVICE 304L-16

INITIAL CONDITIONS AT 3:30 PM 11/11/93

$E_{SPECIMEN} = -218 \text{ mV}$
 $E_{TIP} = -225 \text{ mV}$
 $E_{MOUTH} = -229 \text{ mV}$
 $E_{PT} = +373 \text{ mV}$
 $TIP \text{ CI} = 108 \text{ mV}$
 $MOUTH \text{ CI} = 102 \text{ mV}$
 $BULK \text{ CI} = 109 \text{ mV}$
 $TIP \text{ pH} = -89 \text{ mV}$
 $MOUTH \text{ pH} = -57 \text{ mV}$
 $BULK \text{ pH} = -84 \text{ mV}$

 11/11/93

11/12/93

OPEN CIRCUIT POTENTIALS AND CONDITIONS AT
 3:30 PM 11/12/93

$E_{SPECIMEN} = -75 \text{ mV}$
 $E_{TIP} = -107 \text{ mV}$
 $E_{MOUTH} = -99 \text{ mV}$
 $E_{PT} = +481 \text{ mV}$
 $TIP \text{ CI} = 98.8 \text{ mV}$
 $MOUTH \text{ CI} = 97.8 \text{ mV}$
 $BULK \text{ CI} = 103.3 \text{ mV}$
 $TIP \text{ pH} = -100.6 \text{ mV}$
 $MOUTH \text{ pH} = -103.0 \text{ mV}$
 $BULK \text{ pH} = -79.9 \text{ mV}$

AT $t = 86460$ SEC 11/12/93 3:30 PM $V_{SET} = 200 \text{ mV}$

PRIOR TO ASSEMBLY ELECTRODES WERE CALIBRATED
 USING STANDARD BUFFERS 1.00, 4.00, 7.00, 10.00
 FOR pH ELECTRODES AND Cl^- STOCK SOLUTIONS
 ON PAGE 50 FOR Cl^- ELECTRODES

$pH \text{ TIP} = \text{MISO6 45147} / \text{Ag/AgCl REF MI403 45867}$
 $pH = -17.42(V) + 6.87$

11/12/93

CREVICE 304L-10

$pH \text{ MOUTH} = \text{MISO6 44060} / \text{Ag/AgCl REF MI403 44678}$
 $pH = -17.19(V) + 7.08$
 $pH \text{ BULK} = \text{MISO6 44817} / \text{Ag/AgCl REF MI402*45860}$
 $pH = -17.14(V) + 6.71$
 $CI \text{ TIP} = \text{MIZOO 47228} / \text{Ag/AgCl REF MI403*44629}$
 $ppm \text{ Cl}^- = \text{EXP}[-0.0547(\text{mV}) + 12.41]$
 $CI \text{ MOUTH} = \text{MIZOO 47226} / \text{Ag/AgCl REF MI403*44671}$
 $ppm \text{ Cl}^- = \text{EXP}[-0.0493(\text{mV}) + 12.20]$
 $CI \text{ BULK} = \text{MIZOO 42992} / \text{Ag/AgCl REF MI402*43647}$
 $ppm \text{ Cl}^- = \text{EXP}[-0.0480(\text{mV}) + 12.07]$

$BULK \text{ Ag/AgCl REF FISHER 13-620-53 SN 8118182}$
 $TIP \text{ REFERENCE Ag/AgCl MI403 \# 41402}$
 $MOUTH \text{ REFERENCE Ag/AgCl MI403 \# 45024}$

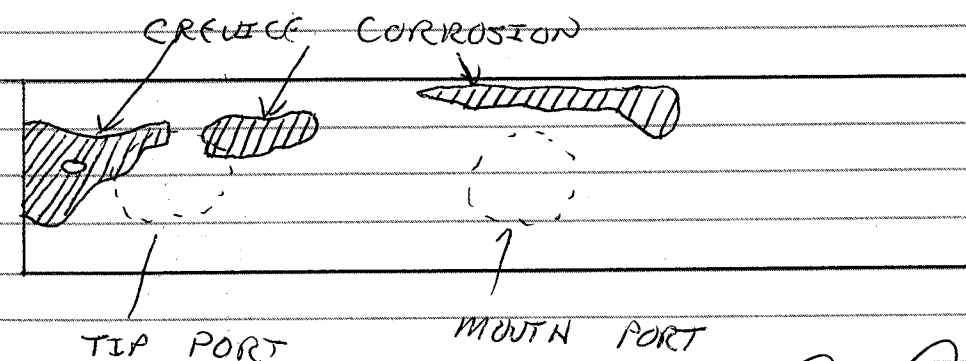
 11/12/93

11/29/93

POST TEST EXAMINATION OF SPECIMEN REVEALS
 3 AREAS OF CREVICE CORROSION ON TOP SIDE
 OF SPECIMEN AND ONE SMALL AREA OF
 CREVICE CORROSION ON BOTTOM SIDE.

DATA FROM EXPERIMENT SAVED AS 304L-10.DAT
 USING CREVICE.WBB. COMPLETE DATA FILE WITH
 pH AND CI PPM DATA FROM CHART RECORDERS
 SAVED AS 304L10.WR1 USING QUATTRO PRO.

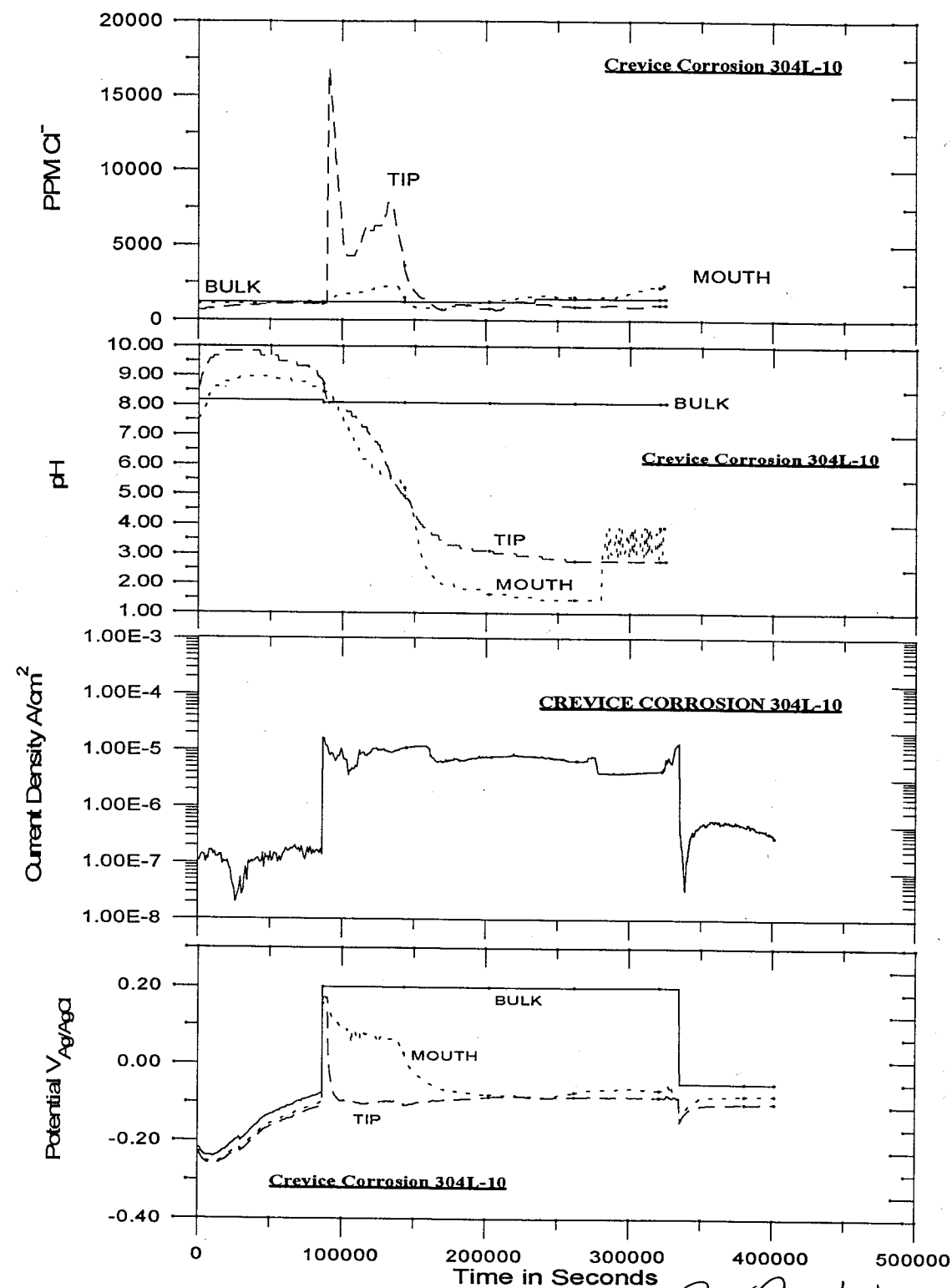
TOP SIDE OF SPECIMEN AT 2:1 SCALE



 11/29/93

11/29/93

304L 10

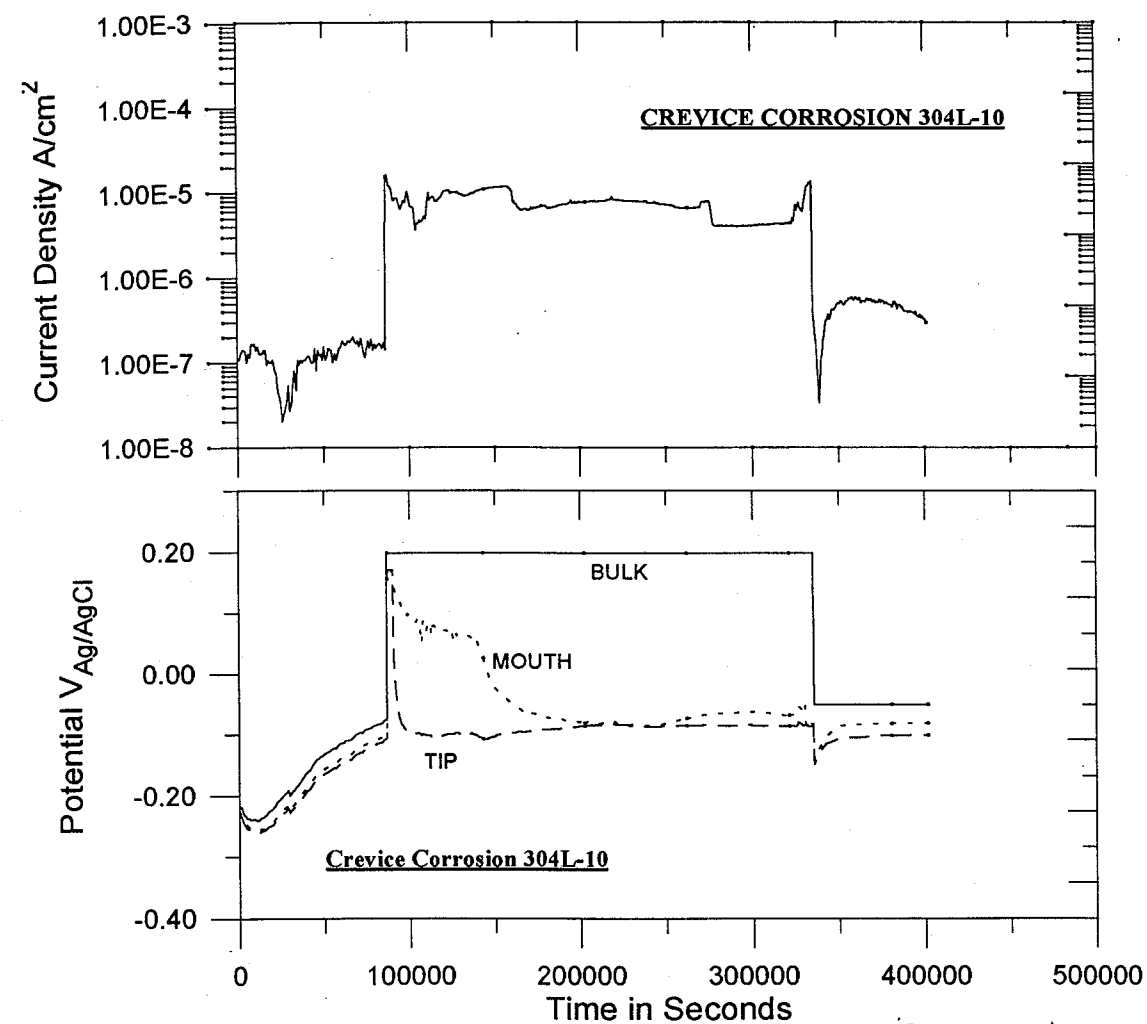


11/29/93

11/29/93

11/29/93

304L 10



11/29/93

PH AND Cl^- ISE CALIBRATION
 DATA SAVED AS 304L10CA.DAT
 ON IWPE 085 DISK

4/28/94

11/29/93

11/16/93

825-13 CREVICE CORROSION

SPECIMEN ALLOY 825 H4371F6 600S.C

SPECIMEN CLEANED AND PREPARED SAME AS
304L-8 P7. ALLOY 825 WIRE USED FOR CONTACT
BY SPOT WELDING TO SIDE OF SPECIMEN

$l = 2.495$ $w = 0.497$ $t = 0.118"$

AREA = 3.18 cm^2 OR 20.55 cm^2

START WT. NOT RECORDED

END WT. 21.32170g

SOLUTION 1000 ppm Cl^- 85 ppm HCO_3^- 20 ppm SO_4^{2-}
10 ppm NO_3^- 2 ppm F- 1000 ml PREPARED AS FOLLOWS

1.64814g NaCl LOT 926448A

0.23631g NaHCO_3 LOT 89778A

20 ml SO_4 - 11/93 STOCK SOLUTION P. 50

10 ml NO_3 - 11/93 " "

2 ml F - 11/93 " "

+ DI WATER TO 1000 ml $T = 25^\circ\text{C}$

START pH = 8.213

END pH = 1.73

500 ml OF STOCK SOLUTION USED IN EXPERIMENT

OBJECTIVE OF EXPERIMENT IS TO DETERMINE

HOW Cl^- AND H^+ MIGRATE INTO CREVICE

PROCEDURE WILL BE SAME AS BEFORE EXCEPT

CONCENTRATION OF BULK Cl^- AND H^+ CONCENTRATIONS

WILL BE CHANGED AT SPECIFIC TIMES. RESPONSE

WILL BE MEASURED AS BEFORE USING Cl^- , pH

AND Ag/AgCl REFERENCE ELECTRODES PLACED IN

THE TIP AND MOUTH LOCATIONS.

SETUP SPECIMEN PLACED IN PLEXIGLASS CELL
WITH ELECTRODE INSERTS (P. 47) C-276 BOLTS
TORQUED TO 20 IN-OZ USING PRTO 6103

ELECTRODE SETUP TO PORT 1 AND PORT 2 SAME
AS 304L-8 P7 SETUP OF METERS AND
CHART RECORDERS SAME AS 304L-8 P7

David D 11/16/93

825-13 CREVICE CORROSION

SPECIMEN CONNECTED TO ESC 440 #2 CHANNEL #1
AS WORKING ELECTRODE. Pt COUNTER ELECTRODE
ALSO CONNECTED TO CHANNEL #1 TIP REFERENCE
CONNECTED TO CHANNEL #3 MOUTH REFERENCE
CONNECTED TO CHANNEL #2 PLEXIGLASS
CELL AND GLASS VESSEL PLACED IN FARADAY
CAGE AT 4:10 PM 11/16/93

ELECTRODES AND CALIBRATION.

BULK Ag/AgCl REF FISHER 13-620-53 SN 8118182

TIP REFERENCE Ag/AgCl MI 403 # 41402

MOUTH REFERENCE Ag/AgCl MI 403 # 45024

pH MOUTH MI 506 44060 / MI 403 # 44628 Ag/AgCl

pH = $-17.19(\text{V}) + 7.08$

pH TIP MI 506 45147 / MI 403 45867 Ag/AgCl

pH = $-17.42(\text{V}) + 6.87$

pH BULK MI 506 44817 / MI 402 Ag/AgCl 45860

pH = $-17.14(\text{V}) + 6.71$

Cl TIP MI 200 47228 / MI 403 44629

Cl ppm = $\text{Exp}[-0.0547(\text{mV}) + 12.41]$

Cl MOUTH MI 200 47226 / MI 403 44671

Cl ppm = $\text{Exp}[-0.0493(\text{mV}) + 12.20]$

Cl BULK MI 200 42992 / MI 402 43647

Cl ppm = $\text{Exp}[-0.0480(\text{mV}) + 12.07]$

POTENTIALS Cl CONCENTRATIONS AND pH

WERE RECORDED OVERNIGHT TO GET

GOOD BASING VALUE BEFORE ALTERING

BULK SOLUTION CONCENTRATION.

David D 11/16/93

11/17/93

825-13 CREVICE CORROSION

INITIAL CONDITIONS AT $t = 88200$ SEC

TIP PH -30 mV

MOUTH PH -5 mV

BULK PH -80 mV

TIP CI 111 mV

MOUTH CI 108 mV

BULK CI 104 mV

TIP POT -0.080 V $Ag/AgCl$ MOUTH POT -0.079 V $Ag/AgCl$ EXT POT -0.049 V $Ag/AgCl$

AT $t = 88200$ SEC 52 ml OF 5.0 M/L $NaCl$ ADDED TO SOLUTION CONCENTRATION OF BULK CI CHANGED TO 0.5 M/L BULK CI ELECTRODE OUTPUT = 34 mV AFTER ADDITION. RESPONSE OF PH AND CI ELECTRODES RECORDED WITH TIME.

Paul D 11/17/93

11/18/93

AT $t = 165600$ SEC CI CONCENTRATIONS OF TIP AND MOUTH STABLE MOUTH CI = 46 mV
TIP CI = 45 mV BULK CI = 30 mV, PH VALUES ALSO STABLE TIP PH = -12 mV MOUTH PH = +5 mV BULK PH = -68 mV. PH OF BULK SOLUTION DECREASED BY THE ADDITION OF 10 ml 10% HNO_3 AT $t = 165600$ SEC. RESPONSE OF CREVICE ELECTRODES RECORDED.

Paul D 11/18/93

11/19/93

8:00 AM 250 ml SOLUTION REMOVED FROM CREVICE CELL IN ORDER TO BRING SOLUTION LEVEL DOWN TO BELOW TOP OF BOTTOM HALF OF CREVICE CELL. INFUX OF CI OR PH INTO CELL MUST OCCUR FROM MOUTH
AT 233900 SEC 40 ml SOLUTION REMOVED AND AT 234000 37 ml 5.0 M/L $NaCl$ ADDED TO BULK. BULK CI CONCENTRATION = 0.99 M/L

11/19/93

825-13
RESPONSE OF CREVICE ELECTRODES RECORDED WITH TIME.

Paul D 11/19/93

11/22/93

AT $t = 499000$ SEC TEST STOPPED SOLUTION LEVEL LOWER THAN TOP OF SPECIMEN DUE TO EVAPORATION BULK $Ag/AgCl$ REF VERY NOISY AND NO LONGER IN CONTACT WITH SOLUTION. PH ELECTRODE # 44060 AT MOUTH REPLACED WITH # 43720 (MISO6) ON 11/19/93 BEFORE BULK CONCENTRATION WAS INCREASED TO ≈ 1 M/L Cl^-

EXAMINATION OF CREVICE SPECIMEN REVEALED NO INDICATION OF CORROSION.

Paul D 11/22/93

11/24/93

DATA FILE SAVED AS 825-13.DAT USING CREVICE.WRB COMPLETE DATA FILE INCLUDING PH AND CI PPM VALUES SAVED AS 825-13.WK1 USING QUATRO PRO.

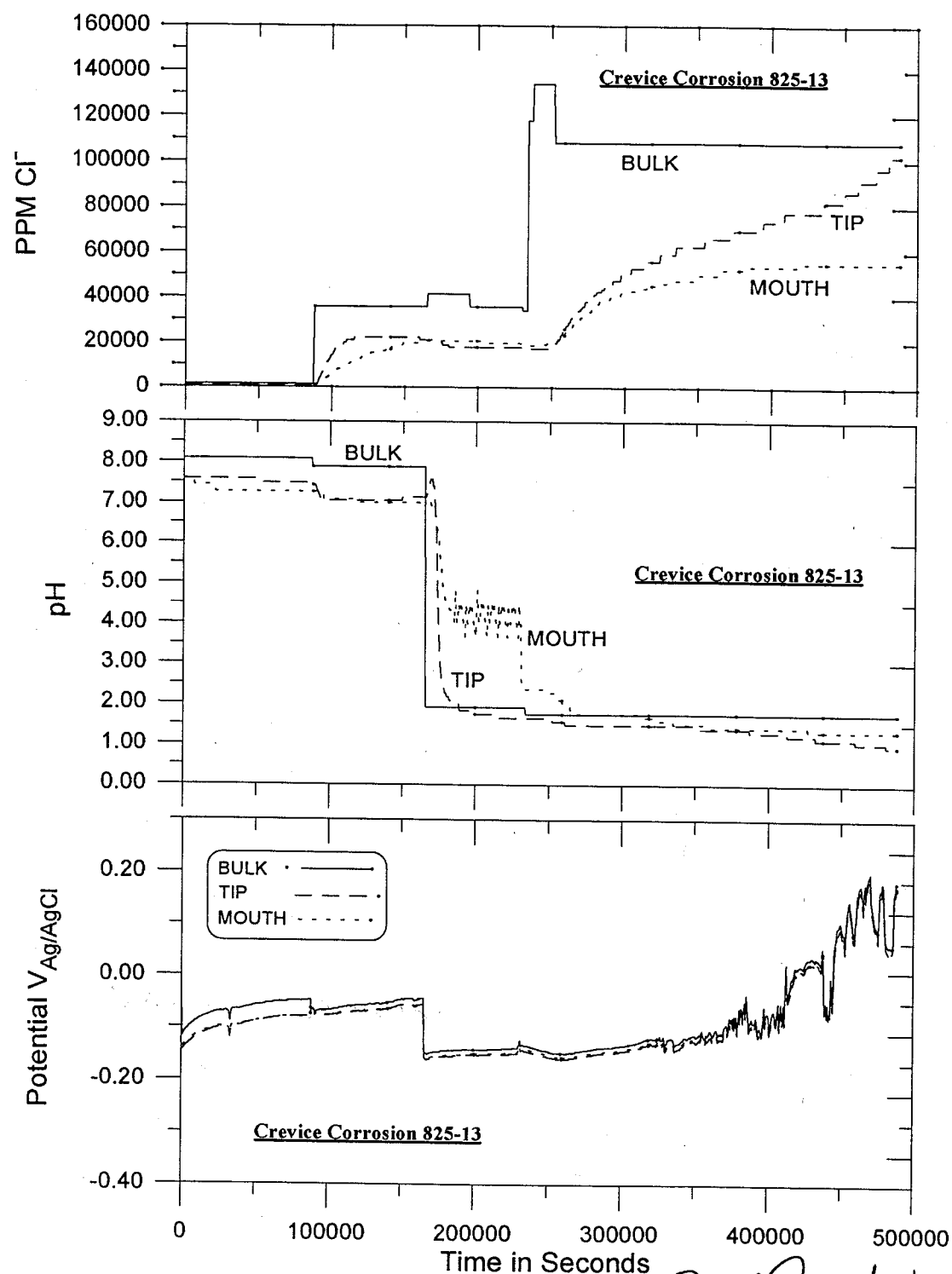
Paul D 11/24/93

PH AND Cl^- ISE CALIBRATION
DATA SAVED AS 82513CAL.DAT
ON IWRG 085 DISK

Paul D 4/28/94

11/29/93

825-13 CREVICE CORROSION



[Signature] 11/29/93

[Signature] 11/29/93

12/15/93

LONG TERM POTENTIOSTATIC TESTS

SPECIMEN SAME AS LT825P1, LT825P1B, LT825P1C
 LT825P1D P 13, 34, 42, 51 & QD 8/31/94
 START WT 29.57395
 SOLUTION 1000 PPM Cl⁻ 85PPM NaCO₃ 20PPM SO₄²⁻ 10PPM NO₃⁻
 2PPM F⁻ 2000ml MAKE AS FOLLOWS
 3.29924g NaCl LOT 926448A
 0.24383g NaHCO₃ LOT 89778A
 40ml ~~80ml~~ 50% SO₄ - 12/93 STOCK SOLUTION
 20ml NO₃ - 12/93
 4ml F - 12/93
 + DI WATER TO 2000ml STOCK SOLUTIONS
 P 65 T=95°C N₂ THERMO 183301
 POTENTIOSTAT ESC 440 #1 CHANNEL #1 DATA
 SAVED AS LT825P1E.DAT USING LONGTM.LIBB
 REFERENCE SCE FISHER 13-620-S1 SN 3106337
 E_{CORR} -127 mV KEITHLEY 614 555368
 E_{PT} +160 mV
 E_{APP} +200 mV
 SPECIMEN STARTED 6:00PM 12/15/93
 SPECIMEN STOPPED 6:00PM 1/12/94
 RUNTIME 672 HOURS OR 2,419,200 SEC
 START PH = 8.030
 END PH = 9.126
 END Cl CONC 1326 PPM
 END WT 29.57378

[Signature] 1/14/94

[Signature] 8/31/94

12/15/93

LT825 P2E LONG TERM POTENTIOSTATIC TEST

SPECIMEN SAME AS LT825PI, LT825PIB, LT825PIC
LT825PID, P 14, 35, 42, 52

START WT 30.82166g

SOLUTION 1000 PPM Cl^- 85 PPM HCO_3^- ~~20 PPM HCO_3^-~~ DD
20 PPM SO_4^{2-} 10 PPM NO_3^- 2 PPM F^- 2000 ml

PREPARED AS FOLLOWS:

3.29777g NaCl LOT 926448A

0.24003g NaHCO_3 LOT 89778940 ml SO_4 - 12/9320 ml NO_3 - 12/934 ml F^- - 12/93

+ DI WATER TO 2000 ml STOCK SOLUTIONS

P65 $T=95^\circ\text{C}$ 1g THERMO # 183305

POTENTIOSTAT ESC 440 #1 CHANNEL #2 DATA

SAVED AS LT825 P2E.DAT USING LONGTM.WBB

REFERENCE SCE FISHER 13-620-S1 SN 2134032

 E_{CORR} -100 mV KEITHLEY 614 SN 555368 E_{PT} +162 mV " E_{APP} 0.0 mV "

SPECIMEN STARTED 6:00 PM 12/15/93 DD

SPECIMEN STOPPED 6:00 PM 1/12/94

RUNTIME 672 HOURS OR 2,419,200 SEC

START pH = 8.148

END pH = 9.014

END Cl^- CONC = 1274

END WT 30.82151

DD
1/14/94DD
8/31/94

12/15/93

STOCK SOLUTIONS.

 SO_4 - 12/93 1000 PPM SO_4^{2-} AS Na_2SO_4
1.48344 g Na_2SO_4 LOT 910 DD 901213
+ DI WATER TO 1000 ml EXP 1/3/94 NO_3 - 12/93 1000 PPM NO_3^- AS NaNO_3
1.37146 g NaNO_3 LOT 897183
+ DI WATER TO 1000 ml EXP 1/3/94 F^- - 12/93 1000 PPM F^- AS NaF
2.21132 g NaF LOT 896405
+ DI WATER TO 1000 ml EXP 1/3/942 M Cl^- - 12/93 2 MOLE/LITER NaCl
117.00757 g NaCl LOT 926448A
+ DI WATER TO 1000 ml EXP 1/3/941 M Cl^- - 12/93 1 MOLE/LITER NaCl
58.44636 g NaCl LOT 926448A
+ DI WATER TO 1000 ml EXP 1/3/940.5 M Cl^- - 12/93 0.5 MOLE/LITER NaCl
29.22334 g NaCl LOT 926448A
+ DI WATER TO 1000 ml EXP 1/3/941000 PPM Cl^- AS NaCl STOCK SOLN 1000 Cl^- - 12/93
3.29731 g NaCl LOT 926448A DD
+ DI WATER TO 2000 ml EXP ~~1/3/93~~ 1/3/94100 Cl^- - 12/93 100 PPM Cl^- AS NaCl
100 ml 1000 Cl^- - 12/93 + 900 ml DI WATER EXP 1/3/94DD
12/15/93

1/4/94

STOCK SOLUTIONS 1/94

SO₄ - 1/94 1000 PPM SO₄²⁻ AS Na₂SO₄
 1.47905 g Na₂SO₄ LOT 901213 IN
 1000 ml DI WATER EXP 2/4/94

NO₃ - 1/94 1000 PPM NO₃⁻ AS NaNO₃
 1.37380 g NaNO₃ LOT 897183 IN
 1000 ml DI WATER EXP 2/4/94

F - 1/94 1000 PPM F⁻ AS NaF
 2.21087 g NaF LOT 896405 IN
 1000 ml DI WATER EXP 2/4/94

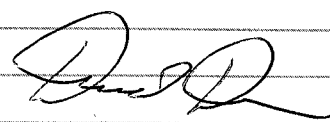
100 CI - 1/94 100 PPM Cl⁻ AS NaCl
 0.1648 g NaCl LOT 926448A IN
 1000 ml DI WATER EXP 2/4/94

1000 CI - 1/94 1000 PPM Cl⁻ AS NaCl
 3.29590 g NaCl LOT 926448A IN
 2000 ml DI WATER EXP 2/4/94

0.5M CI - 1/94 0.5 M ~~AS~~ Cl⁻ AS NaCl
 29.32258 g NaCl LOT 926448A + DI
 WATER TO 1000 ml EXP 2/4/94

1M CI - 1/94 1.0 M ~~AS~~ Cl⁻ AS NaCl
 58.54886 g NaCl LOT 926448A
 + DI WATER TO 1000 ml EXP 2/4/94

2M CI - 1/94 2.0 M Cl⁻ AS NaCl
 116.96236 g NaCl LOT 926448A
 + DI WATER TO 1000 ml EXP 2/4/94



1/4/94

1/10/94

CREVICE CORROSION 304LRTST

4/28/94

SPECIMEN 304L HT # T0954 600 S.C.
 DISC SPECIMEN 1.25" DIA x 0.125" THICK
 SPECIMEN POLISHED TO 600 ~~grit~~ ^{grit} FINISH
 USING S.C. PAPERS, ULTRASONICALLY CLEANED
 IN DETERGENT, RINSED IN DI WATER,
 RINSED IN ACETONE AND DRIED
 START WEIGHT OF SPECIMEN NOT RECORDED
 304L WIRE SPOT WELDED TO TOP OF
 SPECIMEN NEAR EDGE OF 1.25" DIAMETER

STARTING SOLUTION 900 ml OF 1000 PPM CI⁻
 85 PPM HCO₃⁻, 20 PPM SO₄²⁻, 10 PPM NO₃⁻, 2 PPM F⁻
 PREPARED AS FOLLOWS.

1.65053 g NaCl LOT 926448A

0.11956 g NaHCO₃ LOT 897789

20 ml SO₄ - 1/94 STOCK SOLUTION

10 ml NO₃ - 1/94

2 ml F - 1/94

+ DI WATER TO 1000 ml T ≈ 25°C

START PH 8.155

END PH 6.413

OBJECTIVE OF EXPERIMENT IS TO DETERMINE
 HOW CI⁻ MIGRATES INTO CREVICE REGION.

PROCEDURE WILL BE TO ESTABLISH BASELINE
 MEASUREMENT THEN CHANGE BULK CI⁻ CONCENTRATION
 AND RECORD CI⁻ CONCENTRATION IN CREVICE
 WITH CI⁻ ISE ELECTRODES.

SETUP - SPECIMEN PLACED IN NEW RADIAL

PLEXIGLASS CELL C-276 BOLTS TORQUED

TO 20 IN-OZ USING PROTO 6103

ELECTRODE SETUP TO PORTS p. 70

SETUP OF METERS AND CHART RECORDERS.

SAME AS 304L-8 P7 DIMENSIONS

OF RADIAL PLEXIGLASS CREVICE CELL

WITH PORT LOCATIONS p. 69



1/10/94

1/10/94

CREVICE CORROSION 304LRTST

SPECIMEN CONNECTED TO ESC 440 #2 AS ~~QD~~
 CHANNEL #1 AS WORKING ELECTRODE 8/31/94
 TIP REFERENCE CONNECTED TO CHANNEL #2
 PLEXIGLASS CELL AND GLASS VESSEL PLACED
 IN FARADAY CAGE

ELECTRODES AND CALIBRATION

BULK A_1/A_2 CI REF MI 403 # 49467TIP A_1/A_2 CI REF MI 403 # 41402

pH MOUTH MI 506 # 44060 / MI 403 # 44628

pH = $-17.176(V) + 6.907$

pH TIP MI 506 # 45147 / MI 403 # 45867

pH = $-17.519(V) + 7.164$

pH BULK MI 506 # 44817 / MI 402 # 45860

pH = $-17.08(V) + 6.4138$

CI MOUTH MI 200 47226 / MI 403 44671

CI (PPM) = $EXP[-0.0594(mV) + 12.46]$

CI TIP MI 200 47228 / MI 403 44629

CI (PPM) = $EXP[-0.0602(mV) + 12.91]$

CI BULK MI 200 42992 / MI 402 43647

~~CI (PPM) = $EXP[-0.0602(mV) + 12.91]$~~ QD 8/31/94CI (PPM) = $EXP[-0.0505(mV) + 10.92]$

- pH AND CI CALIBRATION DATA IN 304LRC.DAT ON IWPE-085

AFTER SETUP AND ELECTRODE PLACEMENT

CELL WAS ALLOWED TO SIT OVERNIGHT

SO GOOD BASELINE VALUES COULD BE

MEASURED PRIOR TO START OF TEST.

START OF TEST 1/5/94 11:00 AM $t=0$ $E_{corr} = -161mV$ pH TIP = $-53.1mV$ $E_{TIP} = -164mV$ CI TIP = $100mV$ $E_{PT} = +461mV$ pH MOUTH = $-58.7mV$ pH BULK = $-102.3mV$ CI MOUTH = $97.2mV$ CI BULK = $88mV$

QD 11/10/94

1/10/94

CREVICE CORROSION 304LRTST

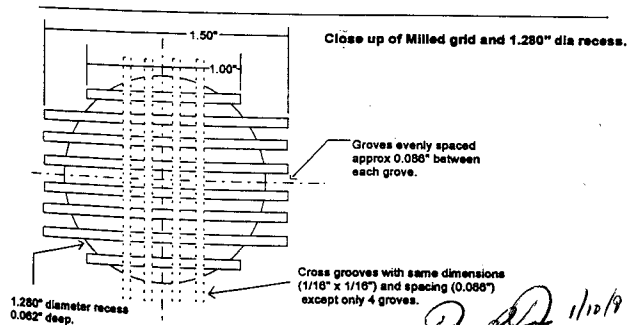
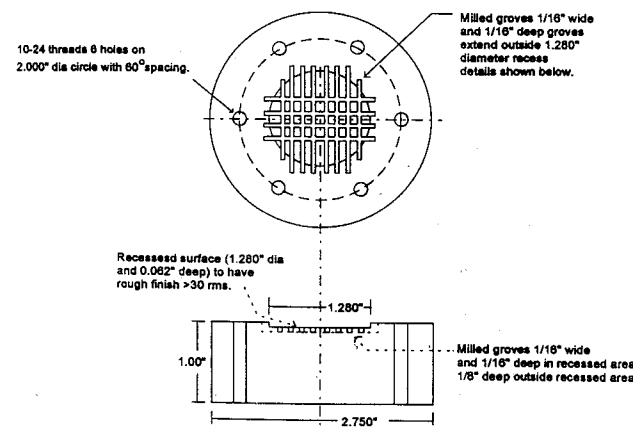
AT 3:00 PM 1/5/94 $t=14400$ SEC CONCENTRATION
 OF Cl^- IN BULK SOLUTION WAS INCREASED
 TO 0.5M BY REPLACING 90 ml OF
 1000 PPM SOLUTION WITH 90 ml OF 5.2 mol/LITER
 $NaCl$. OUTPUT OF ELECTRODES IN CELL
 MONITORED WITH TIME.

AT $t=172800$ SEC OR 48 HOURS INTO TEST
 LOGS AND CHART RECORDERS WERE STOPPED
 CELL WAS DISASSEMBLED AND ELECTRODES
 WERE CHECKED FOR CORRECT OPERATION.
 DATA FILE SAVED AS 304LRTST.DAT USING
 CREVICE.WBB COMPLETE DATA FILE INCLUDING
 pH AND CI ELECTRODE OUTPUTS FROM CHART
 RECORDER TRACES SAVED AS 304LRTST.WK1
 USING QUATTRO PRO. NO CORROSION
 OF SPECIMEN WAS OBSERVED.

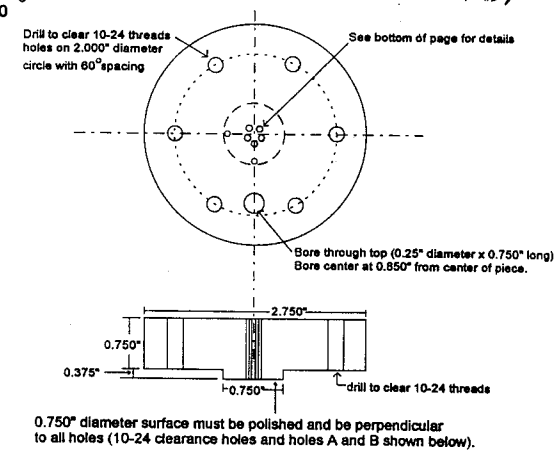
Darrell S. Dunn
Div. 20/Bldg 57
Ext. 6090

All Dimensions +/- 0.002"

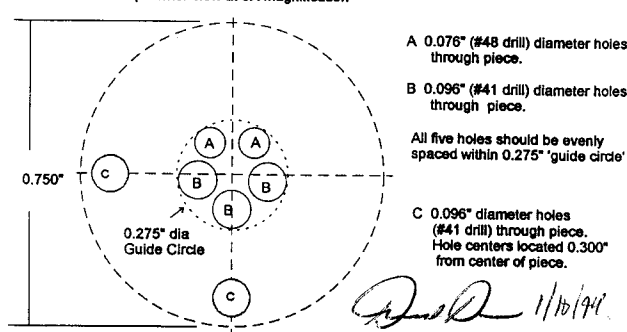
CELL BOTTOM

Darrell S. Dunn
Div. 20/Bldg. 57
Ext. 6090

All dimensions +/- 0.002" CELL TOP

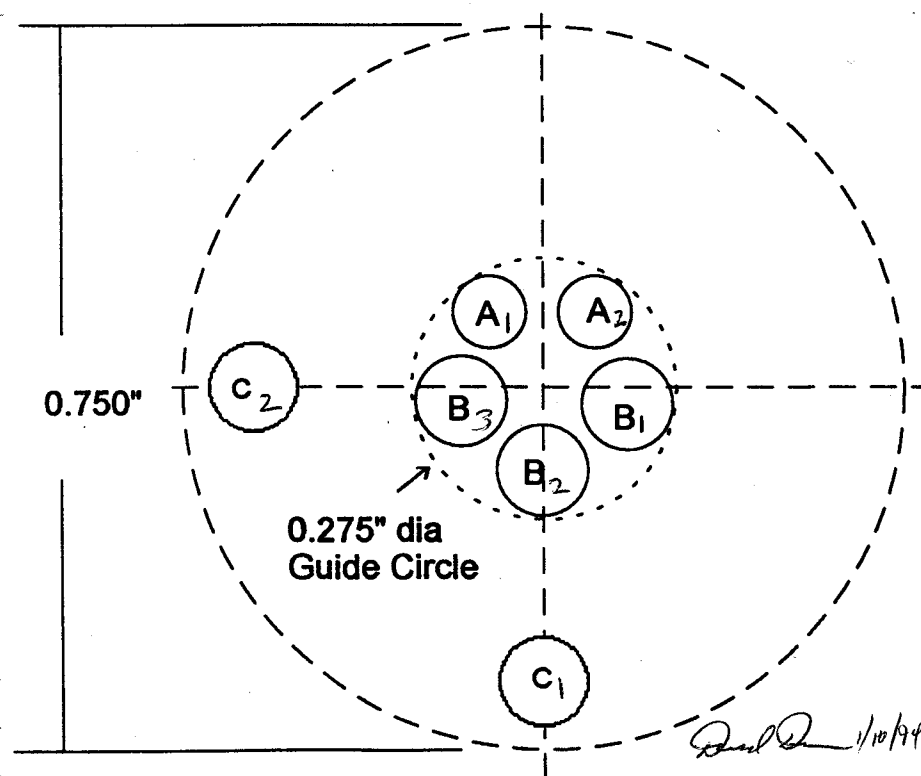


Detail of top center view at 5X magnification



1/10/94

CREVICE CORROSION 304LRTST



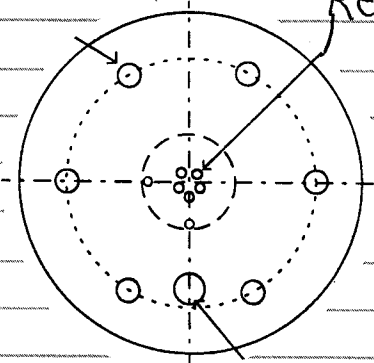
ELECTRODES AT TIP LOCATION

- A₁ PH GLASS ELECTRODE MI 506 # 45147
 A₂ Cl⁻ ISE ELECTRODE MI 200 # 47228
 B₁ Ag/AgCl REFERENCE MI 403 # 44629 FOR MI 200
 B₂ Ag/AgCl REFERENCE MI 403 # 41402 TIP REF.
 B₃ Ag/AgCl REFERENCE MI 403 # 45867 FOR MISOL

ELECTRODES AT MOUTH LOCATION

- C₁ PH GLASS ELECTRODE MI 506 # 44060
 C₂ Cl⁻ ISE ELECTRODE MI 200 # 47226

REDUCED FROM ABOVE. DIAGRAM

REFERENCE ELECTRODES IN BULK SOLUTION
AT LOCATION IDENTIFIED BELOW

- Ag/AgCl REF MI 403 # 44671 MOUTH Cl⁻ ISE REF
 Ag/AgCl REF MI 403 # 44628 MOUTH GLASS pH REF.
 Ag/AgCl REF MI 403 # 49467 SPECIMEN REF.

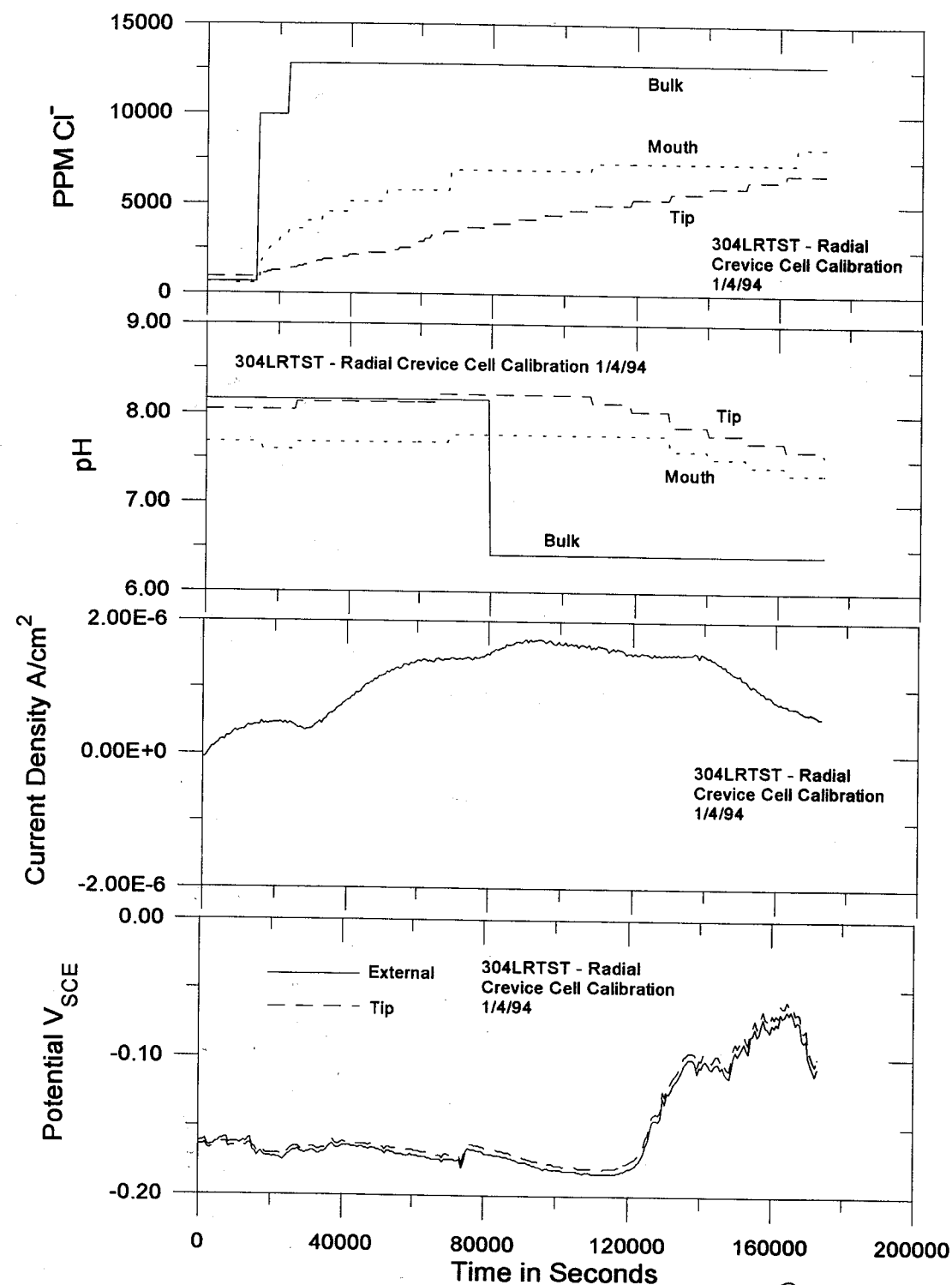
LOCATION OF BULK SPECIMEN REF AND pH & Cl⁻ MOUTH REF.
LISTED ABOVE

D. D. 1/10/94

CREVICE CORROSION ~~304LRTST~~ 304LRTST

8/31/94

11/10/94



D. D. 1/10/94

D. D. 1/10/94

1/17/94

CREVICE CORROSION 304LRTS2

SPECIMEN SAME AS 304LRTST P67

SOLUTION SAME AS 304LRTST AFTER ADDITION
OF CONCENTRATED NaCl AS DESCRIBED ON
PAGE 69 SOLUTION COMPOSITION IS 0.5 M Cl^-
WITH LOW AMOUNTS OF HCO_3^- , SO_4^{2-} , NO_3^- AND F^-
START pH = 6.945

END pH = 1.71

OBJECTIVE IS TO DETERMINE HOW H^+ MIGRATES
INTO CREVICE FROM BULK SOLUTION.

PROCEDURE WILL BE TO SET UP CELL WITH
ELECTRODES, CHANGE BULK pH BY ADDING
 HNO_3 AND MONITORING CHANGES INSIDE CREVICE.
SETUP SAME AS 304LRTST P67 ELECTRODE
SETUP SAME AS 304LRTST P67 SETUP OF METERS
AND CHART RECORDERS SAME AS 304LRTST P.7
DIMENSIONS OF RADIAL CREVICE CELL ON
PAGE 69 ELECTRODE SETUP TO PORTS ON P.70
ELECTRODES AND CALIBRATION.

BULK Ag/AgCl REFERENCE 49467TIP Ag/AgCl REFERENCE 41402 ~~8/31/94~~

pH MOUTH MI 506 # ~~44060~~ 45147 / MI 403 # ~~45867~~ 44628
pH = $-17.52(\text{V}) + 6.97$

pH TIP MI 506 # 45147 / MI 403 # 45867

pH = $-17.10(\text{V}) + 6.88$

pH BULK MI 506 # 44817 / MI 403 # 45860

pH = $-17.30(\text{V}) + 6.47$

Cl MOUTH MI 200 # 47226 / MI 403 # 44671

 $\text{Cl}(\text{ppm}) = \text{Exp}[-0.0559(\text{mV}) + 12.43]$

Cl TIP MI 200 # 47228 / MI 403 # 44629

 $\text{Cl}(\text{ppm}) = \text{Exp}[-0.0547(\text{mV}) + 12.61]$

Cl BULK MI 200 # 42992 / MI 402 # 43647

 $\text{Cl}(\text{ppm}) = \text{Exp}[-0.0479(\text{mV}) + 11.14]$

[Signature] 1/17/94

1/17/94

CREVICE CORROSION 304LRTS2.

CONDITIONS AT START OF TEST 12:00 PM 1/17/94 $t=0$ $E_{\text{CORR}} -108 \text{ mV}$ 8/31/94 $E_{\text{TIP}} -0.99 \text{ V} -99 \text{ mV}$ $E_{\text{PT}} +466 \text{ mV}$

BULK Cl 27.5 mV

BULK pH -81.9 mV

TIP Cl 45.6 mV

TIP pH -30.1 mV

MOUTH Cl 38.7 mV

MOUTH pH -26.1 mV

AT 4:00 PM 1/17/94 $t=14400 \text{ SEC}$ 15 ml

10% HNO_3 ADDED TO SOLUTION BULK pH
DECREASED TO ≈ 1.7 OUTPUT OF ELECTRODES
IN CREVICE CELL MONITORED WITH TIME.

AT $t=340150 \text{ SEC}$, OR 94.5 HOURS INTO

EXPERIMENT ALL LOGS AND CHART RECORDERS
WERE TURNED OFF. CELL WAS DISASSEMBLED
AND ELECTRODES WERE CHECKED FOR CORRECT
OPERATION. DATA FILE SAVED AS 304LRTS2.DAT
USING CREVICE.WBS COMPLETE DATA FILE

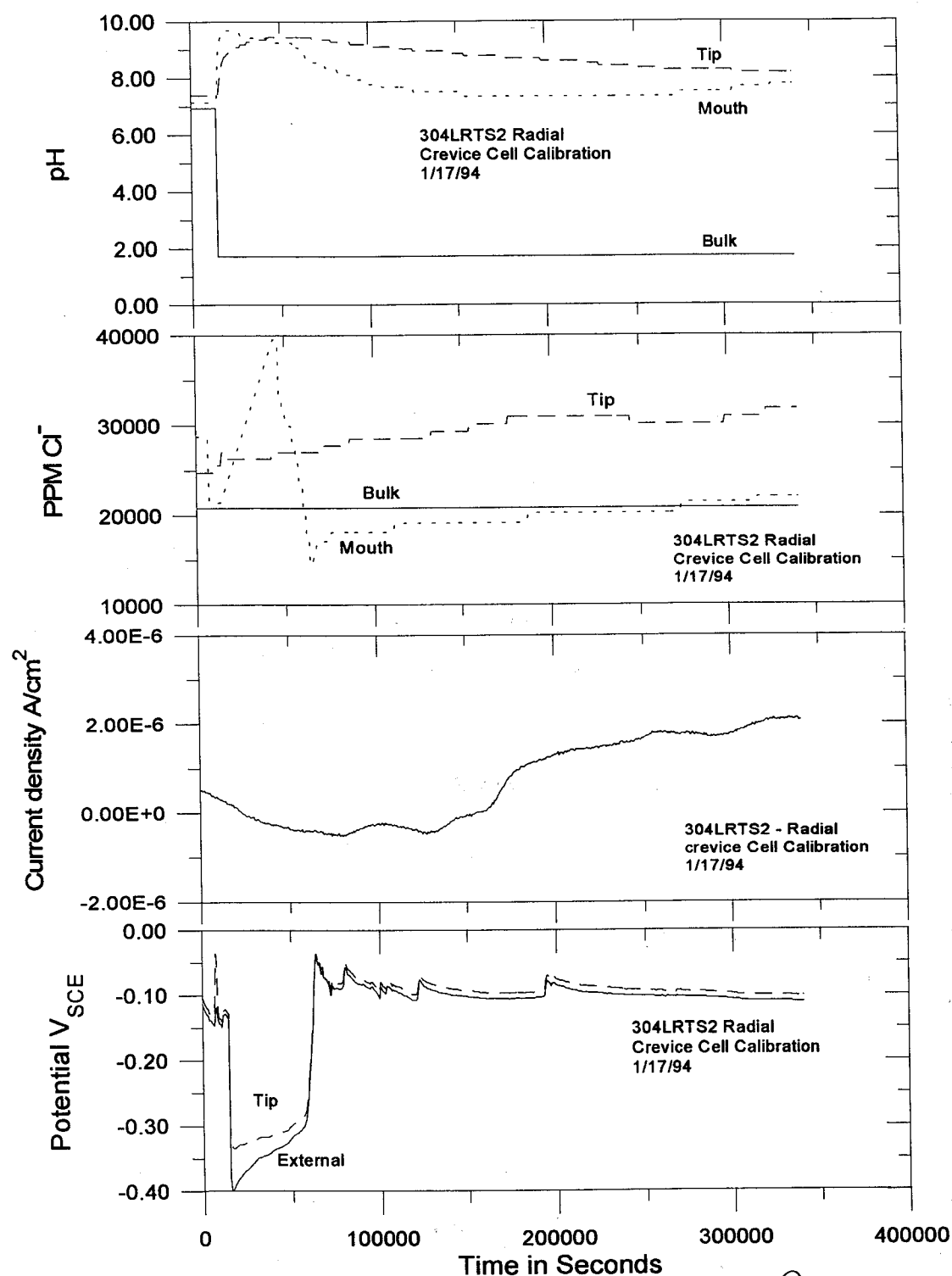
INCLUDING pH AND Cl ELECTRODE DATA
FROM CHART RECORDER TRACES SAVED
AS 304LRTS2.WK1 USING QUATRO PRO

NO CORROSION OF THE SPECIMEN WAS
OBSERVED MOUTH pH ELECTRODE DATA
FROM 62 TO 68.5 HOURS WAS NOT
USED DUE TO PROBLEMS WITH ELECTRODE
MI 506 # 44060 REPLACED WITH MI 506 # 49445
68.5 HOURS INTO TEST

[Signature] 1/17/94
pH AND Cl^- ISE CALIBRATION DATA SAVED AS
304LRT2C.DAT ON IWP6 085

11/17/94

CREVICE CORROSION 304LRTS2



11/17/94

11/17/94

LONG TERM POTENTIOSTATIC TESTS

SPECIMEN SAME AS LT82SP1 → LT82SP1E p 13, 34, 42, 51, 63. 8/31/94

START WT = ~~29.53~~ 29.57378

SOLUTION 1000 ppm Cl⁻ 85 ppm NaCO₃ 20 ppm SO₄²⁻
10 ppm NO₃⁻ 2 ppm F⁻ 2000 ml AS FOLLOWS.

3.30457 NaCl LOT 926448A

0.24112 NaHCO₃ LOT 897789

40 ml SO₄ - 1/94

20 ml NO₃ - 1/94

4 ml F - 1/94

+ DI WATER TO 2000 ml STOCK SOLUTIONS

P 66 T - 95°C N₂ THERMO # 183302

POTENTIOSTAT ESC 440 #1 CHANNEL #1 DATA

SAVED AS LT82SP1F.DAT USING LONGTERM.WBB

REFERENCE SCE FISHER 13-620 -SI SN 0165415

E_{CORR} -121 KEITHLEY 617 # 537418

E_{PT} +162

E_{APP} +200

SPECIMEN STARTED 11/17/94

SPECIMEN STOPPED 2/15/94

RUNTIME 28 DAYS

START pH 7.978

END pH 8.660

END Cl CONC. 1120

END WT 29.54094g

ΔWT = -0.03284g

CREVICE CORROSION IS VISIBLE ON

TOP OF POST OF SPECIMEN. CREVICE

GENERATED DUE TO PTFE PTFE

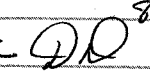
GASKET.

8/31/94

2/22/94

1/17/94

LONG TERM POTENTIOSTATIC TEST

SPECIMEN ~~LT82SP1~~ ~~LT82SP1E~~ ^{8/31/94}  SAME AS
LT8252 - LT82SP2E p 14, 35.42, 52, 64

START WEIGHT 30.82151g

SOLUTION 1000 PPM Cl^- 85 PPM HCO_3^- 20 PPM SO_4^{2-}
10 PPM NO_3^- 2 PPM F^- ~~2000 ml~~ ^{2000 ml} AS FOLLOWS

3.30305 g NaCl LOT 926448A

0.24112 g NaHCO_3 LOT 89778940 ml SO_4^{2-} 1/9420 ml NO_3^- 1/944 ml F^- 1/94


+ DI WATER TO 2000 ml STOCK SOLUTIONS

P66 $T=95^\circ\text{C}$ N_2 THERMO # 183301

POTENTIOSTAT ESC 440 #1 CHANNEL #2

DATA SAVED AS LT8252F.DAT USING LONGTM.WBB

REFERENCE SCE FISHER 13-620-S1 SN 9214083

 E_{CORR} -124 mV KEITNEY 617 # 537418 E_{PT} +180 mV E_{APP} 0 mVSPECIMEN STARTED 1/17/94 

SPECIMEN STOPPED 2/15/94

RUNTIME 28 DAYS

START pH 8.261

END pH 8.910

END Cl^- CONC. 1216

END WT = 30.82462

 $\Delta\text{WT} = +0.00311\text{g}$ WEIGHT GAINNO SIGN OF PITTING OR CREVICE
CORROSION. 2/22/94

2/3/94

POTENTIOSTATIC POLARIZATION 36 GRET 3

SPECIMEN ALLOY 825 HH4371FG WITH
2 36 GRET FINISH SURFACES MEASURING

0.660" x 0.510" OTHER SURFACES AT

600 GRET FINISH AREA = 13 cm^2

START WT 28.78542

SOLUTION 1000 PPM Cl^- 85 PPM HCO_3^- 20 PPM SO_4^{2-} 10 PPM NO_3^- 2 PPM F^- 2000 ml AS FOLLOWS

3.30442g NaCl LOT 926448A

0.24068g NaHCO_3 LOT 89778940 ml SO_4^{2-} 1/94

STOCK SOLUTION

20 ml NO_3^- 1/944 ml F^- 1/94

+ DI WATER TO 2000 ml STOCK SOLUTIONS P66

 $T=95^\circ\text{C}$ N_2 THERMO # 0323008 N_2 PURGED

POTENTIOSTAT ESC 440 #3 DATA SAVED AS

36 GRET 3.DAT

REFERENCE SCE FISHER 13-620-S1 SN 9214080

TEST CONDUCTED IN NEW TEFLON/GLASS REACTION

RETTIGS WITH 1900 ml SOLUTION.

 E_{CORR} -536 mV KEITNEY 617 # 537418 E_{PT} -425 mV E_{APP} +350 mV

SPECIMEN STARTED 2:25 PM 2/3/94

SPECIMEN STOPPED 9:00 AM 2/7/94

RUNTIME 326200 SEC

START pH 7.925

END pH 9.160

END WT = 28.78510g

 $\Delta\text{WT} = -0.00032\text{g}$ NO SIGN OF PITS ON ANY SURFACE
OF SPECIMEN 2/22/94

2/3/94

POTENTIOSTATIC POLARIZATION. 36 GRIT 4

SPECIMEN ALLOY 825 HH4371FG WITH
2 36 GRIT FINISH SURFACES AND
REMAINING SURFACES AT 600 SiC
START WT. 27.53337 AREA 12.97 cm²
SOLUTION 1000 PPM Cl⁻ 85PPM HCO₃⁻ 20PPM SO₄²⁻
10PPM NO₃⁻ 2PPM F⁻ 2000 ml MADE AS FOLLOWS
3.29933 g NaCl LOT 926448A
0.23872 g NaHCO₃ LOT 897789
40ml SO₄ - 1/94 STOCK SOLUTION
20ml NO₃ - 1/94 "
4ml F - 1/94 "
+ DI WATER TO 2000 ml STOCK SOLUTIONS p 66
T = 95°C H₂ THERMO # 0323004 N₂ PURGED
POTENTIOSTAT ESC 440 #3 DATA SAVED
AS 36GRIT 4.DAT.

REFERENCE SCE FISHER 13-620-S1 SN 3106321
TEST CONDUCTED IN TEFLON/GLASS REACTION
KETTLE WITH 1900 ml SOLUTION

E_{CORR} - 514mVE_{PT} - 433mVE_{APA} + 400mV

SPECIMEN STARTED 2:25pm 2/3/94

SPECIMEN STOPPED 9:00am 2/7/94

RUNTIME 326200 SEC

START PH 8.221

END PH 9.046

END WT: 26.56082

ΔWT: -0.97255g

PITS ARE PRESENT ON 36 GRIT FINISH
SURFACES ONLY

 2/22/94

2/3/94

POTENTIOSTATIC POLARIZATION 36 GRIT 5

SPECIMEN ALLOY 825 HH4371FG WITH
2 36 GRIT FINISH SURFACES. REMAINING
SURFACES AT 600 GRIT FINISH
START WT 28.28543 g AREA = 13.10 cm²
SOLUTION 1000 PPM Cl⁻ 85PPM HCO₃⁻ 20PPM SO₄²⁻
10 PPM NO₃⁻ 2PPM F⁻ 2000 ml AS FOLLOWS.
3.29783 g NaCl LOT 926448A
0.23949 g NaHCO₃ LOT 897789
40ml SO₄ - 1/94 STOCK SOLUTION
20ml NO₃ - 1/94 "
4ml F - 1/94 "
+ DI WATER TO 2000 ml STOCK SOLUTIONS p 66
T = 95°C H₂ THERMO 0323007 N₂ PURGED
POTENTIOSTAT ESC 440 #3 DATA SAVED AS
36 GRIT 5.DAT

REFERENCE SCE FISHER 13-620-S1 SN 9214074
TEST CONDUCTED IN TEFLON/GLASS REACTION
8/31/94 ~~TD~~ KETTLE WITH 1900 ml SOLUTION

E_{CORR} - 477mVE_{PT} - 415mVE_{APA} + 450mV

SPECIMEN STARTED 2:25pm 2/3/94

SPECIMEN STOPPED 9:00am 2/7/94

RUNTIME 326200 SEC

START PH 8.058

END PH 9.084

END WT: 27.16804g

ΔWT: -1.11703g

PITS PRESENT ON 36 GRIT FINISH SURFACES
ONLY

 2/22/94

2/24/94

LONG TERM POTENTIOSTATIC TEST LT82SP2G

SPECIMEN SAME AS LT82SP2F P76

START WT ~~26.86574~~ ^{8/31/94} 30.82462gSOLUTION 1000 PPM Cl^- 85PPM HCO_3^- 20PPM SO_4^{2-} 10 PPM NO_3^- 2PPM F^- 2000 ml MADE AS FOLLOWS

3.29648 g NaCl LOT 926448A

0.24271 g NaHCO_3 LOT 89778940 ml - SO_4^{2-} - 2/94 STOCK SOLUTION20 ml NO_3^- - 2/944 ml F^- - 2/94

+ DI WATER TO 2000 ml STOCK SOLUTIONS

P82 T=95°C H_2 THERMO # 183302 ^{8/31/94}POTENTIOSTAT ESC 440 #1 CHANNEL #2 ^{DR 1} DATA

SAVED AS LT82SP2G.DAT USING LONGTM.WBB

REFERENCE SCE FISHER 13-620-51 SN 2134032

 E_{CORR} -189 mV KEITHLEY 614 #467374 E_{PT} +252 mV E_{APP} +300 mV

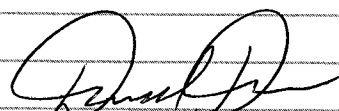
START PH 8.303

SPECIMEN STARTED: 2/24/94 10:00AM

SPECIMEN STOPPED 3/24/94 10:00AM

END PH 8.854

END WT 30.82194g

NO SIGNS OF PITS OR CREVICE CORROSION
ON SPECIMEN
3/24/94 8/31/94

2/24/94

LONG TERM POTENTIOSTATIC TEST LT82SP3A

SPECIMEN: SAME TYPE AS LT82SP1 + LT82SP2

2 MILL FINISHED SURFACES, FULLY IMMERSED

START WT ~~30.82462~~ ^{8/31/94} 26.86574SOLUTION 300 PPM Cl^- , 85PPM HCO_3^- , 1000 PPM SO_4^{2-}
1000 PPM NO_3^- , 2PPM F^- 2000 ml MADE AS FOLLOWS:

0.99164 g NaCl LOT 926448A

0.24028 g NaHCO_3 LOT 8977892.95775g Na_2SO_4 LOT 9012132.74215g NaNO_3 LOT 8971834ml F^- - 2/93 STOCK SOLUTION

+ DI WATER TO 2000 ml STOCK SOLUTIONS

P82 T=95°C H_2 THERMO # 183301 ^{8/31/94}POTENTIOSTAT ESC 440 #1 CHANNEL #2 ^{DR 1} DATA

SAVED AS LT82SP3A.DAT USING LONGTM.WBB

REFERENCE SCE FISHER 13-620-51 SN 3106337

 E_{CORR} -102 mV KEITHLEY 614 #467374 E_{PT} +148 mV E_{APP} 0 mV


START PH 8.060

SPECIMEN STARTED 2/24/94 10:00AM

SPECIMEN STOPPED 3/24/94 10:00AM

END PH 8.746

END WT 26.86305g

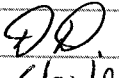
SOME DISCOLORED AREAS ON SPECIMEN
MILL FINISHED SURFACE EXAMINATION
AT 70X DID NOT REVEAL ANY PITS
OR CREVICE CORROSION 3/24/94 8/31/94

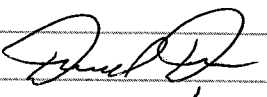
2/24/94 STOCK SOLUTIONS


SO₄-2/94 1000 ppm SO₄⁻ AS Na₂SO₄
 1.47537 g Na₂SO₄ LOT 901213
 + DI WATER TO 1000 ml EXP 3/6/94

NO₃-2/94 1000 ppm NO₃⁻ AS NaNO₃
 1.37180 g NaNO₃ LOT 897183
 + DI WATER TO 1000 ml EXP 3/6/94

F-2/94 1000 ppm F⁻ AS NaF
 2.21902 g NaF LOT 896405
 + DI WATER TO 1000 ml EXP 3/6/94

~~2 m Cl~~ 
 8/31/94

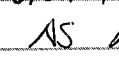

 2/24/94

 8/31/94

3/29/94 STOCK SOLUTIONS

SO₄-3/94 1000 ppm SO₄⁻ AS Na₂SO₄
 1.47431 g Na₂SO₄ LOT 901213
 + DI WATER TO 1000 ml EXP 3/31/94

NO₃-3/94 1000 ppm NO₃⁻ AS NaNO₃
 1.37004 g NaNO₃ LOT 897183
 + DI WATER TO 1000 ml EXP 3/31/94

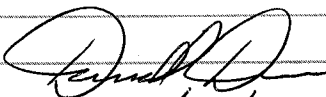
F-3/94 1000 ppm F⁻ ~~AS NaF~~ ^{8/31/94}  AS NaF
 2.21278 g NaF LOT 896405
 + DI WATER TO 1000 ml EXP 3/31/94

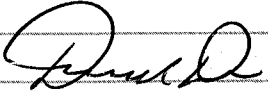
100 Cl-3/94 100 ppm Cl⁻ AS NaCl
 0.16440 g NaCl LOT 926448A
 + DI WATER TO 1000 ml EXP 4/4/94

1000 Cl-3/94 1000 ppm Cl⁻ AS NaCl
 5.29696 g NaCl LOT 926448A
 + DI WATER TO 2000 ml EXP 4/4/94

0.5 m Cl-3/94 0.5 m Cl⁻ AS NaCl
 29.22263 g NaCl LOT 926448A
 + DI WATER TO 1000 ml EXP 4/4/94

1.0 m Cl-3/94 1.0 m Cl⁻ AS NaCl
 58.44784 g NaCl LOT 926448A
 + DI WATER TO 1000 ml EXP 4/4/94


 3/29/94

 8/31/94

3/29/94

LONG TERM POTENTIOSTATIC TEST LT82SP2H

SPECIMEN SAME AS LT82SP2G P80
 START WT 30.82194g
 SOLUTION 1000 ppm Cl^- 85 ppm HCO_3^- 20 ppm SO_4^{2-}
 10 ppm NO_3^- 2 ppm F^- 2000 ml MADE AS FOLLOWS
 3.29816g NaCl LOT 935535
 0.24308g NaHCO_3 LOT 897789
 40 ml SO_4^{2-} 3/94 STOCK SOLUTION P 83
 20 ml NO_3^- 3/94 "
 4 ml F^- 3/94 "
 + DI WATER TO 2000 ml $T=95^\circ\text{C}$ H₉ THERMO 183302
 POTENTIOSTAT ESC 440 #1 CHANNEL # 2
 DATA SAVED AS LT82SP2H.DAT USING LONGTM.WRB
 REFERENCE SCE FISHER 13-620-SI SN 2134032
 E_{corr} -18mV
 E_{AT} +553 mV
 E_{APP} 0mV
 START pH: 8.160
 SPECIMEN STARTED: 4:14 pm 3/29/94
 SPECIMEN STOPPED 5:30 pm 4/26/94
 RUNTIME 28 DAYS
 END pH 8.537
 END Cl CONCENTRATION 1182 ppm
 END WT 30.82188g
 NO SIGN OF PITS OR CREVICE CORROSION
 ON SPECIMEN

[Signature] 4/27/94

[Signature] 8/31/94

3/29/94

LONG TERM POTENTIOSTATIC TEST LT82SP3B

SPECIMEN SAME AS ~~LT82SP3B~~ ^{8/31/94} ~~QD~~ LT82SP3A
 START WT 26.86305g
 SOLUTION 300 ppm Cl^- 85 ppm HCO_3^- 2 ppm F^-
 1000 ppm SO_4^{2-} 1000 ppm NO_3^-
 2000 ml MADE AS FOLLOWS.
 0.99524g NaCl LOT 935535
 0.24628g NaHCO_3 LOT 897789
 4ml F^- 3/94 STOCK SOLUTION P 83
 2.75595g NaNO_3 LOT 897183
 2.95245g Na_2SO_4 LOT 901213
 + DI WATER TO 2000 ml $T=95^\circ\text{C}$ H₉ THERMO 183301
 POTENTIOSTAT ESC 440 #1 CHANNEL #1
 DATA SAVED AS ~~LT82SP2~~ ^{8/31/94} ~~QD~~ LT82SP3B.DAT
 USING LONGTM.WRB
 REFERENCE SCE FISHER 13-620-SI SN 3106337
 E_{corr} -165 mV
 E_{PT} +187mV
 E_{APP} +300mV
 START pH 8.201
 SPECIMEN STARTED: 4:14 pm 3/29/94
 SPECIMEN STOPPED 5:30 pm 4/26/94
 RUNTIME 28 DAYS
 END pH 8.621
 END Cl CONCENTRATION 457 ppm
 END WT 26.86376g
 NO SIGN OF PITS OR CREVICE CORROSION
 ON SPECIMEN

[Signature] 4/27/94

[Signature] 8/31/94

4/7/94

CREVICE CELL CONTROL TEST CURDTSA

OBJECTIVE IS TO DETERMINE HOW H^+ OH^- AND Cl^- MIGRATE INTO CREVICE SPECIMEN POLISHED PLEXIGLASS CONTROL SPECIMEN SOLUTION 1000 PPM Cl^- 85 PPM HCO_3^- 20 PPM SO_4^{2-} 10 PPM NO_3^- 2 PPM F^- AT ROOM TEMP $\approx 20^\circ C$ SETUP: SAME AS 304LRTST P67 SETUP OF METERS AND CHART RECORDERS SAME AS 304L-8 P7. DIMENSIONS OF RADIAL CELL ON PAGE 69 ELECTRODE SETUP TO PORTS P70. ELECTRODE NUMBERS AND CALIBRATIONS GIVEN BELOW.

BULK REFERENCE NONE

TIP REFERENCE MI 403 $Ag/AgCl$ # 41402

PH BULK MI 506 # 44817 / MI 402 # 45860

$$pH = -17.16(V) + 6.241$$

PH TIP MI 506 # 45147 / MI 402 # 45867

$$pH = -17.24(V) + 6.969$$

PH MOUTH MI 506 # 49445 / MI 403 # 44628

$$pH = -17.13(V) + 6.817$$

Cl MOUTH MI 200 # 47226 / MI 403 # 44671

$$Cl(ppm) = \exp[-0.0419(mV) + 11.43]$$

Cl TIP MI 200 # 44199 / MI 403 # 41432

$$Cl(ppm) = \exp[-0.0450(mV) + 11.75]$$

Cl BULK MI 200 # 47223 / MI 402 # 43647

$$Cl(ppm) = \exp[-0.0411(mV) + 10.26]$$

CELL ASSEMBLED 1/17/94 TEST STARTED 6.00 PM 1/17/94 CREVICE CELL AND GLASS VESSEL PLACED IN FARADAY CAGE THROUGHOUT COURSE OF TEST. POTENTIALS OF ELECTRODES MONITORED IN ORDER TO ESTABLISH BASELINE VALUES PRIOR TO ADJUSTING Cl CONCENTRATION

[Signature] 4/7/94

4/7/94

CREVICE CELL CONTROL TEST CURDTSA

CONDITIONS AT START OF TEST

BULK pH 7.56

TIP pH 7.70

MOUTH pH 7.58

BULK Cl 1157 ppm

MOUTH Cl 997 ppm

TIP Cl 1074 ppm

AT 330 PM 1/18/94, 21.5 HOURS AFTER START OF TEST BULK Cl CONCENTRATION WAS CHANGED TO 0.5 MOLAR BY THE ADDITION OF 100 ml 5.0 MOLAR NaCl pH AND Cl MONITORED FOR CHANGES

AT 420 PM 1/26/94 TEST WAS STOPPED Cl CONCENTRATION OF MOUTH AND TIP HAD INCREASED SLIGHTLY BUT WAS STILL BELOW THAT OF THE BULK Cl CONCENTRATION. pH OF BULK SOLUTION DECREASED SLIGHTLY. LARGER DECREASE IN pH WAS EVIDENT AT BOTH THE TIP AND MOUTH LOCATIONS.

DATA FILE OF CHART RECORDER TRACES SAVED AS CURDTSA.WRI OUTPUT OF pH AND Cl ELECTRODES PLOTTED ON PAGE 88.

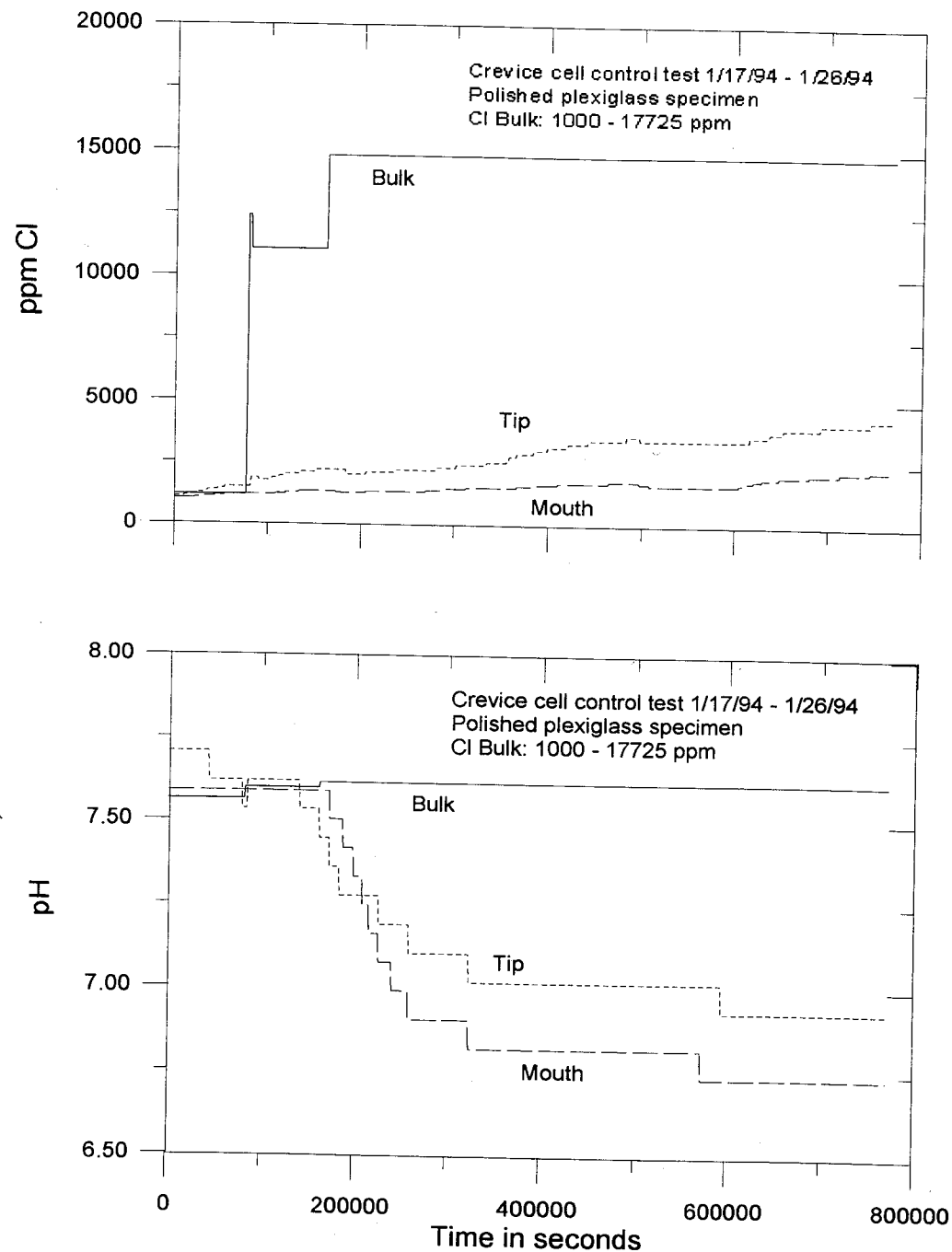
[Signature] 4/7/94

pH AND Cl^- ISE CALIBRATION DATA SAVED AS CURDTSA.C.DAT ON IUPUI ODS

[Signature] 4/28/94

4/7/94

CREVICE CELL CONTROL TEST CURDTSA



[Signature] 4/7/94

4/7/94

CREVICE CELL CONTROL TEST CURDTSB

OBJECTIVE MEASURE Cl^- MIGRATION INTO
CREVICE

SPECIMEN PLEXIGLASS SPECIMEN WITH 220 GRIT
FINISH.

SOLUTION 1000 PPM Cl^- 85 PPM HCO_3^- 20 PPM SO_4^{2-}
10 PPM NO_3^- 2 PPM F^- AT ROOM TEMP

SETUP SAME AS CURDTSA P86 SETUP
OF METERS AND CHART RECORDERS SAME
AS 304L-8 PAGE 7. ELECTRODE SERIAL
NUMBERS AND CALIBRATIONS GIVEN BELOW.

pH BULK MISOG # 44817 / MI 402 # 45860

$\text{pH} = -17.16(\text{V}) + 6.241$

pH TIP MISOG # 45147 / MI 402 # 45867

$\text{pH} = -17.24(\text{V}) + 6.969$

pH MOUTH MISOG # 49445 / MI 403 # 44628

$\text{pH} = -17.13(\text{V}) + 6.817$

Cl MOUTH MI 200 # 47226 / MI 403 # 44628

$\text{Cl (ppm)} = \text{EXP}[-0.049(\text{mV}) + 11.43]$

Cl TIP MI 200 # 44199 / MI 403 # 41432

$\text{Cl (ppm)} = \text{EXP}[-0.0450(\text{mV}) + 11.75]$

Cl BULK MI 200 # 47223 / MI 402 # 43647

$\text{Cl (ppm)} = \text{EXP}[-0.0411(\text{mV}) + 10.26]$

TIP REFERENCE MI 403 # 41402 Ag/AgCl

CELL ASSEMBLED 1/28/94 TEST STARTED

1:00 PM 1/28/94 CREVICE CELL AND

GLASS VESSEL PLACED IN FARADAY CAGE

THROUGHOUT COURSE OF TEST POTENTIALS

OF ELECTRODES MONITORED IN ORDER TO

ESTABLISH BASELINE PRIOR TO INCREASING

Cl CONCENTRATION. AT START OF TEST

TIP Cl ELECTRODE WAS NOISY

[Signature] 4/7/94

4/7/94

CREVICE CELL CONTROL TEST CURDTSB

CONDITIONS PRIOR TO INCREASING Cl CONCENTRATION
OF BULK SOLUTION FROM 1000 PPM TO 0.5 M:

BULK Cl	1023 ppm	BULK pH	7.78
TIP Cl	1286 ppm	MOUTH pH	6.83
MOUTH Cl	997 ppm	TIP pH	7.07

AT 1200 PM 1/30/94 ^{8/31/94} ~~46~~ DD 47 HOURS
AFTER START OF TEST 100 ml OF SOLUTION
WAS REMOVED FROM BULK AND REPLACED
WITH 100 ml OF 5.0 MOLAR NaCl

AT 200 PM 2/4/94 TEST WAS STOPPED
Cl CONCENTRATION AT TIP AND MOUTH
INCREASED AFTER BULK Cl CONCENTRATION
WAS INCREASED. pH AT TIP AND MOUTH
DECREASED SLIGHTLY WITH TIME.

OUTPUT OF CHART RECORDERS SAVED AS
DATA FILE CURDTSB.WRI OUTPUT OF
pH AND Cl ELECTRODES PLOTTED ON
PAGE 91.

David D 4/7/94

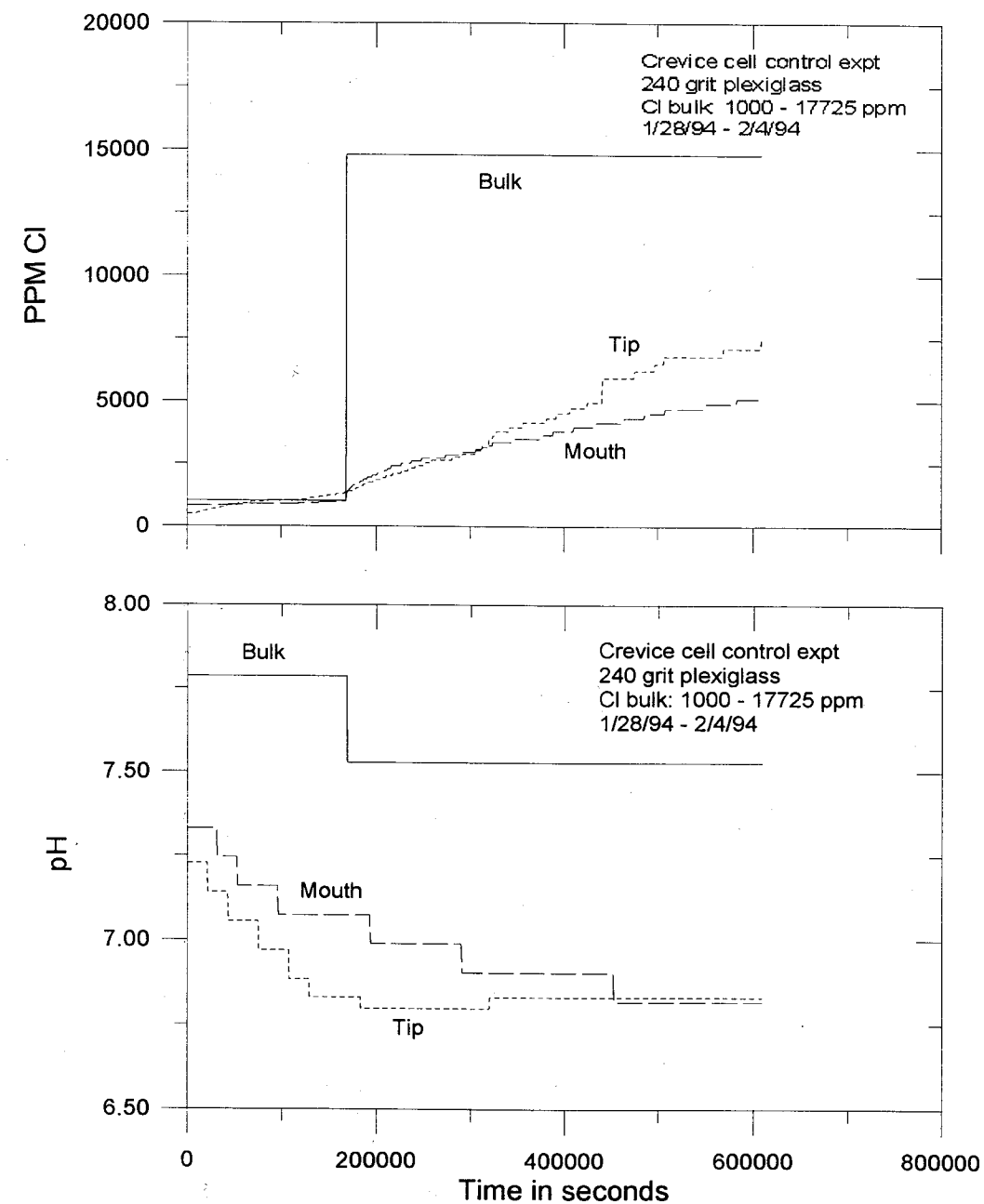
pH AND Cl⁻ ISG CALIBRATION DATA SAVED
AS CURDTSC.DAT ON INPG-085

David D 4/28/94

David D 8/31/94

4/7/94

CREVICE CELL CONTROL TEST CURDTSB



David D 4/7/94

David D 8/31/94

4/7/94

CREVICE CELL CONTROL TEST CURAOTS2

OBJECTIVE MEASURE H^+ AND OH^- MIGRATION
INTO CREVICE

SPECIMEN 220 CRIT FINISH PLEXIGLASS

SOLUTION 1000 PPM Cl^- 85 PPM $NaCO_3$ 20 PPM SO_4^{2-}
10 PPM NO_3^- 2 PPM F^-

SETUP SAME AS CURDTSA P86 SETUP OF
METERS AND CHART RECORDERS SAME AS
304L8 P7 ELECTRODE SERIAL NUMBERS AND
CALIBRATIONS GIVEN BELOW.

TIP REFERENCE MI 403 $Ag/AgCl$ # 41402

pH BULK MI 506 # 44817 / MI 402 # 45860

pH = $-17.16(V) + 6.241$

pH TIP MI 506 # 45147 / MI 403 # 45867

pH = $-17.24(V) + 6.969$

pH MOUTH MI 506 # 49445 / MI 403 # 44628

pH = $-17.13(V) + 6.817$

Cl MOUTH MI 200 # 47226 / MI 403 # 44671

Cl (PPM) = $EXP[-0.0419(mV) + 11.43]$

Cl TIP MI 200 # 44199 / MI 403 # 41432

Cl (PPM) = $EXP[-0.0450(mV) + 11.75]$

Cl (BULK) MI 200 # 47223 / MI 402 # 43647

Cl PPM = $EXP[-0.0411(mV) + 10.26]$

CELL ASSEMBLED 2/6/94 TEST STARTED

2/7/94 CREVICE CELL AND GLASS

VESSEL PLACED IN FARADAY CAGE

THROUGHOUT COURSE OF TEST. POTENTIALS

OF ELECTRODES MONITORED PRIOR TO CHANGING
PH

CONDITIONS AT START OF TEST

pH BULK 7.69 Cl BULK 1157 ppm

pH TIP 6.88 Cl TIP 2018 ppm

pH MOUTH 6.67 Cl MOUTH 1178 ppm

[Signature] 4/7/94

4/7/94

CREVICE CELL CONTROL TEST CURAOTS2

AT 6:00 PM 2/7/94, 9 HOURS AFTER START
OF TEST 10 ml OF 10% HNO_3 ~~ADDED~~ ^{ADDED}
ADDED TO BULK SOLUTION. PH DECREASED TO
2.1 Cl AND pH OF TIP AND MOUTH
RECORDED

AT 11:00 AM 2/10/94 PH INCREASED TO
6.8 IN BULK SOLUTION BY THE ADDITION
OF 11 ml 1 MOLAR NaOH, 1 ml 10% HNO_3 , 0.7 ml
1 MOLAR NaOH. ADDITION WAS COMPLETED AT
11:10 AM Cl AND pH OF TIP AND MOUTH
WERE RECORDED.

REFERENCE ELECTRODE FOR Cl TIP MALFUNCTIONED
AT 318.5 HOURS INTO TEST ON 2/20/94
Cl TIP MEASUREMENTS WERE INCORRECT FROM
THIS TIME THROUGHOUT THE REST OF THE TEST

AT 5:30 PM 2/25/94 PH OF BULK SOLUTION
DECREASED BY THE ADDITION OF 10 ml 10% HNO_3
pH OF TIP AND MOUTH WERE RECORDED
TEST WAS STOPPED 2/26/94 AT 6:16 PM

OUTPUT OF Cl AND pH ELECTRODES INPUT
INTO DATA FILE CURAOTS2.WK1
PLOT OF pH AND Cl DATA ON PAGE
94.

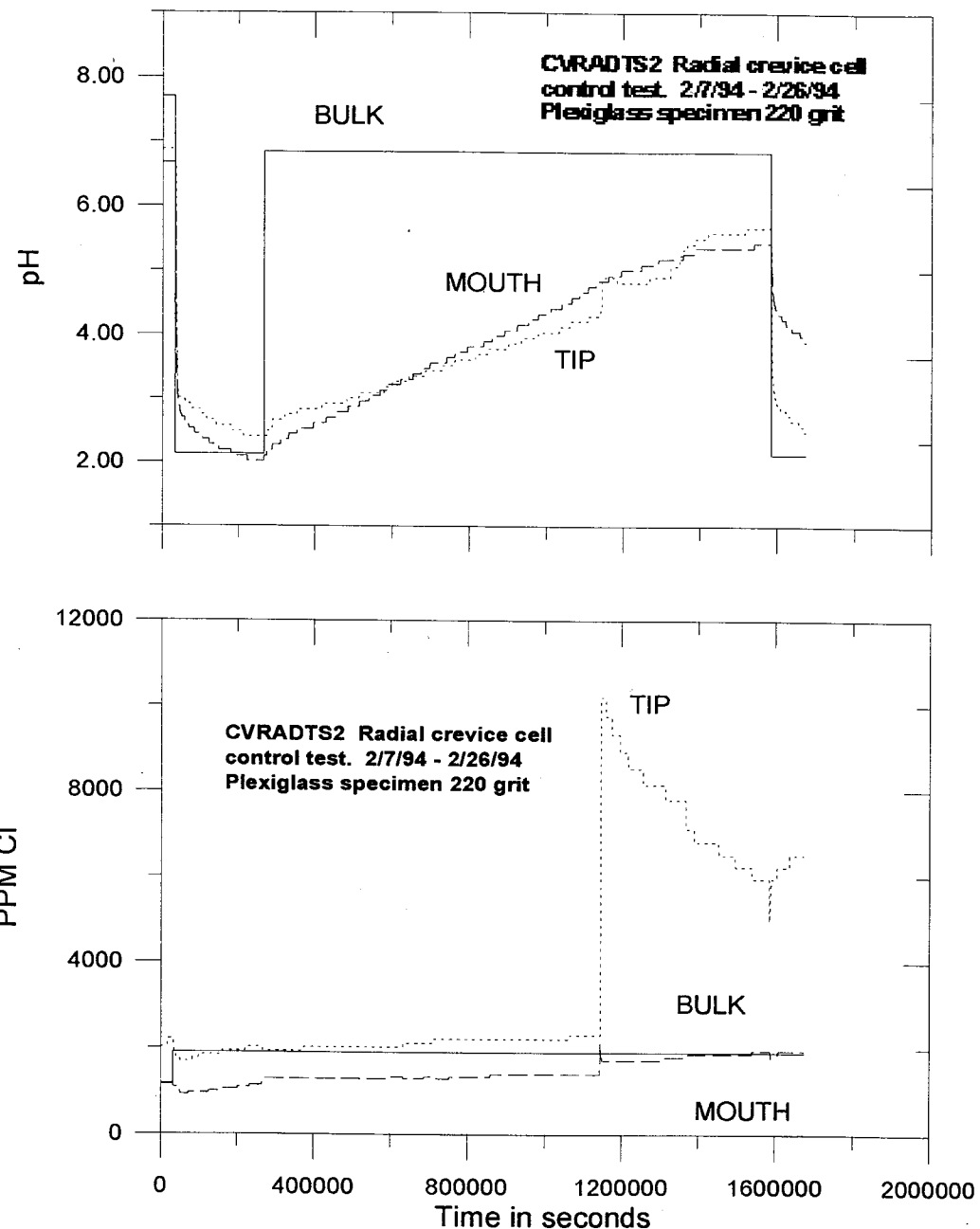
[Signature] 4/7/94

pH AND Cl^- ISE CALIBRATION DATA SAVED
AS CURAD2C.DAT ON IUPRE 085

[Signature] 4/28/94

4/7/94

CREVICE CELL CONTROL TEST CVRADTS2



[Signature] 4/7/94

[Signature] 8/31/94

4/7/94

CREVICE CELL CONTROL TEST CURDTS3

OBJECTIVE MEASURE H^+ AND OH^- MIGRATION INTO CREVICE

SPECIMEN 220 GRIT FINISH PLEXIGLASS

SOLUTION 1000 PPM Cl^- AS NaCl 3.29604 g

NaCl LOT 92644RA ADDED TO 2000ml BOILED DI WATER START pH = 6.205

SETUP SAME AS CURDTS2 P 86 SETUP OF METERS AND CHART RECORDERS SAME AS 304L-8 P7 ELECTRODES AND CALIBRATIONS GIVEN BELOW

TIP REFERENCE MI 403 Ag/AgCl #

pH BULK MISOC # 44817 / MI 402 # 45860

pH = $-17.25(V) + 6.72$

pH TIP MISOC # 45147 / MI 403 # 45867

pH = $-17.39(V) + 7.03$

pH MOUTH MISOC # 49445 / MI 403 # 44625

pH = $-17.36(V) + 6.94$

Cl BULK MI 200 # 47223 / MI 402 # 41436

$Cl(ppm) = \text{EXP}[-0.0474(mV) + 11.39]$ 8/31/94

Cl TIP MI 200 # 44199 / ~~MI 200~~ MI 403 # 41432

$Cl(ppm) = \text{EXP}[-0.0451(mV) + 11.77]$

Cl MOUTH MI 200 # 47239 / MI 403 # 44671

$Cl(ppm) = \text{EXP}[-0.0509(mV) + 12.01]$

CREVICE CELL ASSEMBLED 3/17/94 TEST

STARTED 3/18/94 8:00AM pH AND Cl

MONITORED PRIOR TO CHANGING pH TO ESTABLISH BASELINE READINGS.

CONDITIONS AT START OF TEST.

BULK pH 6.97

MOUTH pH 5.89

BULK Cl 777 ppm

MOUTH Cl 15.21

TIP pH 5.81

TIP Cl 2674 ppm

[Signature] 8/31/94

4/7/94

CREVICE CONTROL TEST CURDTS3

AT 300 PM 3/18/94 0.1 ml 10% HNO_3 ADDED TO BULK SOLUTION. BULK pH DECREASED FROM 6.89 TO 3.82

AT 8:30 PM 3/19/94 0.55 ml 10% HNO_3 ADDED TO BULK SOLUTION. BULK pH DECREASED FROM 3.82 TO 2.92

BULK pH WAS INCREASED FROM 3.01 TO 3.70 ON 3/21/94 BY ADDING 0.1 M NaOH (6.2 ml) AT 9:00 AM

AT 11:00 AM 3/22/94 0.1 M NaOH WAS ADDED UNTIL BULK pH WAS SLIGHTLY GREATER THAN 7. pH DRIIFTED TO SLIGHTLY MORE ACIDIC VALUES WITH TIME. pH OF MOUTH AND TIP INCREASED. AT 9:00 AM 3/29/94 0.7 ml 10% HNO_3 ADDED TO BULK SOLUTION. pH OF BULK DECREASED FROM 7.08 TO 2.95 TEST WAS STOPPED 3/30/94 AT 12:00 PM

OUTPUT OF CI AND pH ELECTRODES INPUT INTO DATA FILE CURDTS3.WK1. OUTPUT OF ELECTRODES PLOTTED ON PAGE 97

pH DECREASED IN TIP AND MOUTH LOCATIONS AFTER pH OF BULK WAS DECREASED. MOUTH RESPONSE WAS FASTER THAN TIP. INCREASE IN pH AT MOUTH AND TIP OCCURRED VERY SLOWLY AFTER BULK pH WAS INCREASED

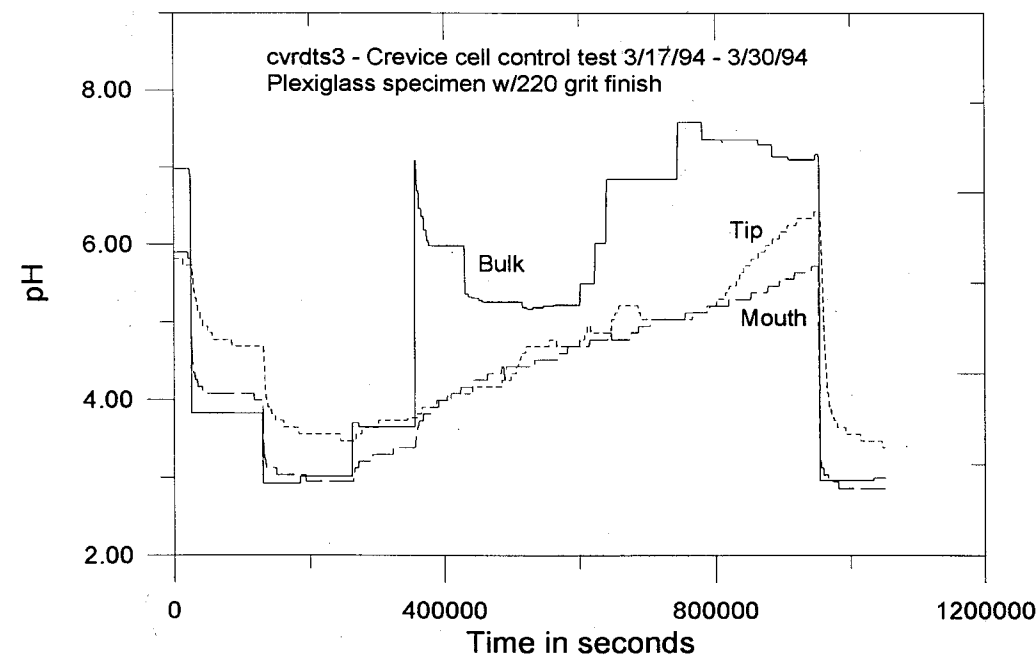
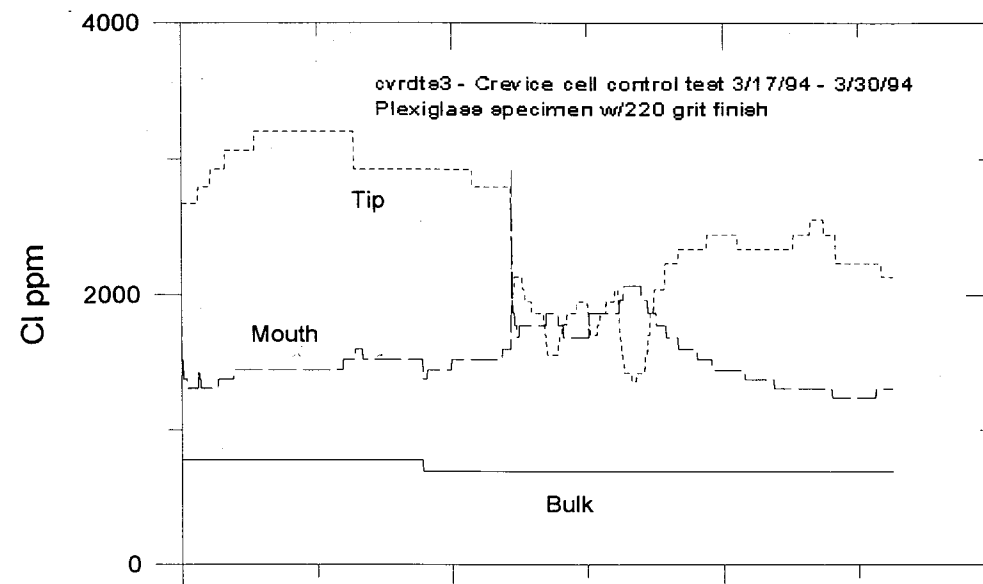
[Signature] 4/7/94

pH AND Cl^- ISE DATA FOR CALIBRATION SAVED AS CURDTS3C.DAT ON I:\WP6 085

[Signature] 8/31/94

4/7/94

CREVICE CELL CONTROL TEST CURDTS3



[Signature] 4/7/94

[Signature] 8/31/94

4/8/94

STOCK SOLUTIONS 4/94

SO₄ - 4/94 1000 ppm SO₄⁻ AS Na₂SO₄
 1.47932 g Na₂SO₄ LOT 901213
 + DI WATER TO 1000 ml EXP 5/3/94

NO₃ - 4/94 1000 ppm NO₃⁻ AS NaNO₃
 1.37162 g NaNO₃ LOT 897183
 + DI WATER TO 1000 ml EXP 5/3/94

F⁻ - 4/94 1000 ppm F⁻ AS NaF
 1.876709 g NaF LOT 896405
 + DI WATER TO 1000 ml EXP 5/3/94

1M Cl⁻ - 4/94 ~~+~~ ^{8/31/94} 1 MOLAR Cl⁻ AS NaCl
 58.44348 g NaCl LOT 935535
 + DI WATER TO 1000 ml

0.5M Cl⁻ - 4/94 0.5 MOLAR Cl⁻ AS NaCl
 29.22460 g NaCl LOT 935535
 + DI WATER TO 1000 ml

1000 Cl⁻ - 4/94 1000 ppm Cl⁻ AS NaCl
 3.29818 g NaCl LOT 935535
 + DI WATER TO 2000 ml

100 Cl⁻ - 4/94 100 ppm Cl⁻ AS NaCl
 0.16640 g NaCl LOT 935535
 + DI WATER TO 1000 ml

[Signature]
 4/8/94

4/28/94

Radially symmetrical Crevice Cell

Objectives: To determine the changes in the chemistry (pH, pCl, potential, current) inside the crevice as a function of externally applied potential.

Justification: Previous experiments (p. 58-62) on alloy 825 in a rectangular crevice indicated that the changes in pH & pCl at the tip and mouth occurred rather quickly and the tip pH was changing faster than the mouth pH in response to a deliberate reduction in the bulk pH (i.e. no corrosion involved). This would indicate that the transport in the rectangular crevice was not unidirectional, as was believed before, but bi-directional. To facilitate comparison to models, a radially symmetrical crevice geometry was conceived. As a first step, control experiments with deliberate additions of H⁺, OH⁻ or Cl⁻ are being conducted. These involve only transport and aqueous speciation, but no faradaic reactions.

Following the control experiments, electrochem. experiments will be conducted using alloy 825 and Type 304L SS.

N. Sridhar
 4/28/94

5/4/94

LONG TERM POTENTIOSTATIC TEST LT825 P2I

SPECIMEN SAME AS LT825 P2H P84

START WT 30.82188g

SOLUTION 1000 ppm Cl^- 85 ppm HCO_3^- 20 ppm SO_4^{2-} 10 ppm NO_3^- 2 ppm F^- 2000 ml MAKE AS FOLLOWS3.29853 g NaCl LOT 9355350.24039 g NaHCO_3 LOT 89778940 ml SO_4^{2-} 4/94 STOCK SOLUTION p 9820 ml NO_3^- 4/94 "4 ml F^- 4/94 "+ DI WATER TO 2000 ml $T=95^\circ\text{C}$ H_2 THERMO 183302

POTENTIOSTAT ESC 440 #1 CHANNEL #2

DATA SAVED AS LT825 P2I.DAT USING LONGTM.WBB

REFERENCE SEE FISHER 13-620-SI SN 9214083

 $E_{\text{CORR}} + 90 \text{ mV}$ $E_{\text{PT}} + 265 \text{ mV}$ $E_{\text{APP}} 0 \text{ mV}$

START pH 8.216

SPECIMEN STARTED 4:30 pm 5/4/94

TEST STOPPED 5:15 pm 6/1/94

END pH 8.708

END WT 30.82132g

NO SIGN OF PITTING OR CREVICE CORROSION

[Signature]
6/6/94

5/4/94

LONG TERM POTENTIOSTATIC TEST LT825 P3C

SPECIMEN: SAME AS LT825 P3B P85

START WT 26.86376g

SOLUTION 300 ppm Cl^- 85 ppm HCO_3^- 2 ppm F^- 1000 ppm NO_3^- 1000 ppm SO_4^{2-} 2000 ml AS FOLLOWS0.99748g NaCl LOT 9355350.24184g NaHCO_3 LOT 8977892.75511g NaNO_3 LOT 8971832.96282g Na_2SO_4 LOT 9012134 ml F^- 4/94 STOCK SOLUTION P 98+ DI WATER TO 2000 ml $T=95^\circ\text{C}$ N_2 THERMO 183301

POTENTIOSTAT ESC 440 #1 CHANNEL #1

DATA SAVED AS LT825 P3C.DAT USING LONGTM.WBB

REFERENCE SEE FISHER 13-620-SI SN 8211163

 $E_{\text{CORR}} - 60 \text{ mV}$

KEITNEY 614 # 467374

 $E_{\text{PT}} + 210 \text{ mV}$ $E_{\text{APP}} + 300 \text{ mV}$

START pH 8.208

SPECIMEN STARTED 4:30 pm 5/4/94

TEST STOPPED 5:15 pm 6/1/94

END pH 8.786

END WT 26.86397

NO SIGN OF PITTING OR CREVICE CORROSION

HIGH CURRENT DENSITY AT START OF TEST

DUE TO BUBBLE IN LUGGIN PROBE

[Signature]
6/6/94

5/11/94

CREVICE REPASSIVATION RP825C1

OBJECTIVE DETERMINE THE REPASSIVATION
POTENTIAL FOR CREVICE CORROSION IN 1000 PPM Cl^-
AT 95°C AS A FUNCTION OF CHARGE DENSITY.
INITIAL ENTRY FOR CREVICE REPASSIVATION
SHOWN ON PAGE 238 OF IWPE 045

SPECIMEN ALLOY 825 HN4371FG SPECIFICATIONS
SHOWN ON IWPE 045 P 235

START WT NOT RECORDED

TEST CONDUCTED IN 2 LITER REACTION CELL
WITH TEFLON TOP

SOLUTION 1000 PPM Cl^- 85 PPM HCO_3^- 20 PPM SO_4^{2-}
10 PPM NO_3^- 2 PPM F^- 2000 ml MAKE AS FOLLOWS

3.29753g NaCl LOT 935535

0.24433g NaHCO_3 LOT 897789

SO_4^{2-} 4/94 20 ml 5/11/94 40 ml STOCK SOLUTION p 98

20 ml NO_3^- 4/94

4 ml F^- 4/94

+ DI WATER TO 2000 ml T=95°C N_2 THERMO #0323008
PURGED WITH N_2 99.999% LIQUID
CARBONIC 426135

REFERENCE FISHER SC6 13-620-SI SN 3106321

E_{CORR} -526mV KEITHLEY 614 #467374

E_{PT} -403mV

START pH 8.070

END pH 9.079

INITIATION 500-620mV FOR 9100 SEC

GROWTH 450mV

REPASSIVATION POTENTIAL WAS NOT OBTAINED
DUE TO LOGIC ERROR

DATA SAVED AS RP825C1.DAT USING

REPASS4F.WBB LISTED ON IWPE 025 P297

POTENTIO STAT ESC 440 #2 CHANNEL #1

TEST CONDUCTED WITH PTFE CREVICE ON 0.75" x 0.75"
FACES WITH C276 BOLT AND NUT TORQUED TO 30 IN.OZ

CREVICE CORROSION ON 4 OF 24 POSSIBLE SITES

5/16/94

5/11/94

CREVICE REPASSIVATION RP825C2.1

OBJECTIVE SAME AS RP825C1 P102

SPECIMEN SAME AS DESCRIBED IN RP825C1 P102

START WT NOT RECORDED

SOLUTION 1000 PPM Cl^- 85 PPM HCO_3^- 20 PPM SO_4^{2-}
10 PPM NO_3^- 2 PPM F^- 2000 ml MAKE AS FOLLOWS

3.29771g NaCl LOT 935535

0.23965g NaHCO_3 LOT 897789

40 ml SO_4^{2-} 4/94 STOCK SOLUTIONS p 98

20 ml NO_3^- 4/94

4 ml F^- 4/94

+ DI WATER TO 2000 ml T=95°C N_2 THERMO #0323008

PURGED WITH 99.999% N_2 FROM LIQUID

CARBONIC TANK #426135

START pH 8.255

END pH 9.266

REFERENCE SC6 FISHER 13-620-SI SN 9214080

POTENTIOSTAT ESC 440 #2 DATA SAVED AS

RP825C2.DAT USING REPASS4F.WBB

E_{CORR} -495mV

KEITHLEY 614 #467374

E_{PT} -382mV

INITIATION 600-620mV

GROWTH 450mV

REPASSIVATION POTENTIAL NOT RECORDED

DUE TO LOGIC ERROR.

TEST CONDUCTED WITH PTFE CREVICE BLOCK
ON 0.75" x 0.75" SPECIMEN FACES. CREVICE
BLOCK SECURED WITH C276 NUT AND BOLT
TORQUED TO 30 IN.OZ

CREVICE CORROSION ON 6 OF 24 POSSIBLE SITES
AND SEVERAL DEEP PITS

5/11/94

5/11/94

CREVICE REPASSIVATION RP825C3

OBJECTIVE SAME AS RP825C1 P 102

SPECIMEN SAME AS DESCRIBED IN RP825C1 P 102

START WT NOT RECORDED

SOLUTION 1000 ppm Cl^- 85 ppm HCO_3^- 20 ppm SO_4^{2-}
10 ppm NO_3^- 2 ppm F^- 2000 ml MADE AS FOLLOWS.

3.29678 g NaCl LOT 935535

0.24870 g NaHCO_3 LOT 89778940 ml SO_4 - 4/94 STOCK SOLUTION P 9820 ml NO_3 - 4/944 ml F^- - 4/94+ DI WATER TO 2000 ml $T=95^\circ\text{C}$ H_2 TNGRMD 0323007PURGED WITH 99.999% N_2 FROM LIQUID

CARBONIC TANK # 426135

START pH 8.039

END pH 9.374

REFERENCE SCE FISHER 13-620-S1 SN 3106321

POTENTIOSTAT ESC 440 #2 CHANNEL #3

DATA SAVED AS RP825C3.DAT USING REPASS4F.WBB

Ecorr - 507

KEITHLEY 614 # 467374

E_{pt} - 393

INITIATION 500-650 mV 4100 SEC

GROWTH 400 mV

REPASSIVATION POTENTIAL - 48 mV

AREA OF SPECIMEN SET AT 1.5 cm^2 INSTEADOF ACTUAL AREA OF 15 cm^2 THEREFORE

CURRENT DENSITY AND CHARGE DENSITY

IS INCORRECT BY A FACTOR OF 10

ACTUAL CHARGE DENSITY 5.7 C/cm^2

TEST CONDUCTED WITH PTFE CREVICE BLOCKS

SECURED WITH C276 NUT AND BOLT TORQUED TO 30 IN. OZ

CREVICE CORROSION ON 12 OF 24 POSSIBLE SITES

 5/16/94

5/11/94

CREVICE REPASSIVATION RP825C4

OBJECTIVE SAME AS RP825C1 P 102

SPECIMEN SAME AS DESCRIBED IN RP825C1 P 102

START WT NOT RECORDED

SOLUTION 1000 ppm Cl^- 85 ppm HCO_3^- 20 ppm SO_4^{2-}
10 ppm NO_3^- 2 ppm F^- 2000 ml MADE AS FOLLOWS

3.29677 g NaCl LOT 935535

0.24876 g NaHCO_3 LOT 89778940 ml SO_4 - 4/94 STOCK SOLUTION P 9820 ml NO_3 - 4/944 ml F^- - 4/94+ DI WATER TO 2000 ml $T=95^\circ\text{C}$ H_2 TNGRMD # 0323005PURGED WITH 99.999% N_2 FROM LIQUID

CARBONIC TANK # 426135

START pH 8.147

END pH 9.032

REFERENCE SCE FISHER 13-620-S1 SN 3106321

POTENTIOSTAT ESC 440 #2 CHANNEL #4

DATA SAVED AS RP825C4.DAT USING REPASS4F.WBB

Ecorr - 636 mV

KEITHLEY 614 # 467374

E_{pt} - 442 mV

INITIATION 500-600 mV

GROWTH 400 mV

REPASSIVATION POTENTIAL - 18 mV

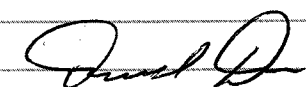
CHARGE DENSITY 5.4 C/C cm^2

TEST CONDUCTED WITH PTFE CREVICE BLOCKS

SECURED WITH C276 NUT AND BOLT TORQUED TO 30 IN. OZ

CREVICE CORROSION ON 21 OF 24 POSSIBLE

SITES A FEW SMALL PITS

 5/16/94

5/11/94

REPASSIVATION POTENTIAL - CREVICE RP825C5

OBJECTIVE SAME AS RP825C1 P 102

SPECIMEN SAME AS DESCRIBED IN RP825C1 P 102

START WT NOT RECORDED

PTFE CREVICE BLOCKS PLACED ON 0.750" x 0.750"
SURFACES. CREVICE BLOCKS SECURED WITH
C 276 NUT AND BOLT TORQUED TO 30 IN. OZSOLUTION 1000 PPM Cl^- 85 PPM HCO_3^- 20 PPM SO_4^{2-}
10 PPM NO_3^- 2 PPM F^- 2000 ml MADE AS FOLLOWS.3.29775 g NaCl LOT 9355350.23781 g NaHCO_3 LOT 89778940 ml SO_4 - 4/94 STOCK SOLUTION p 9820 ml NO_3 - 4/944 ml F^- - 4/94+ DI WATER TO 2000 ml $T=95^\circ\text{C}$ H_2 THERMO 0323008PURGED WITH 99.999% N_2 FROM LIQUID

CARBONIC TANK # 426135

START pH 8.211

END pH 9.294

REFERENCE SCE FISHER 13-620-S1 SN 9214080

POTENTIOSTAT ESC 440 #2 CHANNEL #5

DATA SAVED AS RP825C5.DAT USING REPASS4F.WBB

 E_{CORR} -609 KEITHLEY 614 #467374 E_{PT} -400

INITIATION 550-580 mV

GROWTH 400 mV

REPASSIVATION POTENTIAL -80 mV

CHARGE DENSITY 16 COULOMBS cm^{-2} CREVICE CORROSION ON 23 OF 24 POSSIBLE
SITES A FEW SMALL PITS.

5/16/94

5/11/94

REPASSIVATION CREVICE RP825C6

OBJECTIVE SAME AS RP825C6 P 102

SPECIMEN SAME AS DESCRIBED AS IN RP825C2 P 102

START WT NOT RECORDED

PTFE CREVICE BLOCKS PLACED ON 0.750" x 0.750"
SURFACES AND TORQUED TO 30 IN. OZ WITH
C 276 NUT AND BOLTSOLUTION 1000 PPM Cl^- 85 PPM HCO_3^- 20 PPM SO_4^{2-} 10 PPM NO_3^- 2 PPM F^- 2000 ml MADE AS FOLLOWS.3.29671 g NaCl LOT 9355350.23841 g NaHCO_3 LOT 89778940 ml SO_4 - 4/9420 ml NO_3 - 4/944 ml F^- - 4/94+ DI WATER TO 2000 ml $T=95^\circ\text{C}$ H_2 THERMO 0323007PURGED WITH 99.999% N_2 FROM LIQUID CARBONIC

TANK # 426135

START pH 8.014

END pH 9.017

REFERENCE SCE FISHER 13-620-S1 SN 9214080

POTENTIOSTAT ESC 440 #2 CHANNEL #5

DATA SAVED AS RP825C6.DAT USING REPASS4F.WBB

 E_{CORR} -521

KEITHLEY 614 #467374

 E_{PT} -389

INITIATION 520-580 mV

GROWTH 450 mV

REPASSIVATION POTENTIAL 11 mV

CHARGE DENSITY 11 COULOMBS cm^{-2} SPECIMEN HAS CREVICE CORROSION ON 12 OUT
OF 24 POSSIBLE SITES AND
A FEW SMALL PITS

5/16/94

5/13/94

CREVICE REPASSIVATION RP825C7

OBJECTIVE SAME AS RP825C1 P102

SPECIMEN SAME AS DESCRIBED IN RP825C1 P102

START WT. 29.24953g

END WT 29.22389g

PTFE CREVICE BLOCKS PLACED ON 0.750" x 0.750"
SURFACES. C276 NUT AND BOLT TORQUED TO 40 IN.OZ
SOLUTION 1000 PPM Cl^- 85 PPM HCO_3^- 20 PPM SO_4^{2-}

10 PPM NO_3^- 2 PPM F^- 2000 ml MAKE AS FOLLOWS

3.29596 g NaCl LOT 935535

0.24481 g NaHCO_3 LOT 89778940 ml SO_4^{2-} 5/94 STOCK SOLUTION p 11120 ml NO_3^- 5/94 "4 ml F^- 5/94 "

+ DI WATER TO 2000 ml $T=95^\circ\text{C}$ H_2 THERMO 0323007
PURGED WITH 99.999% N_2 FROM LIQUID
CARBONIC TANK # 426135

START pH 8.278

END pH 9.912

REFERENCE FISHER SCG 13-620-S1 SN 3106345

POTENTIOSTAT ESC 440#2 CHANNEL #1

DATA SAVED AS RP825C7.DAT USING REPASS 4F.W.B.B

 $E_{\text{CORR}} -669 \text{ mV}$ KEITHLEY 614 # 467374 $E_{\text{PT}} -410 \text{ mV}$

INITIATION 520 mV FOR 300 SEC

500 mV FOR 1 hr

GROWTH 470 mV FOR 10100 SEC

REPASSIVATION DOWNWARD SWEEP STARTED AT

 $t = 14000 \text{ SEC}$ AT $t = 14120 \text{ SEC}$ $E = 0 \text{ mV}$ $I = 4.8 \times 10^{-5} \text{ A/cm}^2$ CHARGE DENSITY 6.8 C/cm²

SPECIMEN ABOVE SOLUTION FOR 24 HR PRIOR

TO START OF TEST WHILE SOLUTION WAS HEATED

SPECIMEN IMMERSSED FOR 1 HR PRIOR TO INITIATION

CREVICE CORROSION OBSERVED ON 24 OF 24 SITES

2 SMALL PITS

 5/17/94

5/13/94

CREVICE REPASSIVATION RP825C8

OBJECTIVE SAME AS RP825C1 P102

SPECIMEN SAME AS DESCRIBED IN RP825C1 P102

START WT 29.56606 g

END WT 29.52083 g

PTFE CREVICE BLOCKS PLACED ON 0.750" x 0.750"
SURFACES. C276 NUT AND BOLT TORQUED
TO 40 IN.OZ USING PROTO 6103

SOLUTION 1000 PPM Cl^- 85 PPM HCO_3^- 20 PPM SO_4^{2-} 10 PPM NO_3^- 2 PPM F^- 2000 ml MAKE AS FOLLOWS

3.29821 g NaCl LOT 935535

0.24196 g NaHCO_3 LOT 89778940 ml SO_4^{2-} 5/94 STOCK SOLUTION p 11120 ml NO_3^- 5/94 "4 ml F^- 5/94 "

+ DI WATER TO 2000 ml $T=95^\circ\text{C}$ H_2 THERMO 0323008
PURGED WITH 99.999% N_2 FROM LIQUID CARBONIC
TANK # 426135

START pH 8.288

END pH 9.971

REFERENCE FISHER SCG 13-620-S1 SN 9214080

POTENTIOSTAT ESC 440#2 CHANNEL #2

DATA SAVED AS RP825C8.DAT USING REPASS 4F.W.B.B

 $E_{\text{CORR}} -669 \text{ mV}$ KEITHLEY 614 # 467374 $E_{\text{PT}} -392 \text{ mV}$ "

INITIATION 520 mV FOR 300 SEC

500 mV FOR 1 hr

GROWTH 470 mV FOR 15300 SEC


REPASSIVATION DOWNWARD SWEEP AT $t = 19200 \text{ SEC}$ AT $t = 19330 \text{ SEC}$ $E = -70 \text{ mV}$ $I = 4.3 \times 10^{-5} \text{ A/cm}^2$ CHARGE DENSITY 12 C/cm²

SPECIMEN ABOVE SOLUTION FOR 24 HOURS PRIOR TO START

OF TEST WHILE SOLUTION ~~WAS~~ 5/13/94 WAS HEATED

SPECIMEN IMMERSSED FOR 1 HOUR PRIOR TO INITIATION

CREVICE CORROSION ON 24 OF 24 SITES

2 SMALL PITS  5/17/94

5/13/94

CREVICE REPASSIVATION RP825C9

OBJECTIVE SAME AS RP825C1 P102

SPECIMEN SAME AS DESCRIBED IN RP825C1 p102

START WT 28.79342g

END WT 28.78283g

PTFE CREVICE BLOCKS PLACED ON 0.750" x 0.750" SURFACES, CREVICE BLOCKS SECURED WITH C276 NUT AND BOLT TORQUED TO 40 IN-OZ USING PROTO 6103

SOLUTION 1000 PPM Cl^- 85 PPM NaCO_3 20 PPM SO_4^{2-} 10 PPM NO_3^- 2 PPM F^- 2000 ml MARK AS FOLLOWS

3.29727g NaCl LOT 935535

0.24496g Na_2CO_3 LOT 89778940 ml SO_4 - 5/94 STOCK SOLUTION p11120 ml NO_3 - 5/94 "4 ml F^- - 5/94 "

+ DI WATER TO 2000 ml $T = 95^\circ\text{C}$ H_2 THERMO # 0323005
PURGED WITH 99.999% N_2 FROM LIQUID CARBONIC TANK # 426135

START pH 8.152

END pH 9.244

REFERENCE FISHER 13-620-S1 SN 0169033

POTENTIAL STAT ESC 440 # 2 CHANNEL # 3

DATA SAVED AS RP825C9.DAT USING REPASS 4F.WBB

 E_{corr} -675 mV KEITHLEY 614 # 467374 E_{PT} -374 mV "

INITIATION 520 mV FOR 300 SEC

500 mV FOR 1 hr

GROWTH 470 mV FOR 4400 SEC

REPASSIVATION DOWNWARD SUGGA AT $t = 8300$ SECAT 8404 SEC $E = 11$ mV $I = 4.6 \times 10^{-5}$ A/cm²CHARGE DENSITY 2.7 C/cm²

SPECIMEN ABOVE SOLUTION FOR 24 HOURS WHILE SOLUTION WAS HEATED THEN IMMERSO FOR 1 HOUR PRIOR TO INITIATION
CREVICE CORROSION ON 23 OF 24 SITES

NO PITS

5/17/94

5/13/94

STOCK SOLUTIONS 5/94

SO_4 - 5/94 1000 PPM SO_4^{2-} AS Na_2SO_4
1.47385g Na_2SO_4 LOT 901213
+ DI WATER TO 1000 ml EXP 6/6/94

NO_3 - 5/94 1000 PPM NO_3^- AS NaNO_3
1.37833g NaNO_3 LOT 897183
+ DI WATER TO 1000 ml EXP 6/6/94

F^- - 5/94 1000 ppm F^- AS NaF
1.87637g NaF LOT 896405
+ DI WATER TO 1000 ml

5/13/94

5/26/94

CREVICE REPASSIVATION RP825C10

OBJECTIVE SAME AS RP825C1 P102

SPECIMEN SAME AS DESCRIBED IN RP825C1 P102

START WT 27.52796 g

END WT 26.64179 g

PTFE CREVICE BLOCKS PLACED ON 0.750" x 0.750"

SURFACES CREVICE BLOCKS SECURED WITH C276 NUT AND

BOLT TORQUED TO 40 IN OZ USING PROTO 6103

SOLUTION 1000 PPM Cl^- 85 PPM HCO_3^- 20 PPM SO_4^{2-} 10 PPM NO_3^- 2 PPM F^- 2000 ml MAKE AS FOLLOWS

3.29881 g NaCl LOT 935535

0.24212 g NaHCO_3 LOT 89778940 ml SO_4 - 5/94 STOCK SOLUTION p III20 ml NO_3 - 5/94 "4 ml F^- - 5/94 "+ DI WATER TO 2000 ml $T=95^\circ\text{C}$ N_2 THERMO # 0323005PURGED WITH 99.999% N_2 FROM LIQUID CARBONIC TANK # 426135

START pH 8.121

END pH 9.013

REFERENCE FISHER 13-620-S1 SN 0169033

POTENTIOSTAT ESC 440 #2 CHANNEL #1

DATA SAVED AS RP825C10.DAT USING REPASS4F

 $E_{\text{CORR}} = -730 \text{ mV}$ KETHLEY 614 # 467374 $E_{\text{PT}} = -410 \text{ mV}$ "

INITIATION 520 mV FOR 300 SEC

500 mV FOR 1 hr

GROWTH 450 mV FOR 1 hr

400 mV FOR 407500 SEC

REPASSIVATION DOWNWARD SCAN AT 415000 SEC

5/31/94 8:05 AM AT $t = 415162 \text{ SEC}$ $V_{\text{SET}} = -80 \text{ mV}$ $I = 4 \times 10^{-5} \text{ A/cm}^2$ $C = 231 \text{ C/cm}^2$

SPECIMEN ABOVE SOLUTION FOR 24 HOURS DURING

HEATING AND IMMERSO FOR 1 HOUR PRIOR TO INITIATION

D. J. Q. 6/3/94

5/26/94

CREVICE REPASSIVATION RP825C11

OBJECTIVE SAME AS RP825C1 P102

SPECIMEN SAME AS DESCRIBED IN RP825C1 P102

START WT 27.36829

END WT 26.49687

PTFE CREVICE BLOCKS PLACED ON 0.750" x 0.750" SURFACES

CREVICE BLOCKS TORQUED TO 40 IN OZ USING PROTO

6103 WITH C276 NUT AND BOLT.

SOLUTION 1000 PPM Cl^- 85 PPM HCO_3^- 20 PPM SO_4^{2-} 10 PPM NO_3^- 2 PPM F^- 2000 ml MAKE AS FOLLOWS

3.29700 g NaCl LOT 935535

0.24081 g NaHCO_3 LOT 89778940 ml SO_4 - 5/94 STOCK SOLUTION p III20 ml NO_3 - 5/94 "4 ml F^- - 5/94 "+ DI WATER TO 2000 ml $T=95^\circ\text{C}$ N_2 THERMO # 0323007PURGED WITH 99.999% N_2 FROM LIQUID CARBONIC

TANK # 426135.

START pH 8.066

END pH 9.089

REFERENCE SEC FISHER 13-620-S1 SN 0165403

POTENTIOSTAT ESC 440 #2 CHANNEL #2

DATA SAVED AS RP825C11.DAT USING REPASS4F.WBS

 $E_{\text{CORR}} = -713 \text{ mV}$ KETHLEY 614 # 467374 $E_{\text{PT}} = -381 \text{ mV}$

INITIATION 520 mV FOR 300 SEC

500 mV FOR 1 hr

GROWTH 450 mV FOR 1 hr

400 mV FOR 238800 SEC

REPASSIVATION DOWNWARD SCAN AT 246300 SEC

5/29/94 9:14 AM AT $t = 246417 \text{ SEC}$ $V_{\text{SET}} = -60 \text{ mV}$ $I = 4.0 \times 10^{-5} \text{ A/cm}^2$ $C = 98 \text{ C/cm}^2$

SPECIMEN ABOVE SOLUTION FOR 24 HOURS DURING HEATING

AND IMMERSO FOR 1 HOUR PRIOR TO INITIATION.

D. J. Q. 6/3/94

5/26/94

CREVICE REPASSIVATION RP82SC12

OBJECTIVE SAME AS RP82SC1 P102

SPECIMEN SAME AS DESCRIBED IN RP82SC1 P102

START WT 26.93522 g

END WT 26.81812 g

PTFE CREVICE BLOCKS PLACED ON 0.750" x 0.750" SURFACES

CREVICE BLOCKS SECURED WITH C276 NUT AND BOLT

TORQUED TO 40 IN-OZ USING PROTO 6103

SOLUTION 1000 PPM Cl⁻ 85 PPM HCO₃⁻ 20 PPM SO₄²⁻10 PPM NO₃⁻ 2 PPM F⁻ 2000 ml MAKE AS FOLLOWS

3.29691 g NaCl LOT 935535

0.24050 g NaHCO₃ LOT 89778940 ml SO₄²⁻ 5/94 STOCK SOLUTION p11120 ml NO₃⁻ 5/94 "4 ml F⁻ 5/94 "+ DI WATER TO 2000 ml T=95°C H₂THERMD #0323008PURGED WITH 99.999 % N₂ FROM LIQUID CARBONIC

TANK # 426135

START pH 8.155

END pH 9.311

REFERENCE SCE FISHER 13-620-S1 SN 3106345

POTENTIOSTAT ESC440 #2 CHANNEL #3

DATA SAUGD AS RP82SC12.DAT USING REPASS 4F. WBS

E_{CORR} -744 mV KEITHLEY 614 #467374E_{PT} -401 mV "

INITIATION 520 mV FOR 300 SEC

500 mV FOR 1 hr

GROWTH 450 mV FOR 1 hr

400 mV FOR 62,500 SEC

REPASSIVATION DOWNWARD SCAN AT t= 70,000 SEC

8:20 AM 5/27/94 AT t= 70111 SEC V_{SET} = -60 mVI = 4.8 x 10⁻⁵ A/cm² C = 31 C/cm²SPECIMEN ABOVE SOLUTION FOR 24 HOURS DURING HEATING
AND IMMERSSED FOR 1 HOUR PRIOR TO INITIATION.

6/3/94

5/27/94

INITIAL SCIENTIFIC NOTEBOOK ENTRY FOR THE ANALYSIS OF CREVICE
REPASSIVATION SPECIMENS

Title: Crevice repassivation

Tests performed by: Darrell S. Dunn and Narasi Sridhar

Objectives: Determine the depth of crevice corrosion on crevice repassivation specimens

Equipment: Nikon Optiphot-pol #266309 microscope with #147135 Binocular 10x eyepiece and MPlan 10 DIC objective (10x), MPlan 20/0.4 DIC objective (20x) and graduated focus measuring vertical stage movement in microns. Fowler 8 inch dial caliper SwRI # 20-8C-1 calibrated 12/7/93. Feeler gauges (thickness measured with Fowler caliper).

Materials: Alloy 825, Heat # HH4371FG

Specimen specifications: As shown in IWPE-045 page 235.

Measurement Parameters: Depths of crevice corrosion

Required level of accuracy: Depths ± 10 microns

Uncertainty and sources of error: Depth of crevice corrosion measured only where deepest corrosion could be brought into focus. Crevice corrosion depth calculated assuming no significant uniform corrosion of exposed specimen surface.

Photographs of specimen surfaces taken by: Issac Rodriguez, Division 6, SwRI employee # 6059 with Darrell S. Dunn.

5/27/94

5/27/94

5/27/94

MEASUREMENT OF PIT / CREVICE CORROSION DEPTH

OBJECTIVE: ~~MEASURE~~ DD 5/27/94 DETERMINE
DEPTH OF PITTING AND CREVICE CORROSION
ACCORDING TO ASTM G46 SECTION 6.2.4
EQUIPMENT LISTED ON P115

PROCEDURE FOR CALIBRATION: MEASURE FEELER
GAGE THICKNESS WITH FOWLER CALIPER PLACE
FEELER ~~GAGE~~ DD 5/27/94 GAGE ON NIKON
STAGE AND FOCUS ON TOP OF GAGE. RECORD
FOCUS KNOB POSITION. FOCUS ON FEELER
GAGE UNDERNEATH TOP FEELER GAGE. RECORD
FOCUS KNOB POSITION. DIFFERENCE IN POSITIONS
OF FOCUS KNOB SHOULD BE LINEAR WITH GAGE
THICKNESS. FOCUS KNOB GRADUATIONS ARE IN
MICRONS.

AFTER ESTABLISHING CORRECT READINGS OF MICROSCOPE
MEASURE PIT DEPTH BY FOCUSING ON BOTTOM
OF PIT OR CREVICE. RECORD KNOB POSITION
AND FOCUS ON ORIGINAL UNCORRODED MATERIAL
SURFACE AND RECORD FOCUS KNOB POSITION
DIFFERENCE IN KNOB POSITIONS IS DEPTH OF
PITTING / CREVICE CORROSION.

FEELER GAGE IN / mm	FOWLER THICKNESS IN	NIKON THICKNESS μm
0.0015 / 0.038	0.001 - 0.002	39
0.005 / 0.127	0.005	126
0.010 / 0.254	0.01 <u>DD</u> 5/27/94 0.010	253
0.020 / 0.508	0.020	518
0.025 / 0.635	0.025	627

CONCLUSION: GOOD AGREEMENT BETWEEN CALIBRATED
CALIPER AND NIKON MICROSCOPE. ACCEPTABLE
FOR CORROSION DEPTH MEASUREMENT ACCORDING TO ASTM G46

DD 5/27/94

FORM FOR REQUESTING WORK FROM OTHER DIVISIONS

A. TO BE COMPLETED BY DIVISION 20 PERSONNEL

Requester: DARRELL DUNN Request Date: 5/18/94
Project No.: 20-5704-041 Phone No.: 6090
Description of Work Requested: PHOTOGRAPH CREVICE REPASSIVATION
SPECIMENS, PHOTOGRAPH OF EACH SIDE WITH LABEL
ON BLACK BACKGROUND IS NEEDED.

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

Sample Identification	Description
<u>RP825C7</u>	
<u>RP825C8</u>	
<u>RP825C9</u>	
<u>RP825C1 - RP825C6</u>	

B. TO BE COMPLETED BY DIVISION PERFORMING WORK¹

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

Person Assigned: ISAAC RODRIGUEZ 6059 Signature: Isaac R. D
Division: 06 Date: 5-27-94

Make, Model & Serial No. of Equipment Used (attach list if necessary): MP4 Polaroid CAMERA
SWRI # 12296

Software Used (If any): _____

Standards Used (If any): _____

Negative Numbers (If Applicable): RP825C1 - 67790, 67791 RP825C2 - 67792,
67793, RP825C3 - 67794, 67795, RP825C4 - 67796, 67797,
RP825C5 - 67798, 67799, RP825C6 - 67800, 67807 RP825C7 - 67808,
67809, RP825C8 - 67810, 67811, RP825C9 - 67812, 67813

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

DD 6/6/94

6/6/74

VISUAL INSPECTION OF RP825C1

OBJECTIVE: DETERMINE DEPTH AND DEGREE
OF CREVICE CORROSION

SPECIMEN RP825C1, TEST CONDITIONS p102
ALLOY 825 HH4371FG

PIT DEPTHS NONE

CREVICE CORROSION DEPTHS

SITE NUMBER	DEPTH MICRONS
1	114
2	64
3	69
4	47
5	96
6	44

MAXIMUM DEPTH = 114 MICRONS

MINIMUM DEPTH = 47 MICRONS

AVERAGE DEPTH = 72.3 MICRONS

STANDARD DEVIATION = 27.6 MICRONS

CHARGE DENSITY NOT RECORDED

WEIGHT LOSS NOT RECORDED

PHOTOGRAPHS # 67790, 67791 P. 119

DEPTH MEASUREMENT PROCEDURE P 116

SPECIMEN TO BE REPOLISHED AND REISSUED

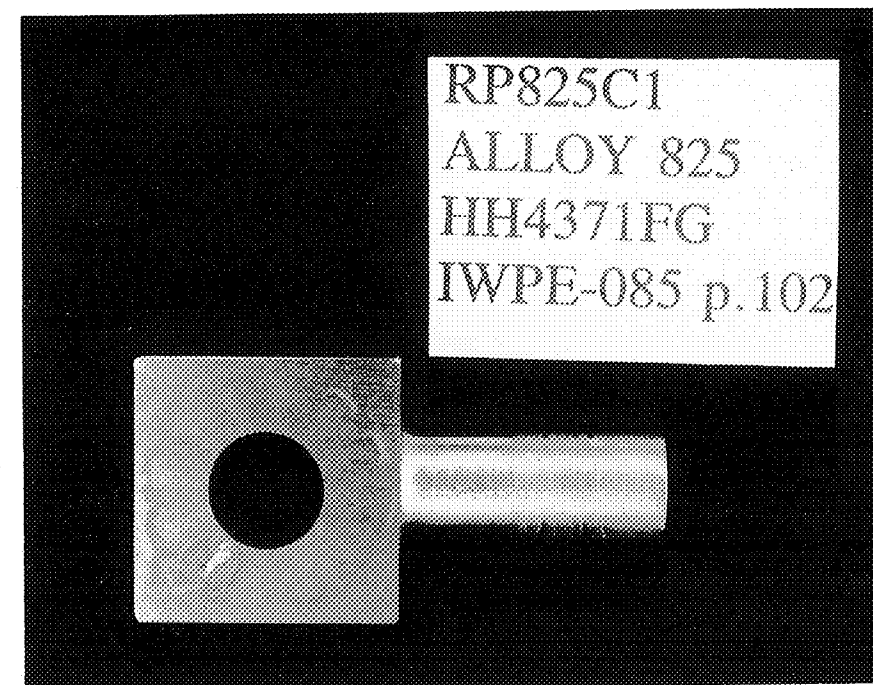
[Signature] 6/6/74

6/6/74

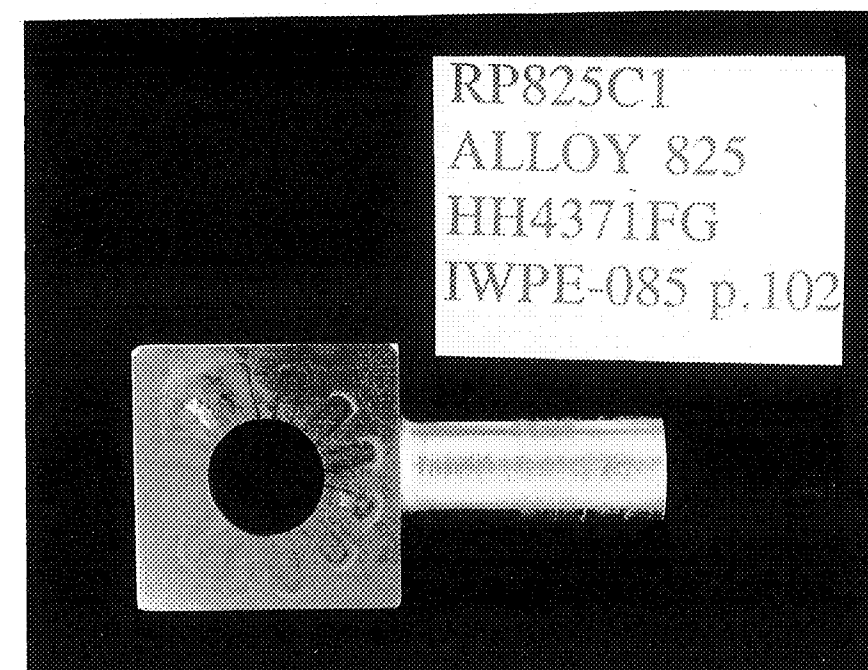
PHOTOGRAPHS OF RP825C1

67791

67791



67790



[Signature] 6/6/74

6/6/94

VISUAL INSPECTION OF RP825C8

OBJECTIVE: DETERMINE THE DEPTH AND
DEGREE OF CREVICE CORROSION

SPECIMEN: RP825C2 TEST CONDITIONS ^{QD 5/30/94} p103 p109
ALLOY 825 HH4371FG

CREVICE CORROSION DEPTNS

SITE #	DEPTH (MICRONS)	SITE #	DEPTH (MICRONS)
1	246	10	443
2	207	11	305
3	190	12	280
4	280	13	315
5	260	14	332
6	218	15	359
7	215	16	207
8	481	17	250
9	327	18	275

MAXIMUM DEPTH 481 MICRONS

MINIMUM DEPTH 190 "

AVERAGE DEPTH 288 "

STANDARD DEVIATION 79.7 "

CHARGE DENSITY 12 C/cm²

WEIGHT LOSS 0.04523 g

PHOTOGRAPHS 67810 67811 p121

DEPTH MEASUREMENT PROCEDURE p116

SPECIMEN TO BE REFINISHED AND REUSED

James D 6/6/94

6/6/94

PHOTOGRAPHS OF RP825C8



James D 6/6/94

6/6/94

VISUAL INSPECTION OF RP825C2

OBJECTIVE: DETERMINE THE DEPTH AND
DEGREE OF CREVICE CORROSION

SPECIMEN RP825C2 TEST CONDITIONS p103
ALLOY 825 HH4371FG

CREVICE CORROSION DEPTHS

SITE #	DEPTH (MICRONS)
1	270
2	536
3	535
4	123
5	404
6	490
7	945
8	439

MAXIMUM DEPTH 945 MICRONS

MINIMUM DEPTH 123 "

AVERAGE DEPTH 467 "

STANDARD DEVIATION 239 "

CHARGE DENSITY NOT RECORDED

WEIGHT LOSS NOT RECORDED

DEPTH MEASUREMENT PROCEDURE p116

PHOTOGRAPHS 67792, 67793 p123

[Signature] 6/6/94

6/6/94

~~PHOTOGRAPHS~~ 405130M4

RP825C2

PHOTOGRAPHS

67792



67793



[Signature] 6/6/94

6/6/94

RP825C3 VISUAL INSPECTION

OBJECTIVE: DETERMINE THE DEPTH AND DEGREE
OF CREVICE CORROSIONSPECIMEN RP825C3 TEST CONDITIONS p 104
ALLOY 825 HH4371FG.

CREVICE CORROSION DEPTHS

~~SITE #~~ ^{QD 5/30/94} ~~DEPTH (MICRONS)~~ ^{QD 5/30/94}

139 QD 5/30/94

70 QD 5/30/94

113 QD 5/30/94

65 QD 5/30/94

64 QD 5/30/94

95 QD 5/30/94

99 QD 5/30/94

SITE #	DEPTH (MICRONS)
1	139
2	70
3	113
4	65
5	64
6	95
7	99

MAXIMUM DEPTH 139 MICRONS

MINIMUM DEPTH 64 "

AUG DEPTH 92 "

SDGV 28

DEPTH MEASUREMENT PROCEDURE p116

PHOTOGRAPHS 67794 67795 p125

SPECIMEN TO BE REPORTED AND REUSED

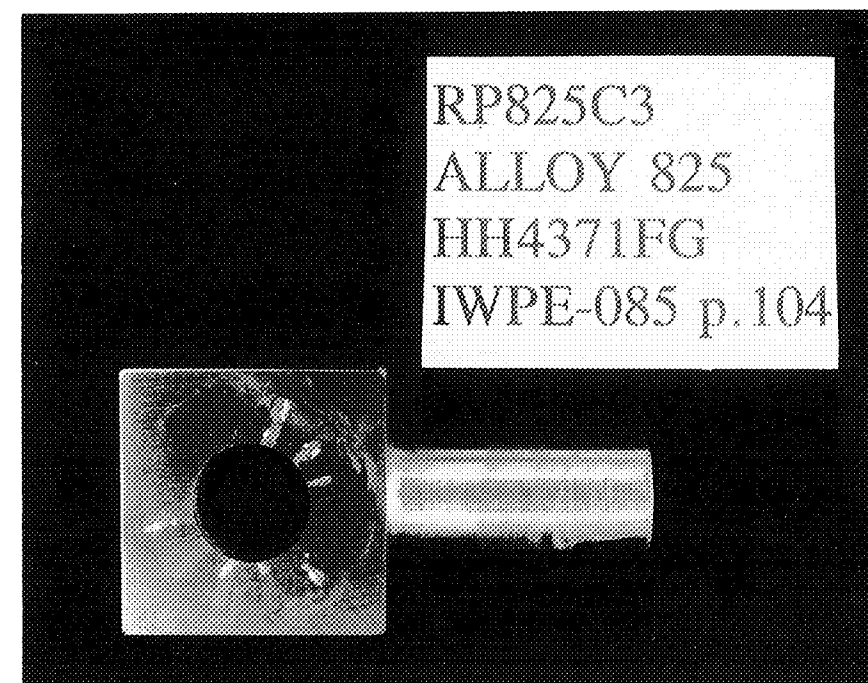
J. D. D. 6/6/94

QD 5/30/94

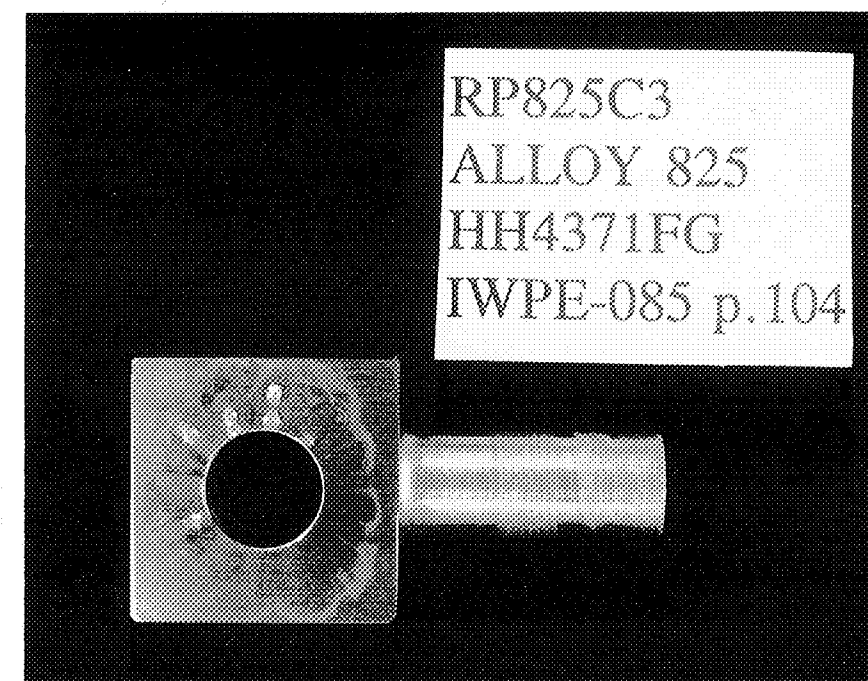
~~RP825C4~~

PHOTOGRAPHS

67794



67795



J. D. D. 6/6/94

RP825C4 VISUAL INSPECTION.

OBJECTIVE DETERMINE DEPTH AND DEGREE
OF CREVICE CORROSIONSPECIMEN RP825C4 TEST CONDITIONS p105
~~ALLOY~~ (1) S/K/94 ALLOY 825 HH4371FG

CREVICE CORROSION DEPTHS

SITE #	DEPTH (MICRONS)
1	108
2	110
3	77
4	71
5	124
6	166
7	118
8	120
9	80
10	177
11	130
12	133

MAXIMUM DEPTH 177 MICRONS

MINIMUM DEPTH 71 "

AVERAGE DEPTH 117

STANDARD DEVIATION 32

CHARGE DENSITY 5.4 C/cm²

DEPTH MEASUREMENT PROCEDURE p116

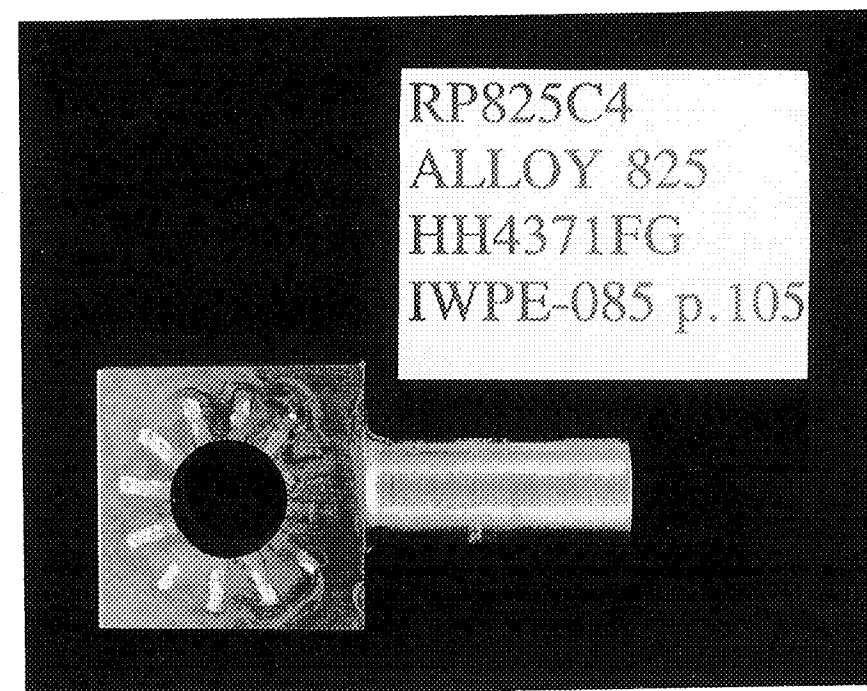
PHOTOGRAPHS 67796 67797

SPECIMEN TO BE REPOLISHED AND REUSED

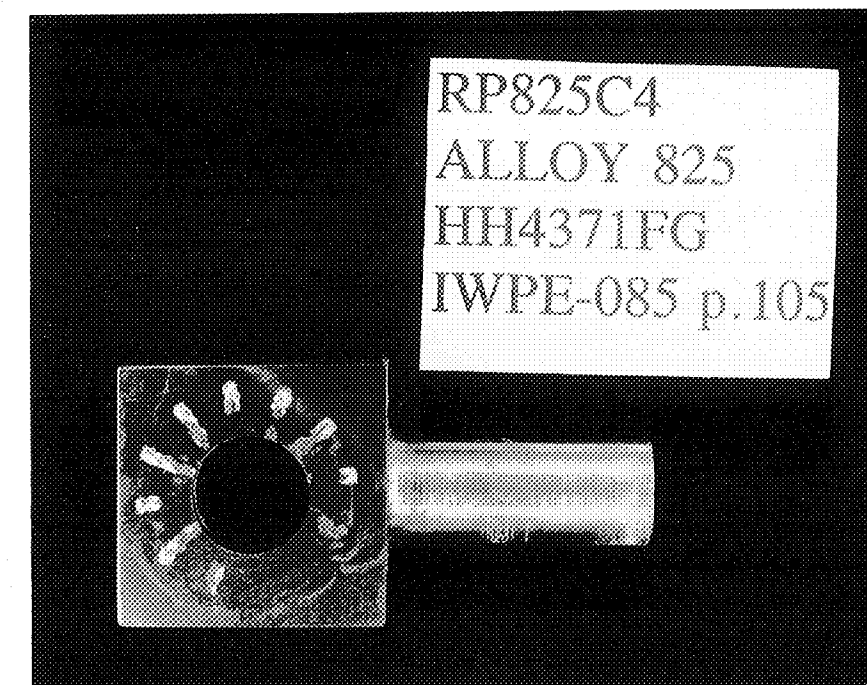
D. D. 6/6/94

RP825C4 PHOTOGRAPHS

67796



67797



D. D. 6/6/94

RP825C5 VISUAL INSPECTION

OBJECTIVE DETERMINING DEPTH AND DEGREE
OF CREVICE CORROSION.

SPECIMEN RP825C5 TEST CONDITIONS p106
ALLOY 825 HH4371FG

CREVICE CORROSION DEPTHS

SITE #	DEPTH (MICRONS)	SITE #	DEPTH (MICRONS)
1	521	10	205
2	95	11	450
3	200	12	206
4	240	13	370
5	173	14	242
6	395	15	227
7	136	16	206
8	340	17	225
9	417		

MAXIMUM DEPTH 521 MICRONS

MINIMUM DEPTH 95 "

AVERAGE DEPTH 273.4

STANDARD DEVIATION 119.4

CHARGE DENSITY 16 COLUMBS/cm²

DEPTH MEASUREMENT PROCEDURE p116

PHOTOGRAPHS 67798, 67799 p129

SPECIMEN TO BE REPORTED AND REUSED

David D. 6/6/94

RP825C5 PHOTOGRAPHS

67798



67799



David D. 6/6/94

RP825C6 VISUAL INSPECTION

OBJECTIVE DETERMINE THE DEPTH AND
DEGREE OF CREVICE CORROSION

SPECIMEN RP825C6 TEST CONDITIONS p.107

ALLOY 825 HH4371FG

CREVICE CORROSION DEPTHS

SITE #	DEPTH (MICRONS)
1	410
2	210
3	360
4	314
5	360
6	260
7	274
8	400
9	521
10	460

MAXIMUM DEPTH 521

MINIMUM DEPTH 210

AVERAGE DEPTH 356.9

STANDARD DEVIATION 95

CHARGE DENSITY 11 C/cm²

DEPTH MEASUREMENT PROCEDURE p.116

PHOTOGRAPHS 67800 67807 p.131

SPECIMEN TO BE REFINISHED AND REUSING

D. M. D. 6/6/94

RP825C6 PHOTOGRAPHS



D. M. D. 6/6/94

RP825C7 VISUAL INSPECTION

OBJECTIVE: DETERMINE THE DEPTH AND
DEGREE OF CREVICE CORROSIONSPECIMEN RP825C7 TEST CONDITIONS p.108
ALLOY 825 HH4371FG

CREVICE CORROSION DEPTHS

SITE #	DEPTH (MICRONS)
1	244
2	236
3	228
4	221
5	330
6	254
7	225
8	213
9	232
10	235
11	226
12	223
13	215
14	218
15	247

MAXIMUM DEPTH 330 MICRONS

MINIMUM DEPTH 215 "

AVERAGE DEPTH 236 "

STANDARD DEVIATION 28

CHARGE DENSITY 6.8 C/cm²

WEIGHT LOSS 0.02564g

DEPTH MEASUREMENT PROCEDURE p.116

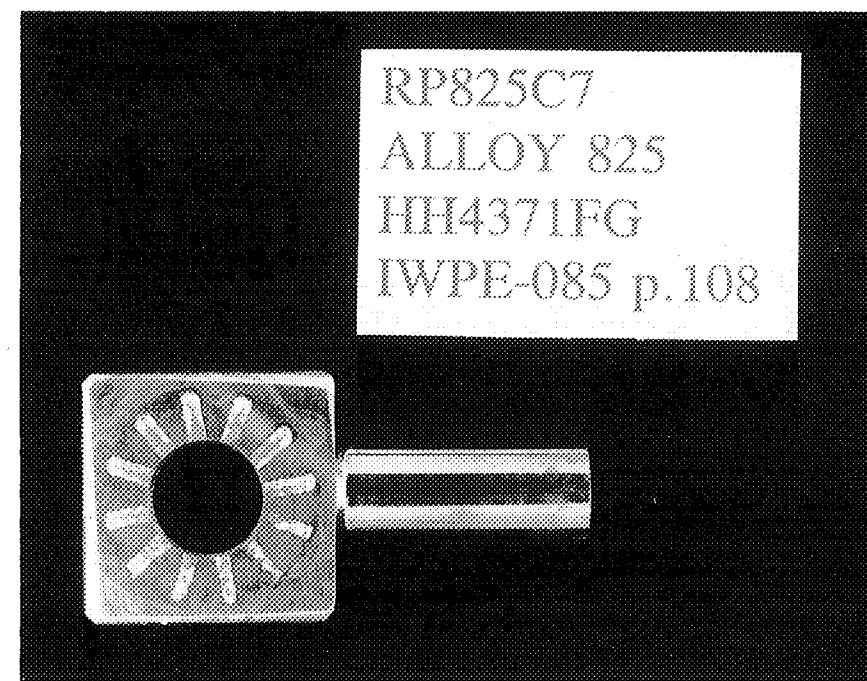
PHOTOGRAPHS 67808, 67809 p.133

SPECIMEN TO BE REFINISHED AND REUSCO

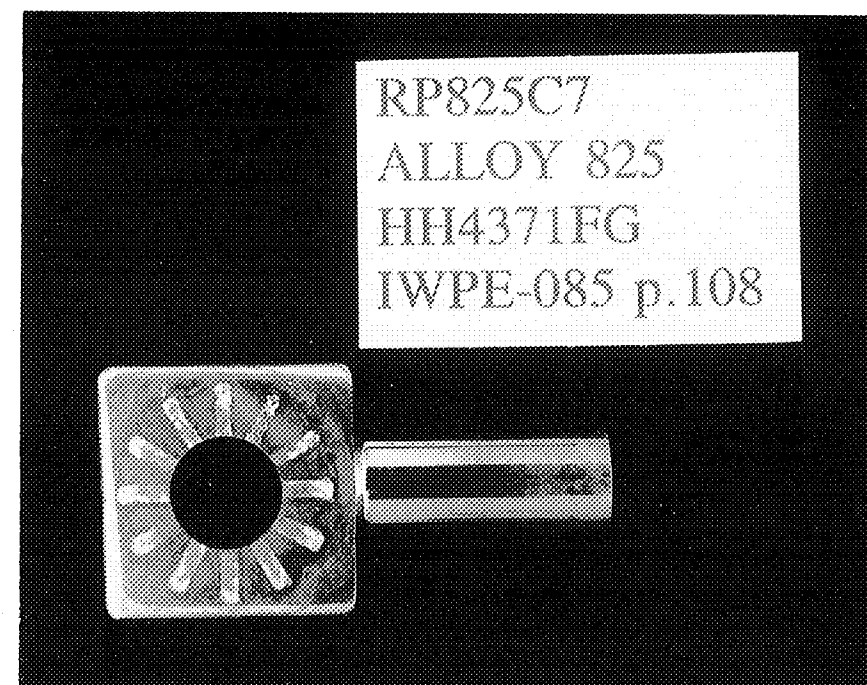
J. D. D. 6/6/94

RP825C7 PHOTOGRAPHS

67808



67809



J. D. D. 6/6/94

RP825C9 VISUAL INSPECTION

OBJECTIVE DETERMINE TAG DEPTH AND

DEGREE OF CREVICE CORROSION

SPECIMEN RP825C9 TEST CONDITIONS ~~7/10~~ 8/29/94 p.110

ALLOY 825 HH4371FG

CREVICE CORROSION DEPTHS

SITE # DEPTH (MICRONS)

1 188

2 168

3 245

4 150

5 154

6 184

7 214

8 138

9 210

10 204

11 98

12 130

13 141

14 180

15 146

16 114

MAXIMUM DEPTH 245 MICRONS

MINIMUM DEPTH 95 MICRONS

AVERAGE DEPTH 166.5

SDGI 39.8

CHARGE DENSITY ~~12 C/cm²~~ DD 8/29/94 2.7 C/cm²WEIGHT LOSS ~~0.04523g~~ DD 8/29/94 0.01059g

DEPTH MEASUREMENT PROCEDURE p.116

PHOTOGRAPHS 67812 67813 p.125

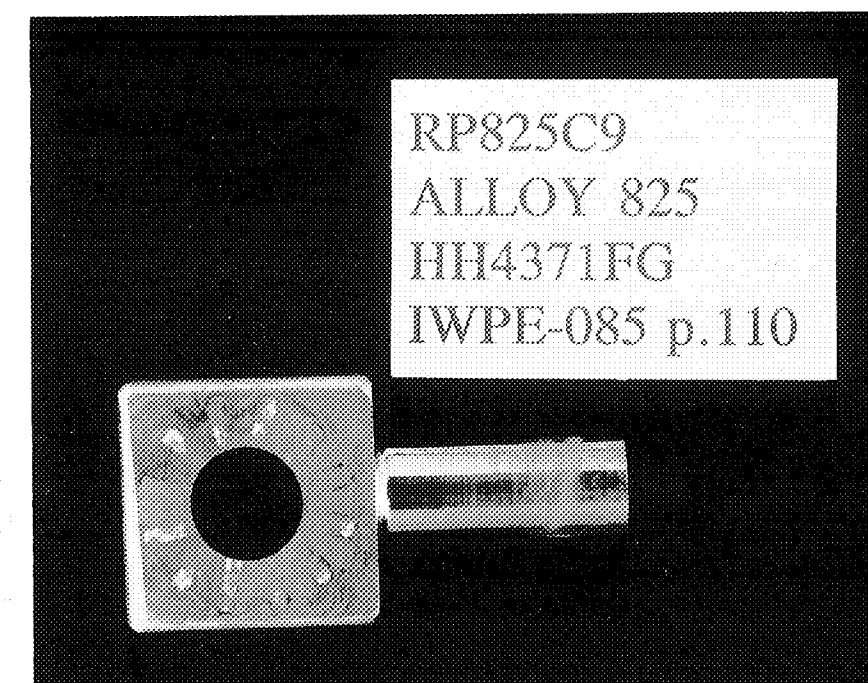
DD 6/6/94

RP825C9 PHOTOGRAPHS

67812



67813



DD 6/6/94

5/31/94

CREVICE CELL CONTROL TEST CURDTS 4

OBJECTIVE MEASURE H^+ AND OH^- MIGRATION
INTO CREVICE

SPECIMEN 220 GRIT PLEXIGLASS

SOLUTION SAME AS CURDTS 3 P. 95

SETUP SAME AS CURDTS 3 P. 95

ELECTRODE CALIBRATION P 137

CREVICE CELL ASSEMBLED 4/4/94 AND MONITORED
TO 4/5/94 TO ESTABLISH BASELINE READINGS

CONDITIONS AT START OF TEST ON 4/5/94 11:30 AM

BULK Cl^- = 97 mV

BULK pH = 51 mV

MOUTH Cl^- = 109 mV

MOUTH pH = 50 mV

TIP Cl^- = 100 mV

TIP pH = 70 mV

pH OF BULK SOLUTION DECREASED ON 4/6/94

AT 9:30 AM BY THE ADDITION OF 0.1 ml 10% HNO_3

BULK pH = 168 mV pH OF TIP AND MOUTH
MONITORED WITH TIME.

pH OF BULK SOLUTION INCREASED ON 4/8/94

BY THE ADDITION OF 1.4 ml 0.1 MOLAR $NaOH$

BULK pH = -151.9 mV pH OF BULK SOLUTION

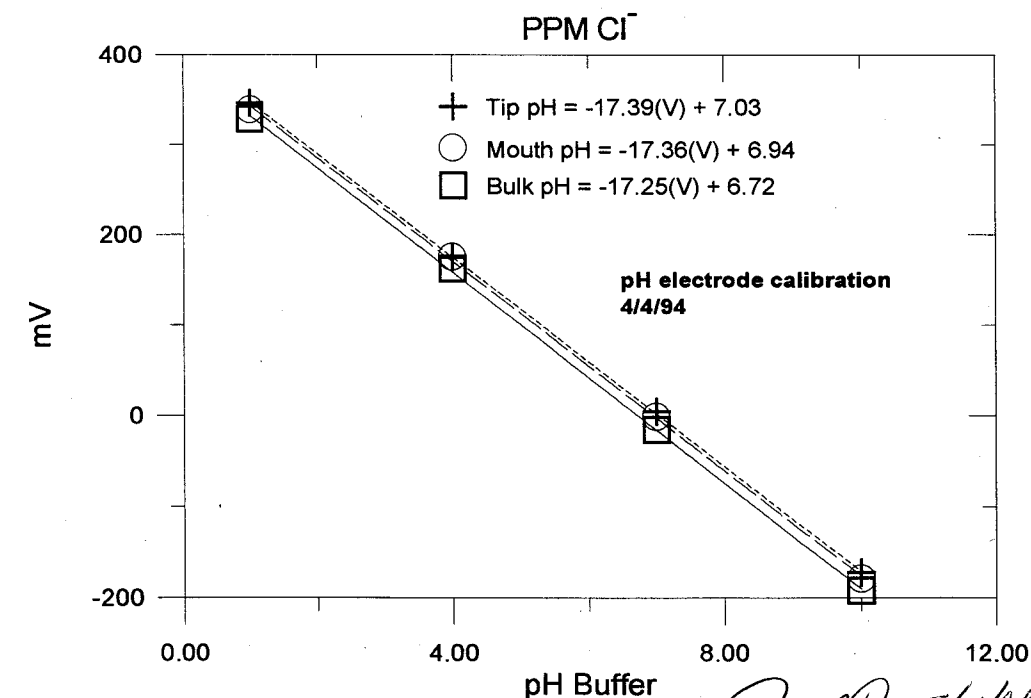
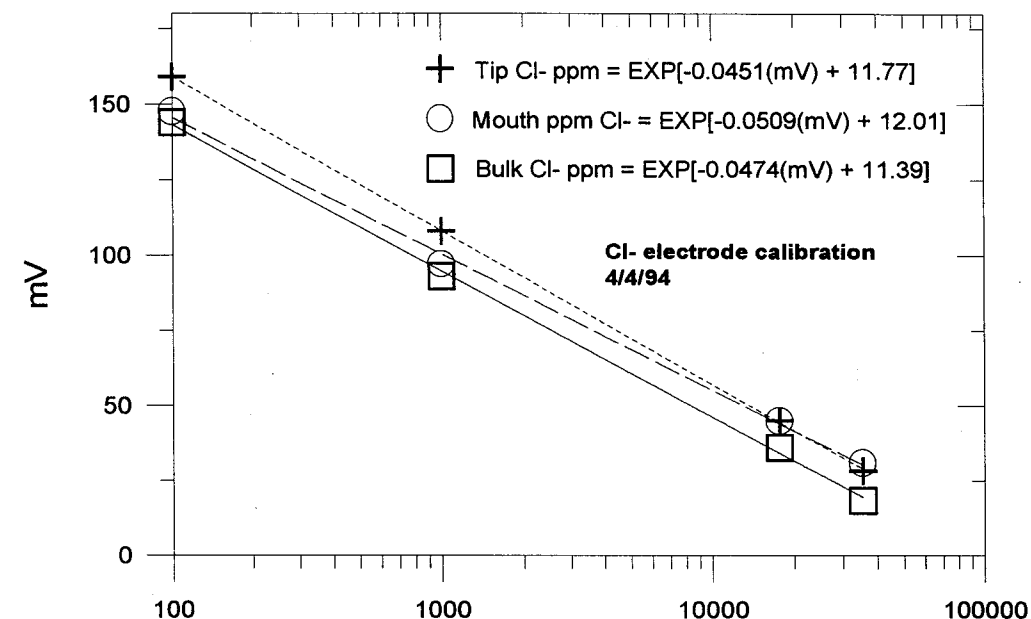
MAINTAINED CONSTANT BY PERIODIC ADDITIONS
OF 0.1 MOLAR $NaOH$ AS FOLLOWS

DATE	TIME	AMOUNT OF 0.1 MOLAR $NaOH$
4/8/94	11:30 AM	0.075 ml
4/8/94	5:40 PM	0.070 ml
4/9/94	2:05 AM	0.06 ml
4/10/94	12:55 AM	0.26 ml
4/10/94	12:28 PM	0.23 ml
4/12/94	10:30 PM	0.3 ml

TEST STOPPED 4/17/94 DATA SAVED AS

CURDTS 4.WR1 ON IMAGE 085

[Signature] 5/31/94



[Signature] 5/31/94

pH BULK MI 506 # 44817 / MI 402 # 45860

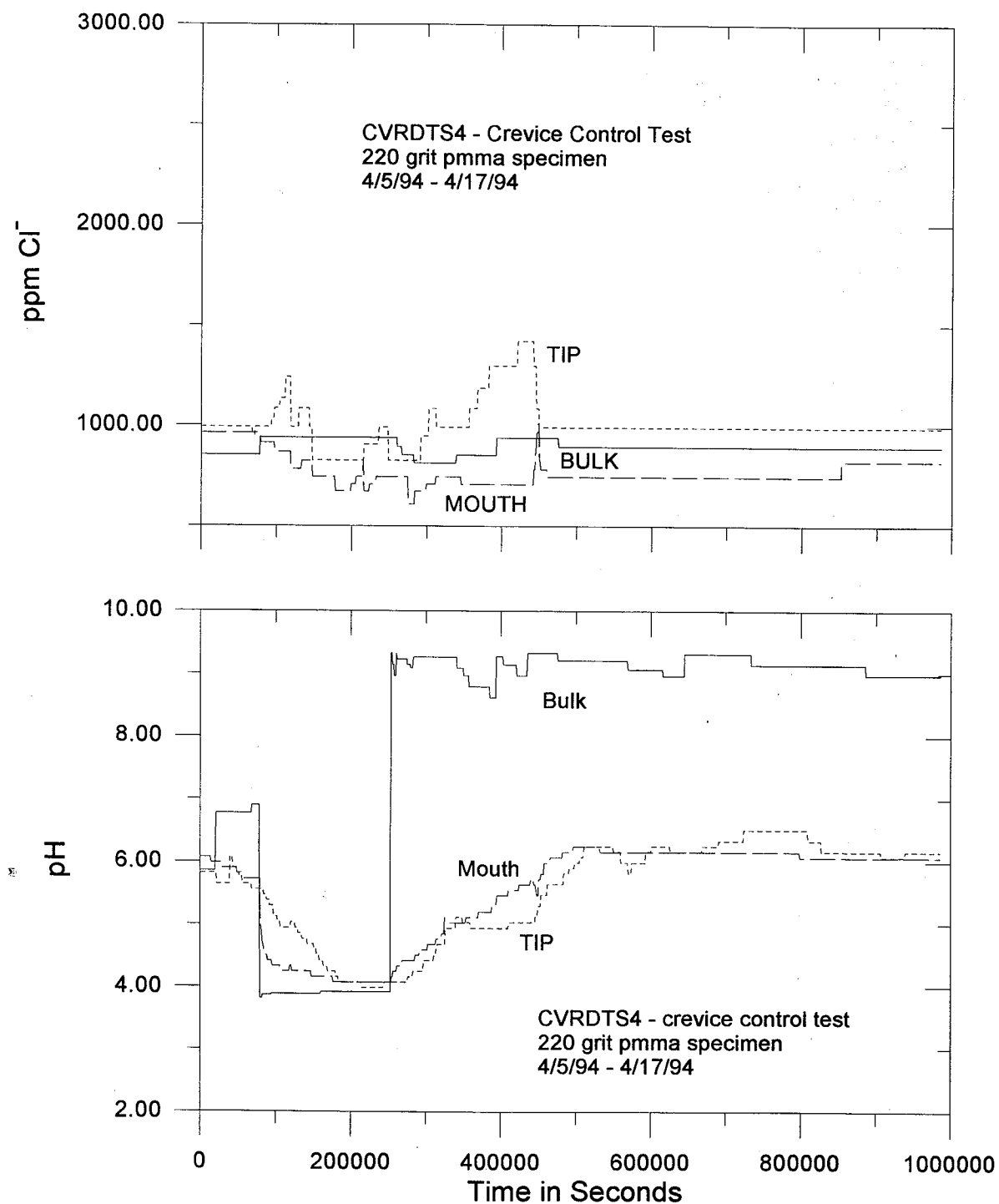
pH TIP MI 506 # 45147 / MI 403 # 45867

pH MOUTH MI 506 # 49445 / MI 403 # 44625

 Cl^- BULK MI 200 # 47223 / MI 402 # 41436 Cl^- TIP MI 200 # 44199 / MI 403 # 41432 Cl^- MOUTH MI 200 # 47239 / MI 403 # 44671

RESULTS PLOTTED ON PAGE 138

[Signature] 5/31/94



[Signature] 5/31/94

6/1/94

CREVICE CELL CONTROL TEST

OBJECTIVE MEASURE MIGRATION OF H^+ AND OH^- IONS INTO CREVICE CELL
SPECIMEN NONE FOR RUN 1 GROVED SPECIMEN FOR PART OF RUN 2 AS NOTED
SOLUTION 1000 ppm Cl^- ~~AND~~ 6/1/94 AS NaCl 3.29673 g NaCl LOT 935535 IN 2000ml DI WATER
SETUP SIMILAR TO PREVIOUS RADIAL CELL CONTROL TESTS WITH THE EXCEPTION THAT NO Cl^- ISG ELECTRODES WERE USED. BULK pH WAS MEASURED IN SOLUTION 2" FROM CELL, DENOTED BULK SOLUTION pH. BULK pH ALSO MEASURED NEAR CELL DENOTED BULK CELL pH TWO pH ELECTRODES PLACED AT MOUTH AND TIP LOCATIONS. pH OF BULK SOLUTION CHANGED BY ADDING HCl OR NaOH . SOLUTION WAS STIRRED TO ELIMINATE GRADIENTS IN BULK SOLUTION CHANGE IN pH OF TIP AND MOUTH LOCATIONS RECORDED AS A FUNCTION OF TIME.

CALIBRATION OF pH ELECTRODES

pH BUFFER	TIP pH #1	TIP pH #2	BULK CELL
	MI 403 41462	MI 403 45867	MI 403 45860
	MI 506 43720	MI 506 45147	MI 506 44817
	ORION EA920 CN1	ORION EA940 CN1	EA940 CN2
1.00	310.0	356.7	310.8
4.00	142.5	192.6	159.3
7.00	-27.7	13.5	-20.1
10.00	-207.0	-164.5	-201.4

[Signature] 6/1/94

CALIBRATION OF PH ELECTRODES

PH BUFFER	MOUTH PH #1	MOUTH PH #2	BULK SOLUTION
	MI 403 44671	MI 403 44628	MI 403 49467
	MISO6 44060	MISO6 49445	MI 506 42130
	ORION 720A #5885	720A #3368	EN920 CH 2
1.00	356.2	331.3	354.8
4.00	192.6	189.4	205
7.00	15.2	-6.7	18.3
10.00	-164.5	-186.7	-168.4

CALIBRATION EQUATIONS

TIP PH #1 $pH = -17.42(V) + 6.44$
 TIP PH #2 $pH = -17.20(V) + 7.21$
 MOUTH PH #1 $pH = -17.23(V) + 7.22$
 MOUTH PH #2 $pH = -17.07(V) + 6.89$
 BULK SOLN $pH = -17.03(V) + 7.24$
 BULK/CELL $pH = -17.45(V) + 6.58$

TEST RUN #1 NO SPECIMEN CELL TOP
 MATED TO CELL BOTTOM BOLTS FINGER TIGHT
 AND SET TO 0 IN O2 TORQUE TO PROTO 6103
 PH AT START = 3.00. PH CHANGED TO 2.00
 BY THE ADDITION OF 2.5ml 0.2g/ml HCl AT
 7:20 PM 5/9/94 INITIAL CONDITIONS:

TIP #1 $pH = 255mV$ 6/1/94 190mV

TIP #2 $pH = 315mV$ 6/1/94 245mV

MOUTH #1 $pH = 247mV$

MOUTH #2 $pH = 220mV$

BULK SOLN pH 213mV BEFORE HCl 278mV AFTER HCl

BULK CELL pH 238mV BEFORE HCl 307mV AFTER HCl

6/1/94

TEST RUN #1 NO SPECIMEN PH OF BULK
 SOLUTION CHANGED FROM 2 TO 3 BY THE
 ADDITION OF NaOH AT 8:20 AM 5/10/94

INITIAL CONDITIONS

TIP PH #1 255mV

TIP PH #2 315mV

MOUTH PH #1 315mV

MOUTH PH #2 285mV

BULK SOLN pH 284mV BEFORE NaOH 220mV AFTER NaOH

BULK/CELL pH 310mV BEFORE NaOH 245mV AFTER NaOH

TEST RUN #2 NO SPECIMEN PH OF BULK

SOLUTION CHANGED FROM 3 TO 2 BY THE

ADDITION OF 0.2g/ml HCl INITIAL CONDITIONS

TIP #1 205

TIP #2 268

MOUTH #1 270

MOUTH #2 245

BULK SOLN 245 BEFORE HCl 308 AFTER HCl

BULK/CELL 225 BEFORE HCl 284 AFTER HCl

TEST RUN #2 PLEXIGLASS SPECIMEN WITH GROOVES

PH OF BULK SOLUTION ADJUSTED TO 5.0 WITH

CELL OPEN. CELL WAS THEN CLOSED WITH

SPECIMEN INSERTED AND BOLTS TORQUED TO 0 IN O2

WITH PROTO 6103 PH OF BULK SOLUTION

ADJUSTED TO pH 2.0. INITIAL CONDITIONS:

TIP #1 126mV

TIP #2 161mV

MOUTH #1 165mV

MOUTH #2 138mV

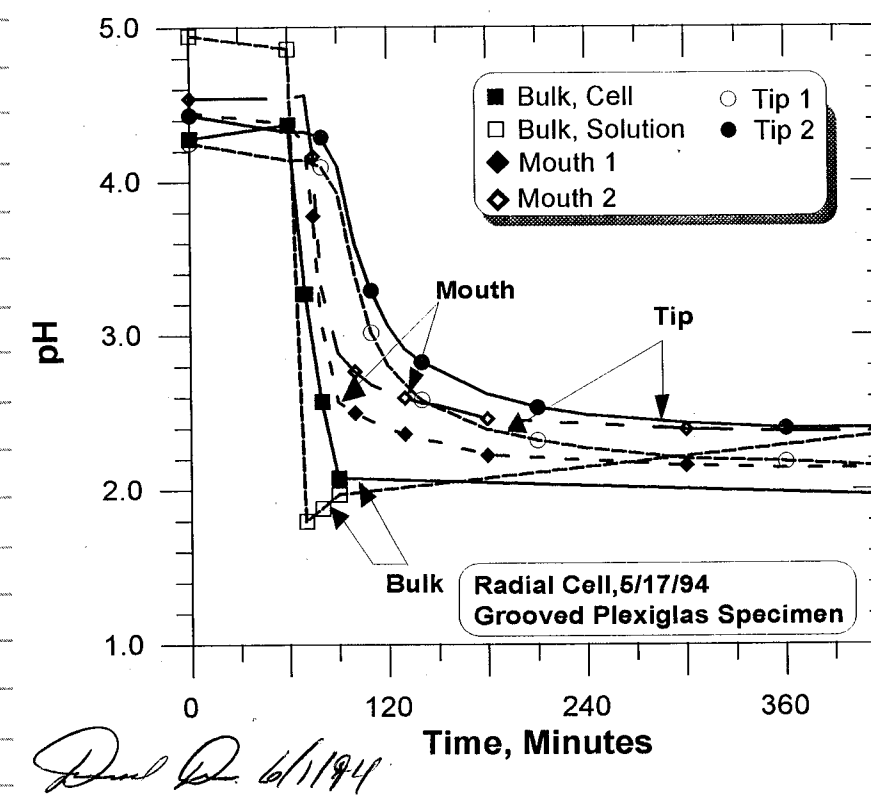
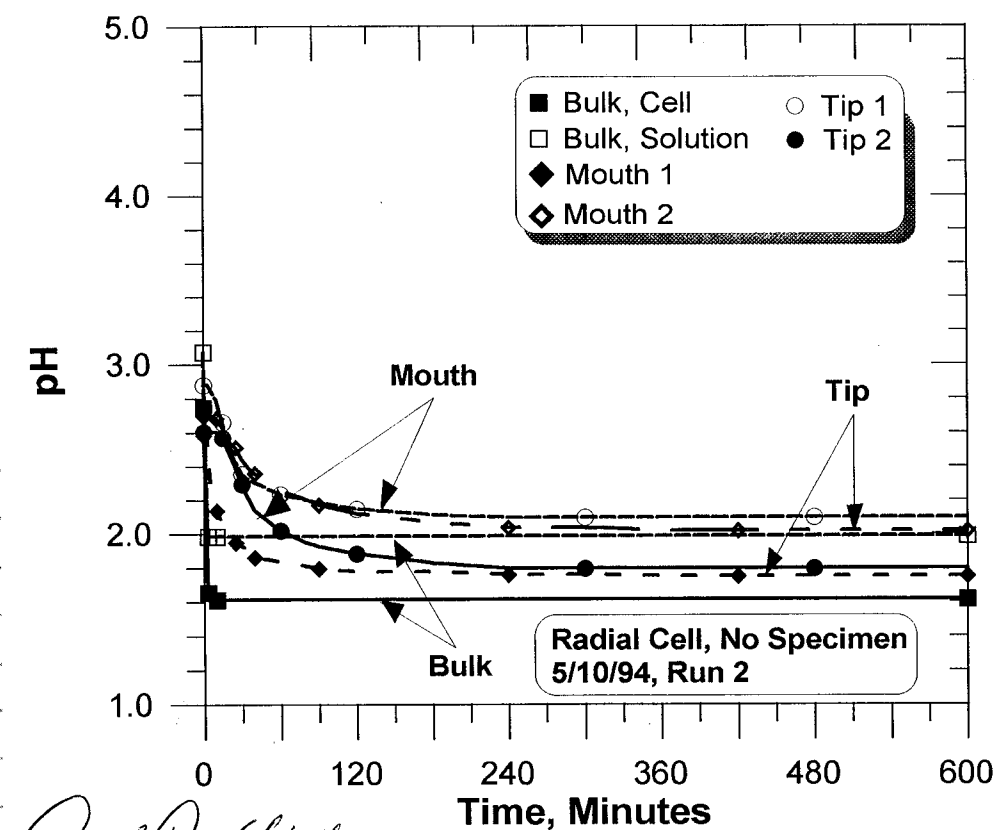
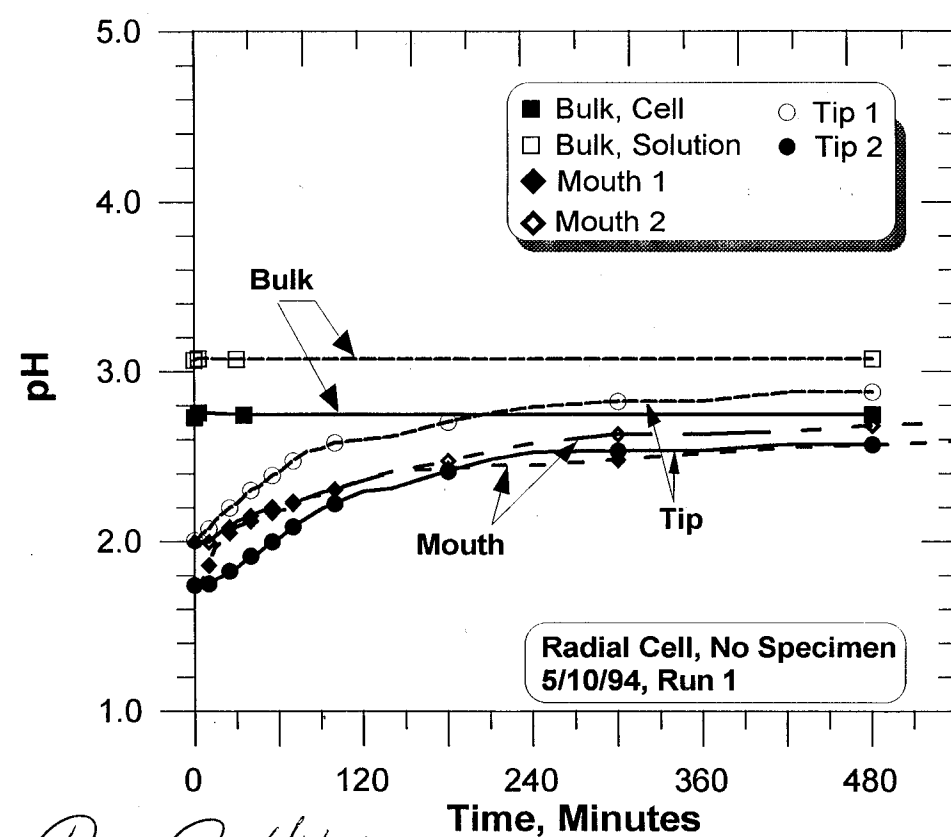
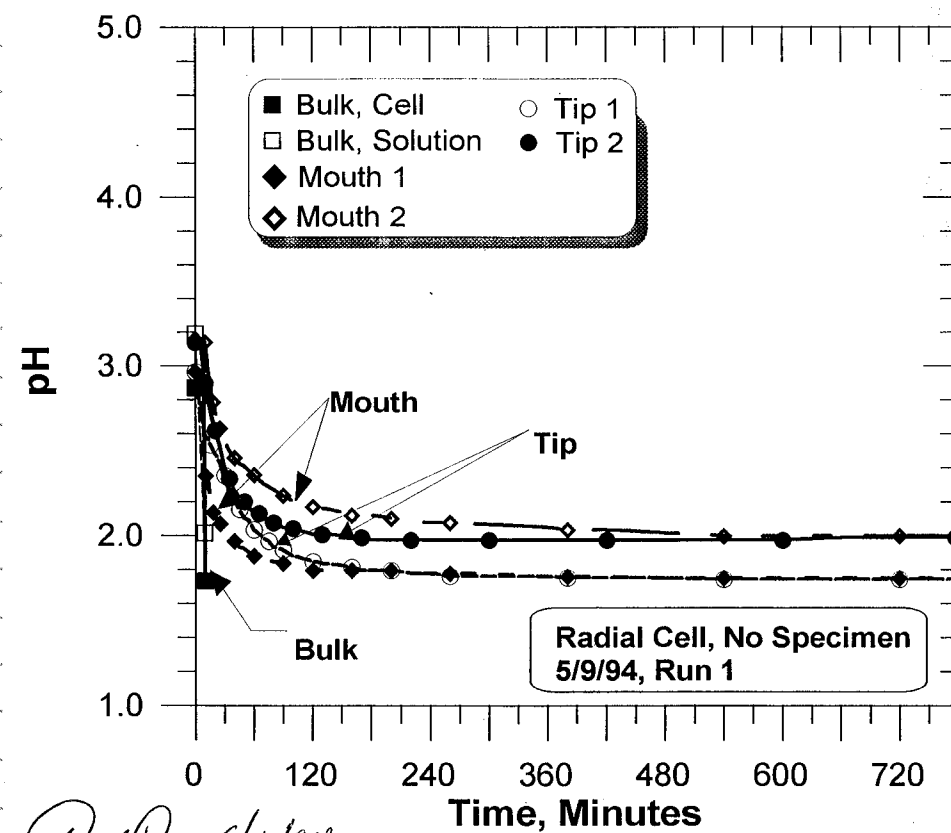
BULK/SOLN 130mV

BULK/CELL 143mV

DATA SAVER ON IUPGOPS PLOTS OF ELECTRODE OUTPUTS

PAGE 142, 143

6/1/94



6/8/94

RP825C10

Objective: Crevice repassivation test — post-test visual examination to measure crevice depth.

Approach: Same as used in p. 116 and p. 118.

Equipment: Same as in p. 115. (NIKON OPTIPHOT-POL
SN: 266309)
(SN 34205, 10X objective + 147135 10X eyepiece)

Site	Depth (μm)
1	473
2	2070
3	1500
4	125
5	190
6	370

Other crevice sites were not measured because they appeared to be intermediate between the deepest & shallowest recorded here.

Total No. of sites attacked: 24 out of 24

N. Sridhar
6/8/94

6/8/94

RP825C11

Objective: Same as in p. 144.

Approach: Same as in p. 144

Equipment: Same as in p. 144

Site	Depth (μm)
1	1350
2	1300
3	830

Other sites were shallower and not measured ¹² ~~also~~ 6/8/94
with the microscope.

Total No. of sites attacked: 21 out of 24

N. Sridhar
6/8/94

6/8/94

RPR25 CR 12

6/8/94

Objective: same as p. 144Approach: same as p. 144Equipment: same as p. 144.SiteDepth, mm

1	560
2	520 590
3	605
4	360
5	235
6	215
7	230
8	185
9	370
10	410
11	320
12	1035
12	480
14	420

Total No. of crinoid sites attacked: 24 out of 24

N. Smith
6/9/94

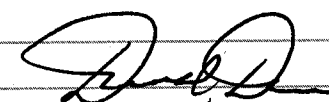
STOCK SOLUTIONS

6/94

SO₄-6/94 1000 PPM SO₄²⁻ AS Na₂SO₄
 1.47822g Na₂SO₄ LOT 901213 + DI WATER
 TO 1000 ml EXP 7/8/94

NO₃-6/94 1000 PPM NO₃⁻ AS NaNO₃
 1.37579g NaNO₃ LOT 897183 + DI WATER
 TO 1000 ml EXP 7/8/94

F-6/94 1000 PPM F⁻ AS NaF
 1.87188g NaF LOT 896405 + DI WATER
 TO 1000 ml EXP 7/8/94


 6/9/94

7/7/94

LONG TERM POTENTIOSTATIC TEST LT82SP2J

SPECIMEN SAME AS LT82SP2J P.100
 START WT 30.82122g
 SOLUTION 1000 PPM Cl^- 85 PPM HCO_3^- 20 PPM SO_4^{2-}
 10 PPM NO_3^- 2 PPM F^- 2000 ml AS FOLLOWS
 3.29909 g NaCl LOT 935535
 0.24454 g NaHCO_3 LOT 897789
 40 ml SO_4 - 6/94 STOCK SOLUTION P147
 20 ml NO_3 - 6/94 "
 4 ml F^- - 6/94 "
 + DI WATER TO 2000 ml $T=95^\circ\text{C}$ H_2 THERMO 183302
 POTENTIOSTAT ESC 440 #1 CHANNEL #1
 DATA SAVED AS LT82SP2J.DAT USING LONGTM.WBB
 REFERENCE SCE FISHER 13-620-S1 SN 3106337
 E_{CORR} -42 mV KEITNEY 617 #537418
 E_{PT} +163 mV "
 E_{APP} 0 mV
 SPECIMEN STARTED 9:30 AM 7/7/94
 START pH 8.127
 END WT 30.82075g
 SPECIMEN STOPPED 9:30 AM 8/11/94
 END pH 8.814
 END Cl CONCENTRATION 1614 PPM
 NO SIGN OF LOCALIZED CORROSION

[Signature]
 8/11/94

7/7/94

LONG TERM POTENTIOSTATIC TEST LT82SP7A

SPECIMEN SAME TYPE AS LT82SP2A-J. 2 MILL
 FINISHED ALLOY 82S SURFACES AND 2 600S: C
 SURFACES. TOTAL AREA = 15cm^2 HEAT # HH4371FG
 START WT 30.31972g
 SOLUTION 1000 PPM Cl^- 85 PPM HCO_3^- 20 PPM SO_4^{2-}
 10 PPM NO_3^- 2 PPM F^- 2000 ml AS FOLLOWS
 3.31021 g NaCl LOT 935535
 0.24385 g NaHCO_3 LOT 897789
 40 ml SO_4 - 6/94 STOCK SOLUTION P147
 20 ml NO_3 - 6/94 "
 4 ml F^- - 6/94 "
 + DI WATER TO 2000 ml $T=95^\circ\text{C}$ H_2 THERMO 183301
 POTENTIOSTAT ESC 440 #1 CHANNEL #2
 DATA SAVED AS LT82SP7A.DAT USING LONGTM.WBB
 REFERENCE SCE FISHER 13-620-S1 SN 3106343
 E_{CORR} -145 mV KEITNEY 617 #537418
 E_{PT} +146 mV "
 E_{APP} +200 mV
 SPECIMEN STARTED 9:30 AM 7/7/94
 START pH 8.220
 END WT 30.31379g
 SPECIMEN STOPPED
 END pH 8.872
 END Cl CONCENTRATION 1513 PPM
 NO SIGN OF LOCALIZED CORROSION

[Signature]
 8/11/94

7/7/94

LONG TERM POTENTIOSTATIC TEST LT82SP8A

SPECIMEN SAME TYPE AS LT82SP2A-J. ALLOY 825
 HEAT # NH4371FG. 2 MILL FINISHED SURFACES
 AND 2 600 S.I.C FINISHED SURFACES AREA = 15 cm²

START WT 31.86402 g

SOLUTION 1000 PPM Cl⁻ 85 PPM HCO₃⁻ 20 PPM SO₄²⁻10 PPM NO₃⁻ 2 PPM F⁻ 1000 ml MADE AS FOLLOWS

1.65951 g NaCl LOT 935535

0.12059 g NaHCO₃ LOT 89778946 ml SO₄ - 6/94 STOCK SOLUTION P14720 ml NO₃ - 6/94 "4 ml F⁻ - 6/94 "

+ DI WATER TO 1000 ml T=95°C H₂ THERMO 183304
 POTENTIOSTAT ESC 440 #1 CHANNEL #3

DATA SAVED AS LT82SP8A.DAT USING LONGTM.WBB

REFERENCE SCE FISHER 13-620-SI SN 8211163

E_{corr} -157.4 mV KEITHLEY 617 # 537418E_{pt} +129 mV "E_{app} +100 mV

SPECIMEN STARTED 9:30 AM 7/7/94

START pH 8.214

END WT 31.86077 g

SPECIMEN STOPPED 9:30 AM 8/11/94

END pH 8.892

END Cl CONCENTRATION 1583 PPM

NO SIGN OF LOCALIZED CORROSION

Paul D.
 8/11/94

7/7/94

LONG TERM POTENTIOSTATIC TEST LT82SP4A

SPECIMEN SAME AS CREVICE REPASSIVATION TESTS

IWPG 045 P 238 EXCEPT WITH 1 MILL FINISHED
 SURFACE. AREA = 20 cm²

START WT 38.97912

SOLUTION 1000 PPM Cl⁻ 85 PPM HCO₃⁻ 20 PPM SO₄²⁻10 PPM NO₃⁻ 2 PPM F⁻ 1000 ml AS FOLLOWS

1.64986 g NaCl LOT 935535

0.12174 g NaHCO₃ LOT 89778920 ml SO₄ - 6/94 STOCK SOLUTION P14710 ml NO₃ - 6/942 ml F⁻ - 6/94

+ DI WATER TO 1000 ml T=95°C H₂ THERMO 183306
 POTENTIOSTAT ESC 440 #1 CHANNEL #4

DATA SAVED AS LT82SP4A USING LONGTM.WBB

REFERENCE SCE FISHER 13-620-SI SN 2134032

E_{corr} -162 mV KEITHLEY 617 # 537418E_{pt} (GRAPHITE ROD) -38 mVE_{app} 0 mV

SPECIMEN STARTED 9:30 AM 7/7/94

START pH 8.248

2 PTFE CREVICE BLOCKS ON 0.75" x 0.75" SURFACES
 HELD WITH C276 BOLT AND NUT TORQUED TO

40 IN.OZ USING PROTO 6103 CAL DUE 7/24/94

END WT 38.97666 g AFTER SCALE REMOVAL

END pH 8.966

SPECIMEN STOPPED 9:30 AM 8/11/94

END Cl CONCENTRATION 1489 PPM

NO SIGN OF LOCALIZED CORROSION

Paul D.
 8/11/94

7/7/94

LONG TERM POTENTIOSTATIC TEST LT82SP5A

SPECIMEN SAME AS CREVICE REPASSIVATION TESTS
ON IWPE 045 P 238 EXCEPT WITH MILL
FINISHED SURFACE. AREA = 20 cm²

START WT 39.11606g

SOLUTION 1000 PPM Cl⁻ 85PPM NCO₃⁻ 20PPM SO₄²⁻
10PPM NO₃⁻ 2PPM F⁻ 1000 ml AS FOLLOWS.

1.64999g NaCl LOT 935535

0.12452g NaHCO₃ LOT 89778920 ml SO₄-6/94 STOCK SOLUTION p14710 ml NO₃-6/94 STOCK SOLUTION p1472 ml F⁻-6/94 STOCK SOLUTION p147+ DI WATER TO 1000 ml T=95°C H₂ THERMO 0323002

POTENTIOSTAT ESC 440 #1 CHANNEL #5

DATA SAVED AS LT82SP5A.DAT USING LONGTM.WBB

REFERENCE SCE FISHER 13-620-SI SN 9214083

E_{corr} -190 mV KEITHLEY 617 # 537418E_{pt} (GRAPHITE ROD) - 32 mVE_{app} -100 mV

SPECIMEN STARTED 9:30 AM 7/7/94

START pH 8.215

2 PTFE CREVICE BLOCKS ON 0.75" x 0.75" SURFACES

HELD WITH C276 BOLT AND NUT TORQUED TO

40 IN·OZ USING PROTO 6103 CAL DUE 7/24/94.

END WT 39.11332g AFTER SCALE DEPOSIT

WAS REMOVED FROM SPECIMEN POST

END pH 8.953

END Cl CONCENTRATION 1400 PPM

NO SIGN OF LOCALIZED CORROSION

D. B. 8/11/94

7/7/94

LONG TERM POTENTIOSTATIC TEST LT82SP6A

SPECIMEN SAME AS CREVICE REPASSIVATION TESTS

ON IWPE 045 P 238 EXCEPT WITH MILL-

FINISHED SURFACE. TOTAL SURFACE AREA = 20 cm²

2 PTFE CREVICE BLOCKS ON 0.75" x 0.75" SURFACES

HELD WITH C276 BOLT AND NUT TORQUED TO

40 IN·OZ USING PROTO 6103 CAL DUE 7/24/94

START WT 38.44409g

SOLUTION 1000 PPM Cl⁻ 85PPM NCO₃⁻ 20PPM SO₄²⁻10 PPM NO₃⁻ 2PPM F⁻ 1000 ml MADE AS FOLLOWS.

1.6495g NaCl LOT 935535

0.12319g NaHCO₃ LOT 89778920 ml SO₄-6/94 STOCK SOLUTION p14710 ml NO₃-6/942 ml F⁻-6/94+ DI WATER TO 1000 ml T=95°C H₂ THERMO 1238002

POTENTIOSTAT ESC 440 #1 CHANNEL #6

DATA SAVED AS LT82SP6A.DAT USING LONGTM.WBB

REFERENCE SCE FISHER 13-620-SI SN 9214074

E_{corr} -171 mV KEITHLEY 617 # 537418E_{pt} (GRAPHITE ROD) - 10 mVE_{app} 200 mV

SPECIMEN STARTED 9:30 AM 7/7/94

START pH 8.300

END WT 38.43841g AFTER SCALE WAS REMOVED

SPECIMEN STOPPED 9:30 AM 8/11/94

END pH 9.024

END Cl CONCENTRATION 1353 PPM

SOME SHALLOW CREVICE CORROSION ON

MILL FINISHED SURFACES SEE PHOTOGRAPH

P 171 - 172

D. B. 8/11/94

7/26/94

CREVICE CORROSION 304L-11

OBJECTIVE: MEASURE pH CI CONCENTRATION

POTENTIAL AND CURRENT INSIDE ACTIVE CREVICE
SPECIMEN) 304L HT T0954 $d = 1.248$ $t = 0.126$

START WT = 21.17897g 600 S.C FINISH.

SOLUTION) 1000 PPM Cl^- 85PPM HCO_3^- 20PPM SO_4^{2-} 10 PPM NO_3^- 2PPM F^- 1000 ml MAKE AS FOLLOWS

1.65484 g NaCl LOT 935535

0.12411 g $NaHCO_3$ LOT 89778920 ml SO_4^{2-} 7/94 STOCK SOLUTION p16110 ml NO_3^- 7/94 STOCK SOLUTION p1612 ml F^- 7/94 STOCK SOLUTION p161

+ DI WATER TO 1000 ml SOLUTION AT

ROOM TEMPERATURE = APPROX. 24°C

START pH = 8.20

SETUP LOCATION OF pH AND CI ELECTRODES

SAME AS 304LRTST SHOWN ON P. 70

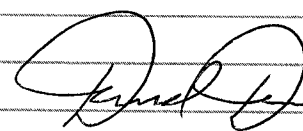
ADDITIONAL HOLES ADJACENT TO C_1 AND C_2

FOR REFERENCE ELECTRODES FOR pH AND

CI ELECTRODES AT MOUTH

ELECTRODE CALIBRATION DATA

	CI AT TIP	CI AT MOUTH	CI BULK
	44199 MI200 (ISE)	47228 MI200 (ISE)	47223 MI200 (ISE)
	43636 MI506 (REF)	41402 MI403 (REF)	41436 MI403 (REF)
	43636 MI403 (REF)		
ppm Cl^-	mV	mV	mV
100	147	158	125
1000	96	104	96
17725	35	47	42
35450	17	30	18

 7/26/94
CREVICE CORROSION 304L-11
ELECTRODE CALIBRATION DATA

	PH AT TIP	PH AT MOUTH	PH IN BULK
	45147 MI506 (pH)	44817 MI506 (pH)	44628 MI506 (pH)
	45867 MI403 (REF)	45860 MI403 (REF)	49445 MI403 (REF)
	PH AT BULK	PH AT MOUTH	
pH	mV	mV	mV
1.00	349.9	325.9	332
4.00	181.6	158.0	171.9
7.00	7.7	-20.1	-4.7
10.00	-170	-195	-184.9

pH AT TIP CONNECTED TO ORION EA 940 CHANNEL #1

ORION EA 940 SN 2330

pH AT MOUTH CONNECTED TO ORION EA920 SN 5001A

CHANNEL #1

pH IN BULK CONNECTED TO ORION EA940 SN 2330

CHANNEL #2

ORION EA940 CONNECTED TO DATA SHUTTLE CHANNEL

#1

ORION EA920 CONNECTED TO DATA SHUTTLE CHANNEL #2

DATA SHUTTLE CONNECTED TO COMPUADO 212 286

COMPUTER.

CI AT TIP CONNECTED TO ORION 720A CHANNEL #1 SN 3368

CI AT BULK CONNECTED TO ORION 720A CHANNEL #2 SN 3368

CI AT MOUTH CONNECTED TO ORION 720A CHANNEL #4 SN 5885

ORION 720A SN 3368 CONNECTED TO DATA SHUTTLE

CHANNEL #4

ORION 720A SN 5885 CONNECTED TO DATA SHUTTLE

CHANNEL #4

DATA SHUTTLE IDENTIFICATION MODEL # DS-8-TC

SN 224R2.02

 7/26/94

7/26/94

CREVICE CORROSION 304L-11

KEITHLEY 614 CONNECTED TO SPECIMEN AND
TIP REFERENCE ELECTRODE MI 403 # 44629
LOCATION OF TIP REFERENCE SHOWN ON
PAGE 70. KEITHLEY 614 # 467374 OUTPUTS
CONNECTED TO DATASHUTTLE CHANNEL # 6
KEITHLEY 485 PICOAMMETER CONNECTED TO
P+ COUNTER ELECTRODE AND COUNTER ELECTRODE
LEAD OF ESC 440 #3 POTENTIOSTAT CHANNEL
#4. KEITHLEY 485 #509163 SET ON 2 mA
RANGE AND CONNECTED TO DATA SHUTTLE
CHANNEL # 5

BULK REFERENCE MI 403 # 44671
CONNECTED TO ESC 440-3 CHANNEL #4
LOCATION OF BULK REFERENCE SHOWN ON
PAGE 70.

PH AT TIP AND MOUTH CI AT TIP AND
MOUTH POTENTIAL AT TIP AND BULK
SPECIMEN POTENTIAL AND CURRENT INPUT
INTO WORKBENCH VERSION 2.1 USING
DATA SHUTTLE. DATA COLLECTED WITH
WORKBENCH SETUP CREVICE2.WBB

DATA SAVED AS 304L-11.DAT

CELL RADIAL PLEXIGLASS CREVICE CELL
WITH C276 BOLTS TORQUED TO 10 IN OZ
USING PROTO 6103 TORQUE WRENCH
NO TOP USED ON CELL SOLUTION WAS
NOT DEGRATED. NO STIRRING OF SOLUTION

TEST STARTED 5:40 PM 7/26/94

INITIAL CONDITIONS

E_{CORR} -76 mV KEITHLEY 614

E_{TIP} -65 mV "

I 0 mA KEITHLEY 485

PH TIP -77.4 mV CI TIP 95 mV

PH MOUTH -80 mV CI MOUTH 99 mV

PH BULK -91.4 mV CI BULK 87 mV

PH AND CI mV MEASURED WITH ORION METER

Paul D 7/26/94

7/27/94

CREVICE CORROSION 304L-11

INITIAL VALUES SHOWN BY WORKBENCH

E_{TIP} -67 mV

I 0 mA

PH MOUTH 8.24

PH TIP 8.43

CI MOUTH 1193 ppm CI

CI TIP 1203 ppm CI

CALCULATION CHECK

TIP PH = 8.43 (WORKBENCH)

TIP PH = -77.4 mV ORION EA940 SN 2330

REGRESSION EQUATION P158 PLOTTED FROM

DATA IN TABLE ON PAGE 155

TIP PH = $-0.0173 \text{ mV} + 7.09$

TIP PH = $-0.0173(-77.4) + 7.09$

TIP PH = 8.42

VERY CLOSE TO WORKBENCH VALUE OF 8.43

MOUTH PH = $-0.0173 \text{ mV} + 6.86$

MOUTH PH = -80 mV WITH ORION EA920 SN 5001A

MOUTH PH = $-0.0173 \text{ mV} + 6.86$ 7/21/94

MOUTH PH = 8.24 SAME AS WORKBENCH VALUE

TIP CI = 95 mV ORION 720 A #3368

TIP CI = 1203 ppm USING WORKBENCH

TIP CI = $\text{EXP}[-0.0455 \text{ mV} + 11.30]$ AS CALCULATED
FROM ~~RE-DO~~ 7/27/94 CALIBRATION DATA

TIP CI = $\text{EXP}[-0.0455(95) + 11.30]$

TIP CI = $\text{EXP}[6.98]$

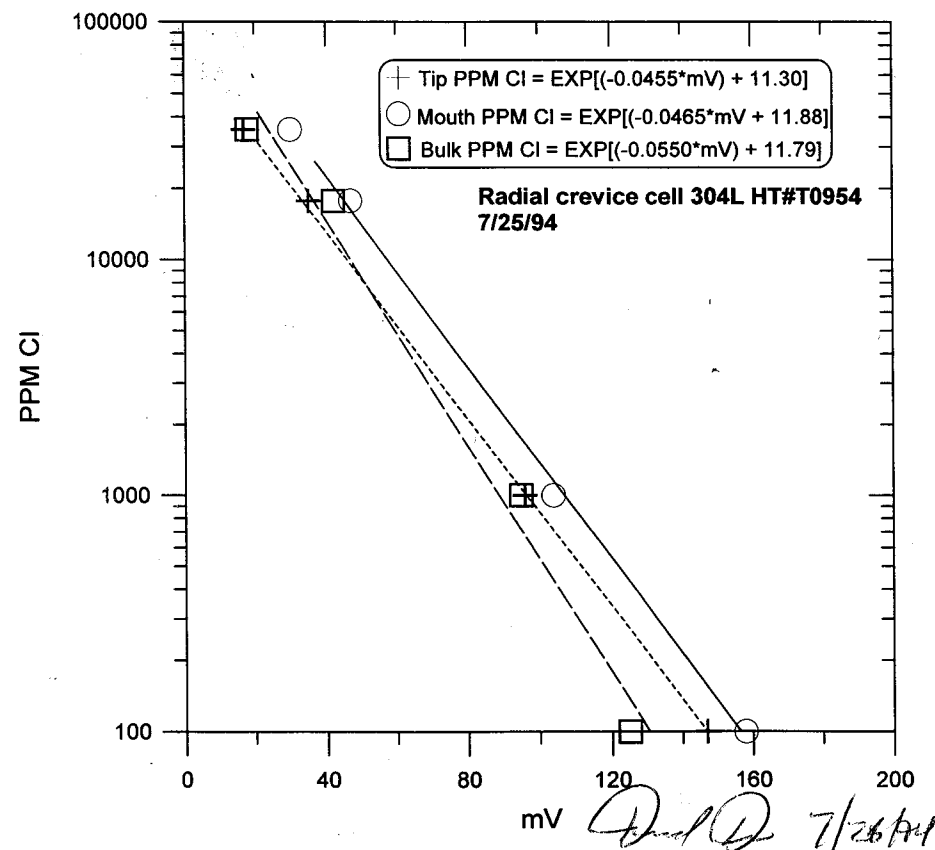
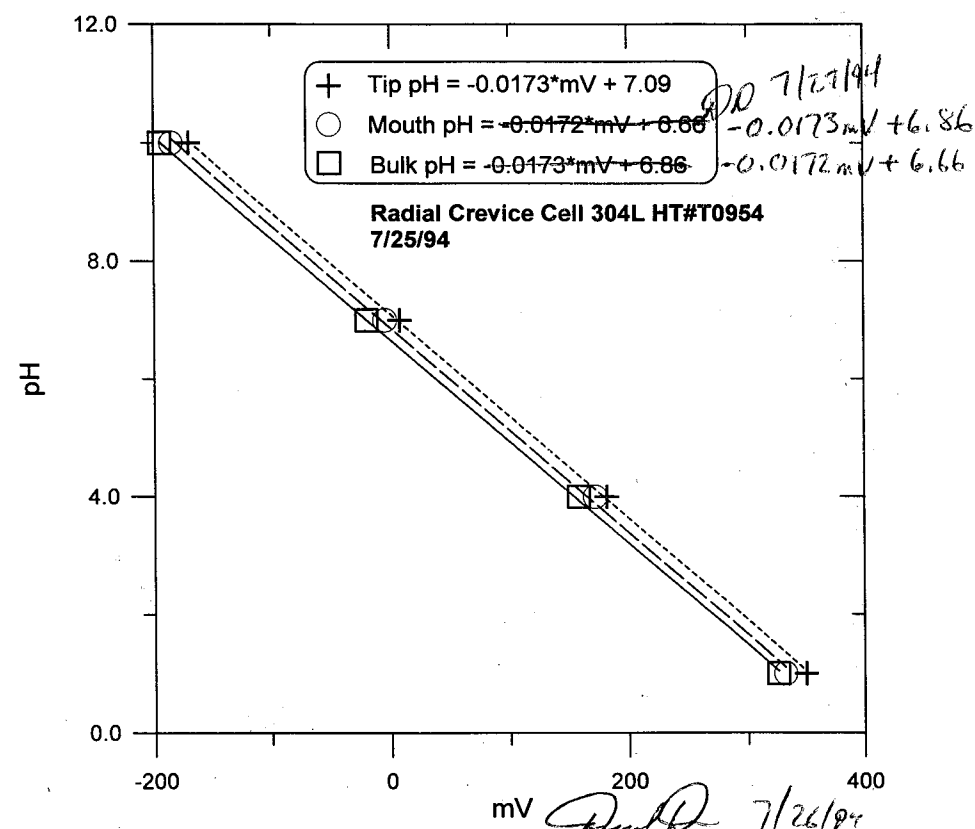
TIP CI (ppm) = 1074 COMPARED TO WORKBENCH 1203 ppm CI

MOUTH CI = $\text{EXP}[-0.0465 \text{ mV} + 11.88]$ FOR 95 99 mV

MOUTH CI = 1445 ppm COMPARED TO WORKBENCH 1193

Paul D 7/27/94

DD 7/27/94



Handwritten signature and date: $7/27/94$

7/27/94

CREVICE CORROSION 304L-11

AT 8:45 AM 7/27/94 $E_{\text{SET}} = 200 \text{ mV}$

WORKBENCH READINGS

PH MOUTH 8.21
PH TIP 8.49
Cl MOUTH 1533 ppm
Cl TIP 1572 ppm

$E_{\text{TIP}} = -0.056 \text{ V}$
 $E_{\text{COR}} = -0.060 \text{ V}$

POTENTIAL APPLIED AT $t = 54,100 \text{ SEC}$

7/28/94

AT 9:40 AM 7/28/94 EXTERNAL POTENTIAL
DECREASED TO $0.0 \text{ V}_{\text{Ag/AgCl}}$ CURRENT DENSITY
DECREASED FROM $5 \times 10^{-5} \text{ A}$ TO $2 \times 10^{-5} \text{ A}$
PH READINGS STABLE PPM Cl READINGS
ERRATIC Cl ISG ELECTRODES MAY BE SHORTING
TO GROUND BY TOUCHING SPECIMEN

7/29/94 $t = 222,600 \text{ SEC}$ TEST STOPPED
POST TEST ELECTRODE CHECK END PH BULK = 8.02

PH	PH TIP	PH MOUTH	PH BULK
1.00	349.5 mV	346.8 mV	326.0 mV
4.00	181.9	177.2	156.3
7.00	7.4	2.0	-19.7
10.00	-177.2	-170.8	-177.1

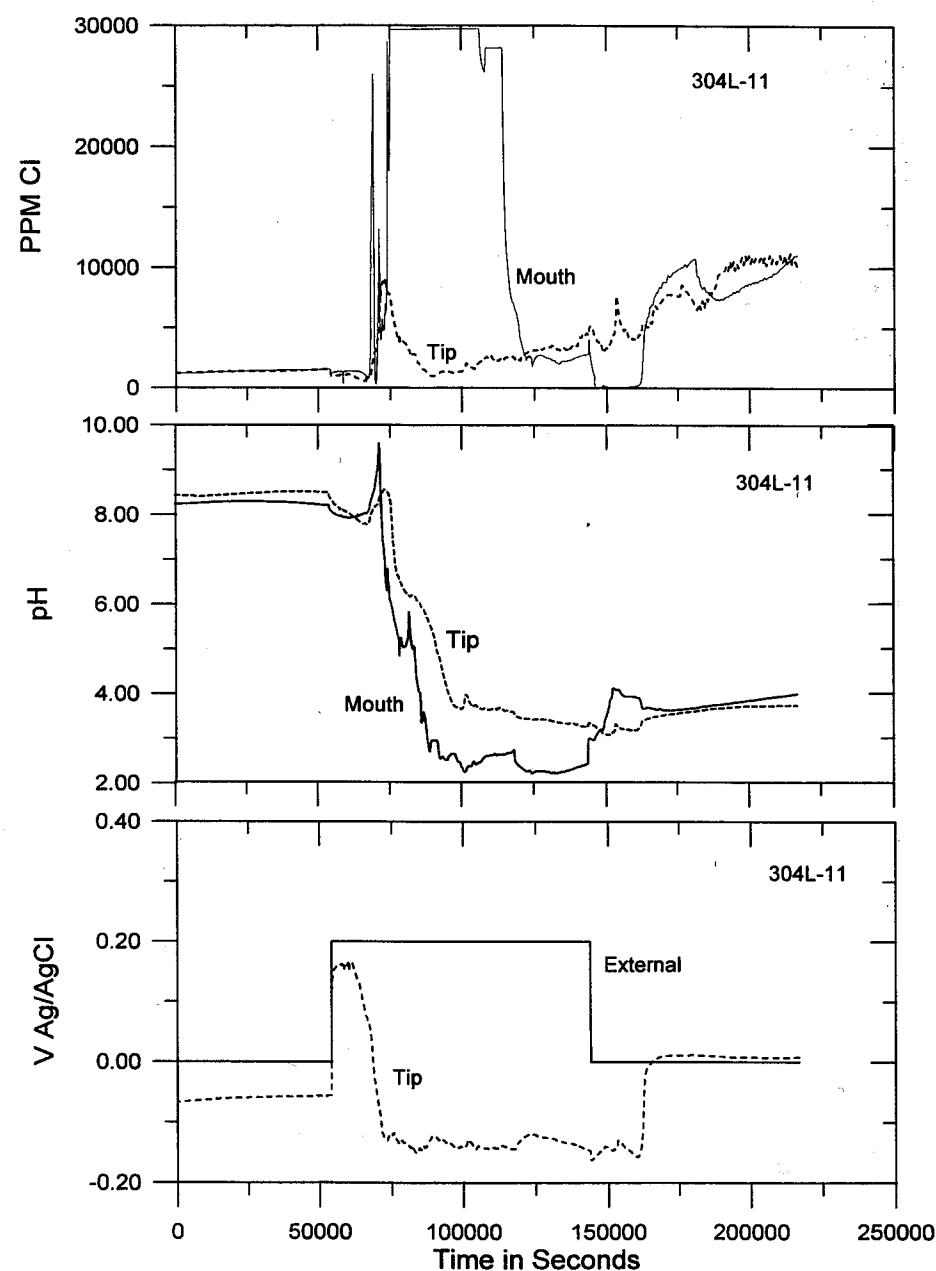
7/29/94

ppm Cl	Cl TIP	Cl MOUTH	Cl BULK
100	119.8 mV	150.9 mV	171 mV
1000	94.3	106.0	112.8
17725	38.7	49	40.3
35450	32.0	20.3	14.3

Handwritten signature and date: $7/29/94$

304L 11 TEST RESULTS

END WT 21.16101g



[Signature] 8/3/94

CURRENT DENSITY RECORDS AS 0 FOR ENTIRE
TEST DUE TO LOG IN ERROR OF CREVICE Z.W.B.B

[Signature] 8/3/94

STOCK SOLUTIONS 7/94 PREPARED 7/18/94

~~SO₄ - 7/94~~ ^{7/18/94} SO₄ - 7/94 1000 ppm SO₄²⁻
AS Na₂SO₄ 1.47820 g Na₂SO₄ LOT 901213
+ DI WATER TO 1000 ml EXP 8/12/94

NO₃ - 7/94 1000 ppm NO₃⁻ AS NaNO₃
1.39344 g NaNO₃ LOT 897183
+ DI WATER TO 1000 ml EXP 8/12/94

F⁻ - 7/94 1000 ppm F⁻ AS NaF
1.87559 g NaF LOT 896405
+ DI WATER TO 1000 ml EXP 8/12/94

100 Cl⁻ - 7/94 100 ppm Cl⁻ AS NaCl
0.17118 g NaCl LOT 935535
+ DI WATER TO 1000 ml EXP 8/12/94

1000 Cl⁻ - 7/94 1000 ppm Cl⁻ AS NaCl
3.29754 g NaCl LOT 935535
+ DI WATER TO 2000 ml EXP 8/12/94

0.5 M Cl⁻ - 7/94 0.5 molar Cl⁻ AS NaCl
26.44275 g NaCl LOT 935535
+ DI WATER TO 1000 ml EXP 8/12/94

1.0 M Cl⁻ - 7/94 1.0 molar Cl⁻ AS NaCl
58.44968 g NaCl LOT 935535
+ DI WATER TO 1000 ml EXP 8/12/94

8/3/94

CREVICE CORROSION 304L-12

OBJECTIVE MEASURE CURRENT DENSITY
POTENTIAL pH AND Cl CONCENTRATION INSTAB
ACTIVE CRACKS

SPECIMEN 304L HT T0954 $d = 1.247$ $t = 0.115$

START WT = NOT RECORDED

600 SiC FINISH ON TOP SURFACE AND

60 SiC FINISH ON BOTTOM SURFACE

SOLUTION 1000 ppm Cl⁻ 85 ppm HCO₃⁻

20 ppm SO₄²⁻ 10 ppm NO₃⁻ 2 ppm F⁻

1000 ml MAKE AS FOLLOWS

1.64254 g NaCl LOT 935535

0.12086 g NaHCO₃ LOT 897789

20 ml SO₄ - 7/94 STOCK SOLUTION p161

10 ml NO₃ - 7/94 STOCK SOLUTION p161

2 ml F⁻ - 7/94 STOCK SOLUTION p161

+ DI WATER TO 1000 ml TEMPERATURE =

ROOM TEMPERATURE $\approx 24^{\circ}\text{C}$

START pH = 8.20

SETUP SAME AS 304L-11 P 154

ELECTRODE CALIBRATION DATA CHLORINE ELECTRODES

	TIP Cl	MOUTH Cl	BULK Cl
	MI200 44176	MI200 47228	MI200 47233
	MI403 43636	MI403 41402	MI403 41436
ppm Cl ⁻	mV	mV	mV
100	148	158	126
1000	102	107	90
17725	50	48	37
35450	34	30	13

8/3/94

ELECTRODE CALIBRATION DATA pH ELECTRODES

	TIP pH	MOUTH pH	BULK pH
	MI504 45147	MI506 49445	MI506 44817
	MI403 45867	MI403 44628	MI403 45860
pH	mV	mV	mV
1.00	343	328	320
4.00	179	170	158
7.00	6	-10	-21
10.00	-173	-187	-198

INITIAL CONDITIONS

WORKBENCH

METERS

MOUTH pH	7.38	-34 mV	ORION EA920 5001A
MOUTH Cl	1203 ppm	-13 mV	ORION EA940 SN2330
TIP pH	7.29	-13 mV	ORION EA940 SN2330
TIP Cl	905 ppm	107 mV	ORION 720A SN3368
TIP POTENTIAL	-23 mV	-22 mV	KEITHLEY 614 467374
EXTERNAL POTENTIAL	-23 mV	-22 mV	KEITHLEY 614 467374
BULK pH	NOT RECORDED	-91 mV	ORION EA940 SN2330
BULK Cl	NOT RECORDED		
MOUTH Cl	1203 ppm	99.6 mV	ORION 720A SN3368

TEST STARTED 11:20 AM 8/3/94

11:50 AM ~~8/03/94~~ 8/03/94 EXTERNAL POTENTIAL

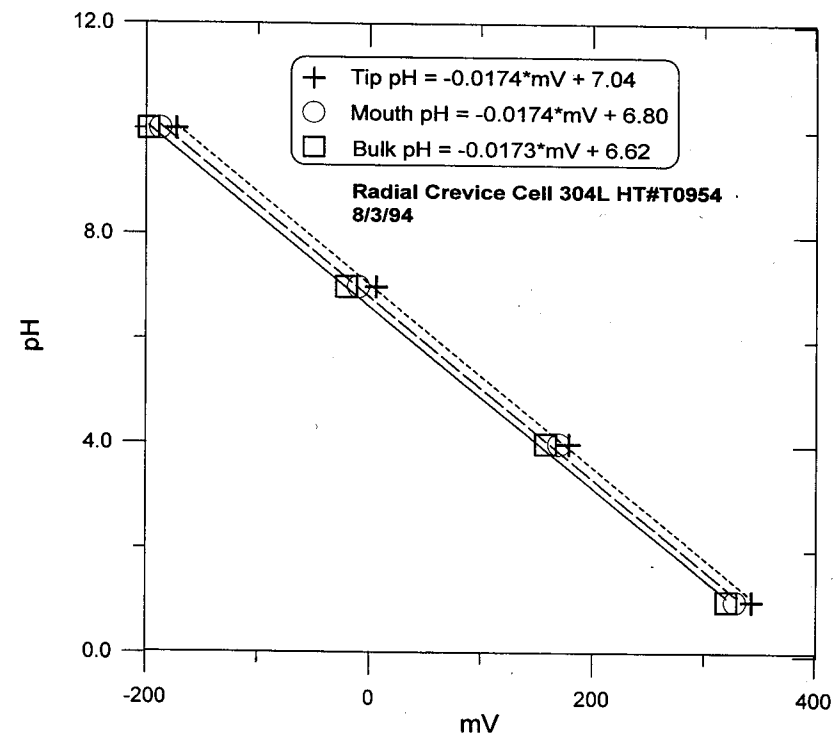
SET AT ± 0.150 mV

TEST STOPPED 8/8/94 SOLUTION EVAPORATED

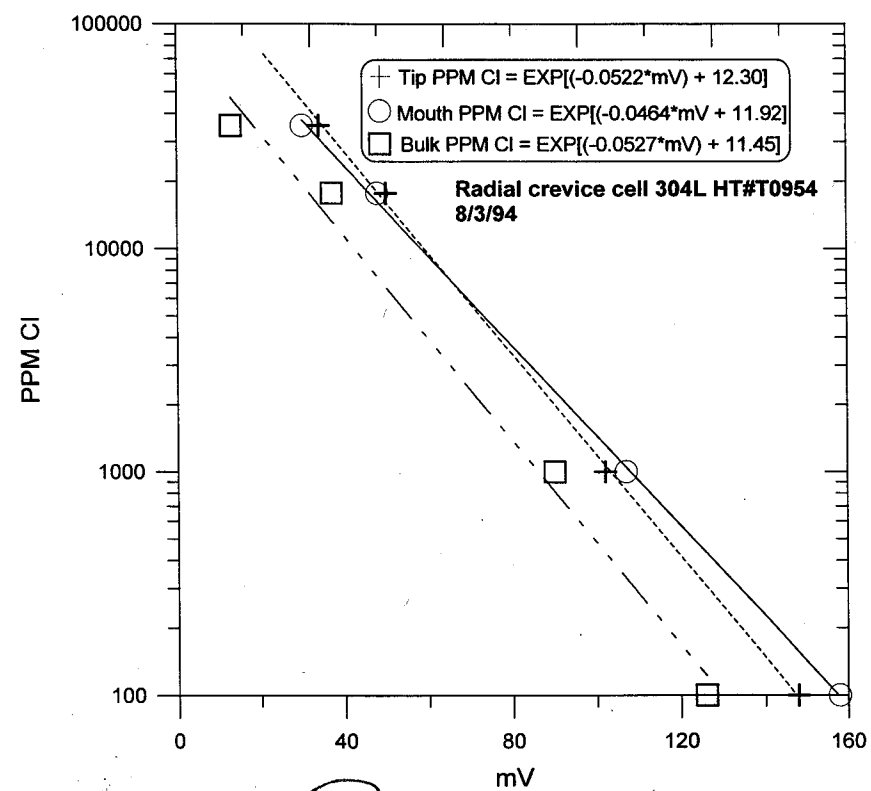
FROM CELL SOLUTION LEVEL BELOW SPECIMEN

AND ELECTRODES NO LONGER IN SOLUTION

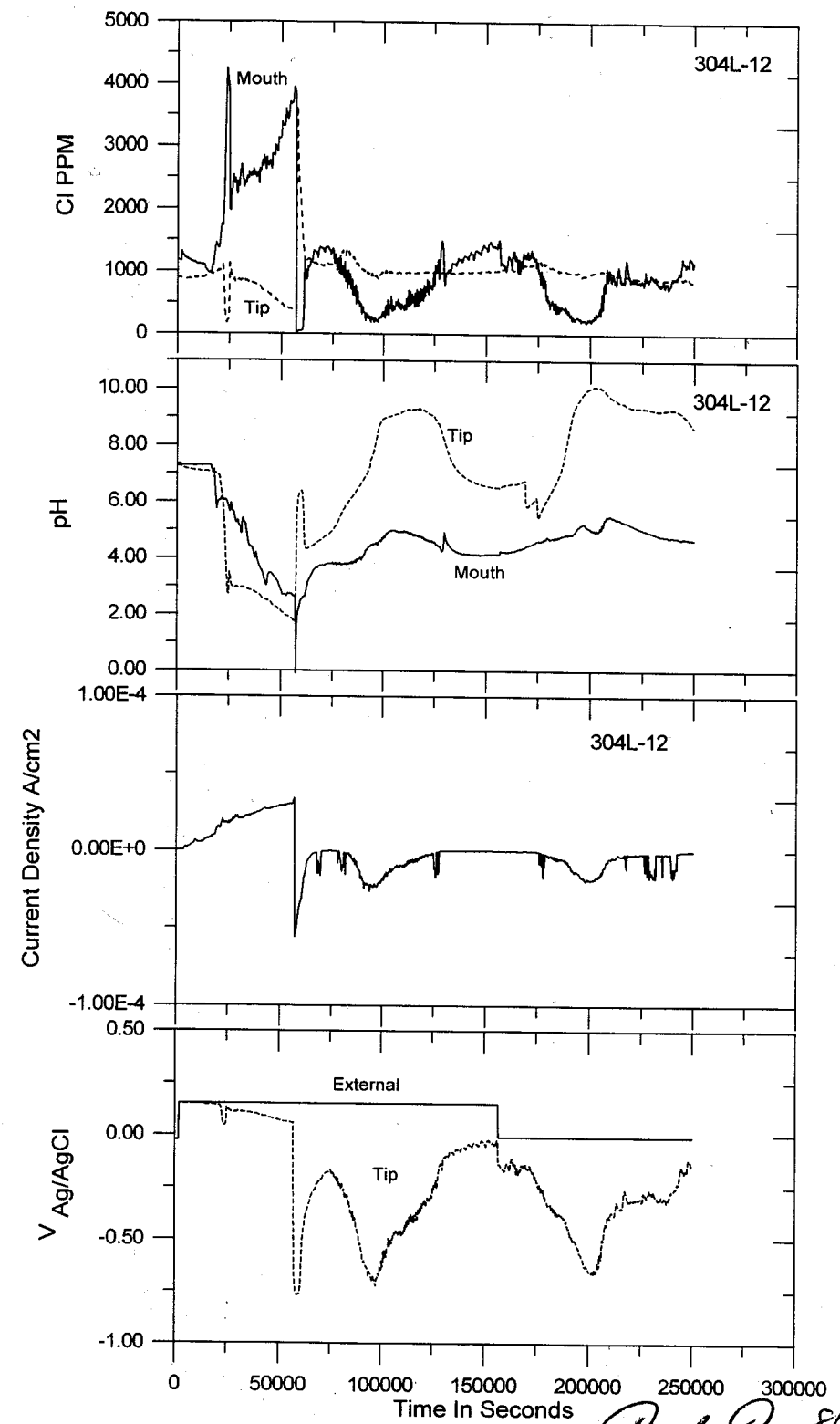
ELECTRODE CALIBRATION PLOTS P164 pH, Cl, CURRENT
DENSITY AND POTENTIAL PLOTS P165 THROUGH
250,000 SEC OF TEST DATA SAVED AS 304L-12.DAT



Paul D 8/4/94



Paul D 8/4/94



Paul D 8/4/94

CREVICE CORROSION 304L-13

OBJECTIVE MEASURE CURRENT DENSITY POTENTIAL
PH AND Cl^- CONCENTRATION INSIDE ACTIVE
CREVICE

SPECIMEN 304L NT T0954 $d = 1.247$ $t = 0.119$

START WT 20.74368 g

600 SIC FINISH ON TOP SURFACE AND

60 SIC FINISH ON BOTTOM SURFACE

SOLUTION 1000 PPM Cl^- , 85 PPM HCO_3^-

20 PPM SO_4^{2-} 10 PPM NO_3^- 2 PPM F^-

1000 ml MADE AS FOLLOWS

1.64857 g NaCl LOT 935535

0.12085 g NaHCO_3 LOT 897789

20 ml SO_4 - 8/94 STOCK SOLUTION

10 ml NO_3 - 8/94 STOCK SOLUTION

2 ml F^- - 8/94 STOCK SOLUTION

+ DE WATER TO 1000 ml

SOLUTION AT ROOM TEMPERATURE $\approx 24^\circ\text{C}$

START pH

SETUP SAME AS 304L-11 p154

ELECTRODE CALIBRATION DATA CHLORIDE ELECTRODES

	TIP Cl^-	MOUTH Cl^-	BULK Cl^-
	MI200 44176	MI200 47228	MI200 44447
	MI403 43636	MI403 41402	MI403 41432
PPM Cl^-	mV	mV	mV
100	185	169	150
1000	114	113	106
17725	50	49	54
35450	36	34	37

USING STOCK Cl^- SOLUTIONS p161

Done 8/9/94

ELECTRODE CALIBRATION DATA pH ELECTRODES

	TIP pH	MOUTH pH	BULK pH
	MI506 45147	MI506 49445	MI506 44817
	MI403 45867	MI403 44628	MI403 45860
pH	mV	mV	mV
1.00	348	339	336
4.00	185	169	164
7.00	7	-4	-11
10.00	-168	-179	-188

USING STANDARD pH BUFFERS.

INITIAL CONDITIONS

	WORKBENCH	METERS	DD 8/9/94
MOUTH pH	7.86	-55.5 mV	ORION EA940 EA920
TIP pH	8.00 - 8.55	-50.1 mV	ORION EA940 SN2330
MOUTH Cl^-	1103 PPM	104.8 mV	ORION 720A SN5885
TIP Cl^-	1342 PPM	113.1 mV	ORION 720A 3368
TIP POTENTIAL	-0.116 V	-0.113 V	KEITHLEY 614 #467374
EXTERNAL POTENTIAL	-0.120 V	-0.120 V	KEITHLEY 614 #467374
BULK pH		-81 mV	ORION EA940 SN2330
BULK Cl^-		111.9 mV	ORION 720A 3368

TEST STARTED AT 3:00 PM 8/9/94

Ag/AgCl REF ELECTRODE MI503 #45867

CHANGED FOR MI503 #43647 AT START

OF TEST

AT 4:00 PM EXTERNAL POTENTIAL SET TO +185 mV

VS. Ag/AgCl $t = 3600$ SEC

AT 5:24 PM $t = 8500$ SEC POTENTIAL TURNED

OFF NUMEROUS BUBBLES AT END OF ELECTRODES

CELL DISASSEMBLED CREVICE CORROSION AROUND

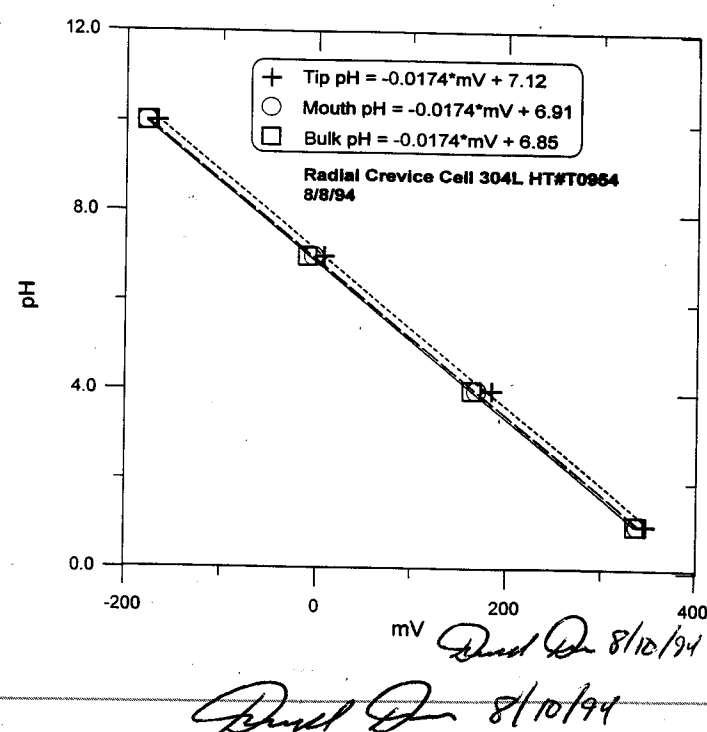
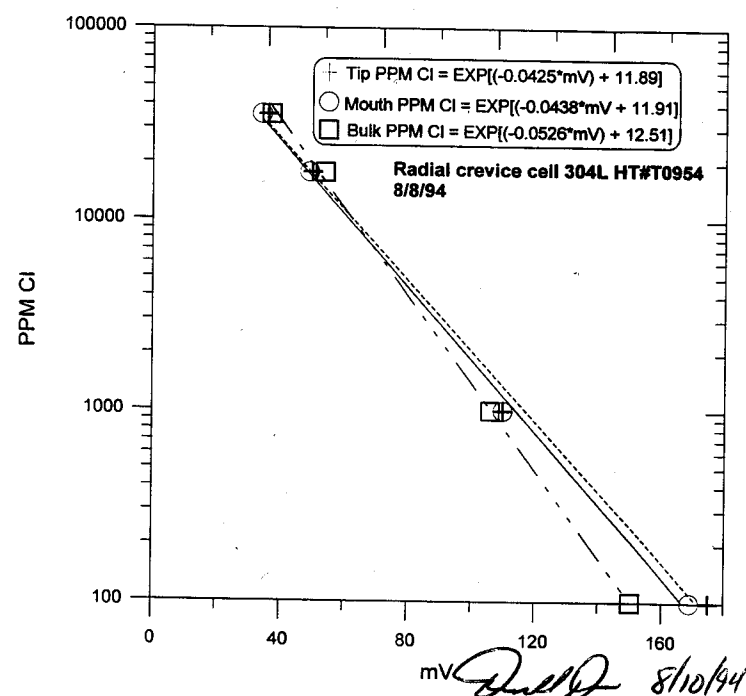
OUTSIDE OF TOP SIDE OF CREVICE CELL

Done 8/9/94

SMALL REGIONS OF CREVICE CORROSION
AROUND BOTTOM SIDE OF SPECIMEN

END WT 20.74316g

DATA SAVED AS 304L-13



CREVICE CORROSION 304L-14

OBJECTIVE MEASURE pH, Cl CONCENTRATION, POTENTIAL
AND CURRENT DENSITY INSIDE ACTIVE CREVICE

SPECIMEN 304L HT T0954 d=1.246 t=0.119

START WT = 20.79680g

600 SiC FINISH ON TOP 60 SiC FINISH
ON BOTTOM OF SPECIMEN

SOLUTION 1000 PPM Cl⁻ 85 PPM HCO₃ 20 PPM SO₄²⁻

10 PPM NO₃⁻ 2 PPM F⁻ 1000 ml MAKE AS FOLLOWS

1.65072 g NaCl LOT 935535

0.12124 g NaHCO₃ LOT 897789

20 ml SO₄ - 8/94 STOCK SOLUTION

10 ml NO₃ - 8/94 STOCK SOLUTION

2 ml F⁻ - 8/94 STOCK SOLUTION

+ DI WATER TO 1000 ml

SOLUTION AT ROOM TEMPERATURE $\approx 24^{\circ}\text{C}$

SETUP SAME AS 304L-11 P 154

ELECTRODE CALIBRATIONS SAME AS 304L-13 P 168

INITIAL CONDITIONS AT 8:45 AM 8/10/94 t=50,700 SEC

	WORKBENCH	METERS
MOUTH pH	7.31	-22 mV ORION EA 920 SN5001A
TIP pH	7.15	-1.5 mV ORION EA 940 SN 2330
MOUTH Cl	1380 PPM	103 mV ORION 720A SN 5885
TIP Cl	1814 PPM	106 mV ORION 720A SN 3368
TIP POTENTIAL	-0.097	-0.094 KEITHLEY 614 *467374
EXT POTENTIAL		-0.095 KEITHLEY 614 *467374
BULK pH		-85 mV ORION EA 940 SN 2330
BULK Cl		111 mV ORION 720A SN 3368

AT 8:50 AM 8/10/94 t=51,100 SEC EXTERNAL

POTENTIAL SET TO +0.175 mV

SOLUTION STIRRED THROUGHOUT TEST.

SAME PROBLEMS AS 304L-13, BUBBLES IN ELECTRODE
PORTS EXPERIMENT STOPPED CELL DISASSEMBLED

DATA SAVED AS 304L-14, DAT *Quill* 8/11/94

STOCK SOLUTIONS 8/94

SO₄ - 8/94 1000 ppm SO₄²⁻ AS Na₂SO₄
 1.47052 g Na₂SO₄ LOT 901213
 + DI WATER TO 1000 ml EXP

NO₃ - 8/94 1000 ppm NO₃⁻ AS NaNO₃
 1.39017 g NaNO₃ LOT 897183
 + DI WATER TO 1000 ml EXP

F⁻ - 8/94 1000 ppm F⁻ AS NaF
 1.87604 g NaF LOT 896405
 + DI WATER TO 1000 ml EXP

[Signature] 8/12/94

8/12/94

PHOTOS OF LT825P6A

OBJECTIVE DOCUMENT REGIONS OF CREVICE
 CORROSION ON MILL FINISHED SURFACE
 OF LT825P6A

ANALYSIS CREVICE CORROSION ON 12 SITES OF
 MILL FINISHED SURFACES. SUM DISCOLORATION
 AROUND PTFE CREVICE WASHER CONTACT AREAS
 OF 600 S.C SURFACE BUT NO CREVICE CORROSION
 TEST P 153 PHOTOS P 172

FORM FOR REQUESTING WORK FROM OTHER DIVISIONS

A. TO BE COMPLETED BY DIVISION 20 PERSONNEL

Requester: DARRELL DUNN Request Date: 8/12/94
 Project No.: 20-S704-041 Phone No.: 6090
 Description of Work Requested: PHOTO OF ALLOY 825 SPECIMEN

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

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

Sample Identification

LT825P6

Description

ALLOY 825 HN437IF6

B. TO BE COMPLETED BY DIVISION PERFORMING WORK¹

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

Person Assigned: ISAM RODRIGUEZ 6059 Signature: *[Signature]*
 Division: 06 Date: 8/12/94

Make, Model & Serial No. of Equipment Used (attach list if necessary): M P 4

Software Used (If any):

Standards Used (If any):

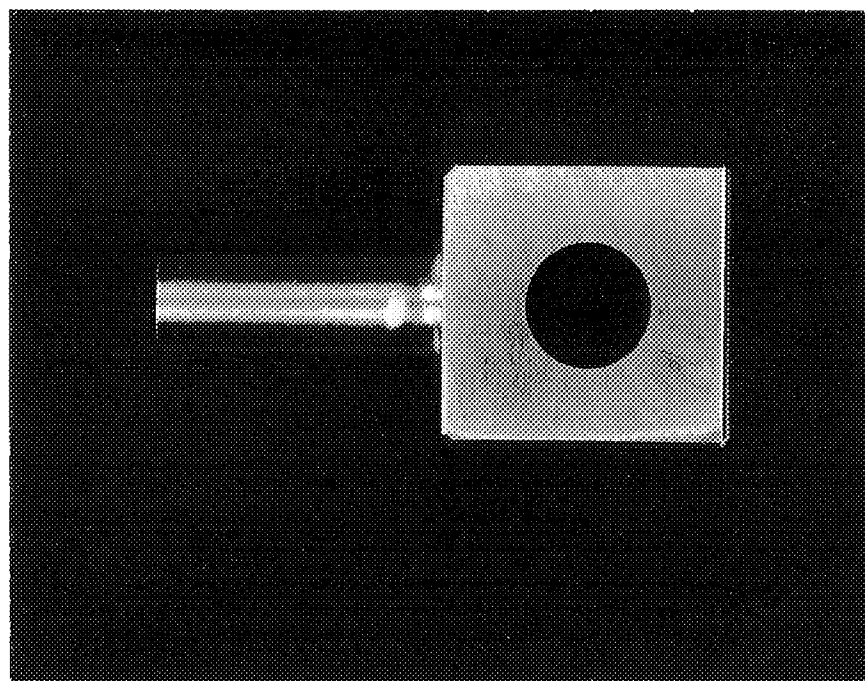
Photographic Negative Numbers (If Applicable): 69032, 69033

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

[Signature] 8/12/94
[Signature] 8/12/94

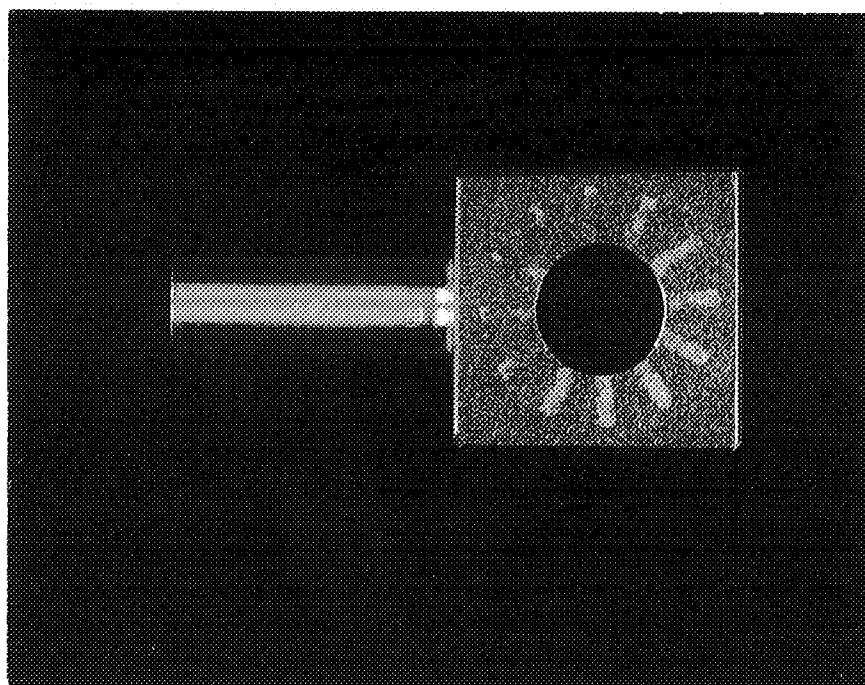
69032

LT825P6A 8/12/94 600 S.C. SURFACE



69033

LT825P6A 8/12/94 M.F.L. FINISHED SURFACE



[Signature] 8/12/94

LONG TERM POTENTIOSTATIC TEST LT825P2K

SPECIMEN SAME AS LT825P2J P148
 START WT 30.82108 g
 SOLUTION 1000 PPM Cl^- 83 PPM HCO_3^- 20 PPM SO_4^{2-}
 10 PPM NO_3^- 2 PPM F^- 2000 ml AS FOLLOWS
 3.30190 g NaCl LOT 935535
 0.24319 g NaHCO_3 LOT 897789
 40 ml SO_4 - 8/94 STOCK SOLUTION
 20 ml NO_3 - 8/94 STOCK SOLUTION
 4 ml F^- - 8/94 STOCK SOLUTION
 + DI WATER TO 2000 ml $T = 95^\circ\text{C}$
 HQ THERMOMETER # 183303 CAL DUE 28 JULY 95
 START pH 8.297
 POTENTIOSTAT ESC 440 #1 CHANNEL #1
 DATA SAVER AS LT825P2K.DAT USING
 LONG TM. WBB
 REFERENCE SCE FISHER 13-620-SI SN 3106343
 $E_{\text{CORR}} = -25 \text{ mV}$ KEITHLEY 614 # 555368 CAL DUE 11/18/94
 $E_{\text{AP}} = +181 \text{ mV}$ KEITHLEY 614 # 555368 CAL DUE 11/18/94
 $E_{\text{APP}} = 0 \text{ mV}$ KEITHLEY 614 # 555368
 SPECIMEN STARTED 8/15/94 5:20 PM *[Signature]*
~~ST~~ *[Signature]* 8/15/94
 STOPPED 9/12/94 5:20 PM
 END pH = 8.888
 END WT 30.82226 g
 NO SIGN OF LOCALIZED CORROSION

[Signature]
 9/12/94

LONG TERM POTENTIOSTATIC TEST LT82SP7A

SPECIMEN SAME AS LT82SP7A P149
 START WT 30.31379g
 SOLUTION 1000 PPM Cl^- 85PPM HCO_3^- 20PPM SO_4^{2-}
 10 PPM NO_3^- 2PPM F^- 2000 ml AS FOLLOWS
 3.30714 g NaCl LOT 935535
 0.24614 g NaHCO_3 LOT 897789
 40 ml SO_4 - 8/94 STOCK SOLUTION p176
 20 ml NO_3 - 8/94 STOCK SOLUTION p170
 4 ml F^- - 8/94 STOCK SOLUTION p170
 + DI WATER TO 2000 ml $T=95^\circ\text{C}$
 Hg THERMOMETER # 183304 CAL DUE 25 JAN 95
 START pH 8.399
 DATA SAVED AS LT82SP7A.DAT USING LONGTM.WBB
 POTENTIOSTAT ESC 440 #1 CHANNEL # 2
 REFERENCE SCE FISHER 13-620-S1 SN 3106337
 $E_{\text{CORR}} -86\text{mV}$ KEITNLEY 614 # 555368
 $E_{\text{PT}} +195\text{mV}$ KEITNLEY 614 # 555368
 $E_{\text{APP}} +200\text{mV}$ KEITNLEY 614 # 555368
 SPECIMEN STARTED 8/15/94 - ST QD 8/15/94 5:20 PM
 STOPPED 5:20 PM 9/12/94
 END pH 9.197
 END WT 30.31569g
 NO SIGN OF LOCALIZED CORROSION

9/12/94

LONG TERM POTENTIOSTATIC TEST ~~LT82SP7A~~ LT82SP8B AD 8/15/94

SPECIMEN SAME AS LT82SP8A P150
 START WT 31.86076 g
 SOLUTION 1000 PPM Cl^- 85PPM HCO_3^- 20PPM SO_4^{2-}
 10 PPM NO_3^- 2PPM F^- 1000 ml AS FOLLOWS
 1.64897 g NaCl LOT 935535
 0.11933 g NaHCO_3 LOT 897789
 20 ml SO_4 - 8/94 p170 STOCK SOLUTION
 10 ml NO_3 - 8/94 STOCK SOLUTION p170
 2 ml F^- - 8/94 STOCK SOLUTION p170
 + DI WATER TO 1000 ml $T=95^\circ\text{C}$
 Hg THERMOMETER # 61771 CAL DUE 22 JULY 95
 START pH 8.425
 POTENTIOSTAT ESC 440 #1 CHANNEL # 3
 DATA SAVED AS LT82SP8B.DAT USING LONGTM.WBB
 REFERENCE SCE FISHER SCE 13-620-S1 SN 9214083
 $E_{\text{CORR}} -138\text{mV}$ KEITNLEY 614 # 555368
 $E_{\text{PT}} +165\text{mV}$ "
 $E_{\text{APP}} +100\text{mV}$ "
 SPECIMEN STARTED 8/15/94 5:20 PM
 STOPPED 9/12/94 5:20 PM
 END pH 8.870
 END WT 31.8578g
 NO SIGN OF LOCALIZED CORROSION

9/12/94

LONG TERM POTENTIOSTATIC TEST LT82SP4B

SPECIMEN SAME AS LT82SP4B P 151

AREA = 20 cm²

START WT 38.97666 g

2 PTFE CREVICE BLOCKS ON 0.75" x 0.75"
SURFACES HELD WITH C276 BOLT AND

NUT TORQUED TO 40 IN OZ WITH

PROTO 6103 CALIBRATED: 7/28/94 NEXT CAL DUE: 1/28/95

SOLUTION 1000 ppm Cl⁻ 85 ppm NaCO₃ 20 ppm SO₄²⁻10 ppm NO₃⁻ 2 ppm F⁻ 1000 ml AS FOLLOWS

1.64917 g NaCl LOT 935535

0.11834 g NaHCO₃ LOT 89778920 ml SO₄²⁻ - 8/94 STOCK SOLUTION p17010 ml NO₃⁻ - 8/94 STOCK SOLUTION p1702 ml F⁻ - 8/94 STOCK SOLUTION p170

+ DI WATER TO 1000 ml T = 95°C

H₂ THERMOMETER # 61644 CAL DUE 22 JULY 95

POTENTIOSTAT ESC 440 #1 CHANNEL # 4

DATA SAVED AS LT82SP4B.DAT USING LONGTM.WBB

REFERENCE SCG FISHER 13-620-SI SN 8211163

E_{corr} -114 mV KEITHLEY # 555368E_{GRAPHITE} -28 mV KEITHLEY 614 # 555368E_{APP} 0 mV

START pH 8.281

SPECIMEN STARTED 8/15/94 5:20 PM *DD*

STOPPED 9/12/94 5:20 PM

END pH 8.933

END WT 38.97859 g

NO SIGN OF LOCALIZED CORROSION

DD
9/12/94

LONG TERM POTENTIOSTATIC TEST LT82SP5B

SPECIMEN SAME AS LT82SP5A P 152

SURFACE AREA = 20 cm²

START WT 39.11332

2 PTFE CREVICE BLOCKS ON 0.75" x 0.75"

SURFACES HELD WITH C276 BOLT AND NUT

TORQUED TO 40 IN OZ WITH PROTO 6103

CALIBRATED 7/28/94 NEXT CAL DUE 1/28/95

SOLUTION 1000 ppm Cl⁻ 85 ppm NaCO₃ 20 ppm SO₄²⁻10 ppm NO₃⁻ 2 ppm F⁻ 1000 ml AS FOLLOWS

1.63045 g NaCl LOT 935535

0.12185 g NaHCO₃ LOT 89778920 ml SO₄²⁻ - 8/94 STOCK SOLUTION p17010 ml NO₃⁻ - 8/94 STOCK SOLUTION p1702 ml F⁻ - 8/94 STOCK SOLUTION p170

+ DI WATER TO 1000 ml T = 95°C

H₂ THERMOMETER # 115789 CAL DUE 22 JULY 95

POTENTIOSTAT ESC 440 #1 CHANNEL # 5

DATA SAVED AS LT82SP5B.DAT USING LONGTM.WBB

REFERENCE SCG FISHER 13-620-SI SN 9214074

E_{corr} -136 mVE_{GRAPHITE} -12 mV KEITHLEY 614 # 555368E_{APP} -100 mV

START pH 8.314

SPECIMEN STARTED 8/15/94 ~~5:20 PM~~ 8/15/94 5:20 PM

STOPPED 9/12/94 5:20 PM

END pH 9.370

END WT 39.11688 g

NO SIGN OF LOCALIZED CORROSION

DD
9/12/94

LONG TERM POTENTIOSTATIC TEST LT82SP6B

SPECIMEN SAME AS ~~LT82SP6B~~ DAT ~~P-90~~ 8/15/94
 LT82SP6A P153 AREA = 20 cm²

START WT 38.43841 g

2 PTFE CREVICE BLOCKS ON 0.75" x 0.75" SURFACES
 WELD WITH C276 BOLT AND ~~TOT~~ 8/15/94 NUT

TORQUE TO 40 IN·OZ USING PROTO 6103

CALIBRATED 7/28/94 NEXT CAL DUE 1/28/95

SOLUTION 1000 PPM Cl⁻ 85 PPM HCO₃ 20 PPM SO₄²⁻
 10 PPM NO₃ 2 PPM F⁻ 1000 ml AS FOLLOWS

1.64890 g NaCl LOT 935535

0.12246 g NaHCO₃ LOT 892789

20 ml SO₄ - 8/94 DD 8/15/94 SO₄ - 8/94 STOCK SOLUTION

10 ml NO₃ - 8/94 STOCK SOLUTION P170

2 ml F⁻ - 8/94 STOCK SOLUTION P170

+ DI WATER TO 1000 ml T = 95°C

Hg THERMOMETER 115809 CAL DUE 22 JULY 95

POTENTIOSTAT ESC 440 #1 CHANNEL # 6

DATA SAVED AS LT82SP6B.DAT USING LONGTERM.WBB

REFERENCE SCE FISHER 13-620-S1 SN 2134032

E_{SCHE} -112 mV KEITNEY 614 #555368

E_{GRAPH} -7 mV KEITNEY 614 #555368

E_{APP} +200 mV

START pH 8.319

SPECIMEN STARTED 8/15/94 5:20 pm

STOPPED 9/12/94 5:20 pm

END pH 9.007

END WT 38.43599 g

NO SIGN OF ADDITIONAL LOCALIZED CORROSION

[Signature]
 9/12/94

CREVICE CORROSION 304L-15

OBJECTIVE MEASURE pH Cl CONCENTRATION
 POTENTIAL AND CURRENT DENSITY INSIDE
 ACTIVE CREVICE

SPECIMEN 304L NT TO 954 d = 1.246 t.
 START WT.

600 SiC FINISH ON TOP OF SPECIMEN 60 SiC
 FINISH ON BOTTOM SIDE SPECIMEN IS SAME

AS 304L-14 REPOLISHED AT END OF 304L-14
 TEST

SOLUTION 1000 PPM Cl⁻ AS NaCl MAKE

BY 1.65004 g NaCl LOT 935535 + DI
 WATER TO 1000 ml

SOLUTION AT ROOM TEMPERATURE ≈ 24°C

SETUP SAME AS 304L-11 P154

pH ELECTRODE CALIBRATION DATA

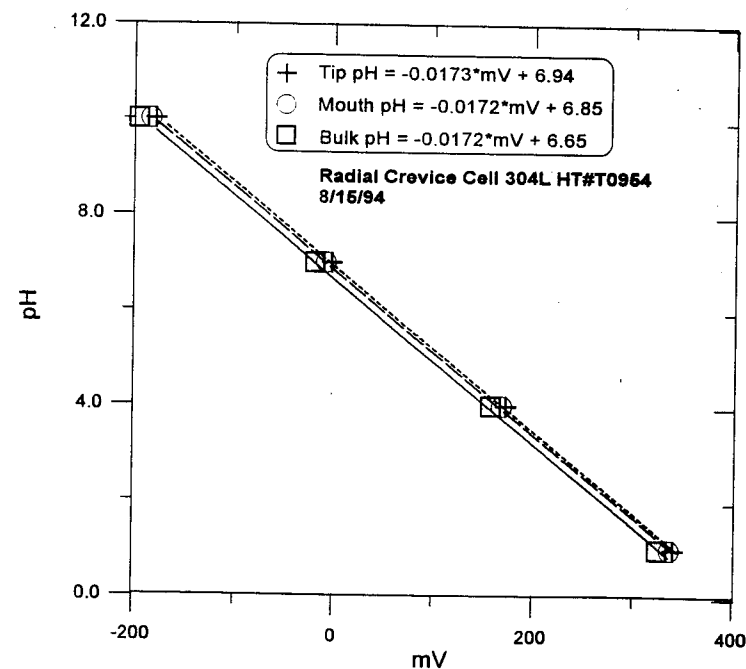
MIS06 45147	MIS06 49445	MIS06 44817
MI403 45867	MI403 44628	MI403 45860
TIP	MOUTH	BULK
pH	mV	mV
1.00	341	337
4.00	173	169
7.00	-2	-8
10.00	-179	-184

Cl ELECTRODE CALIBRATION DATA

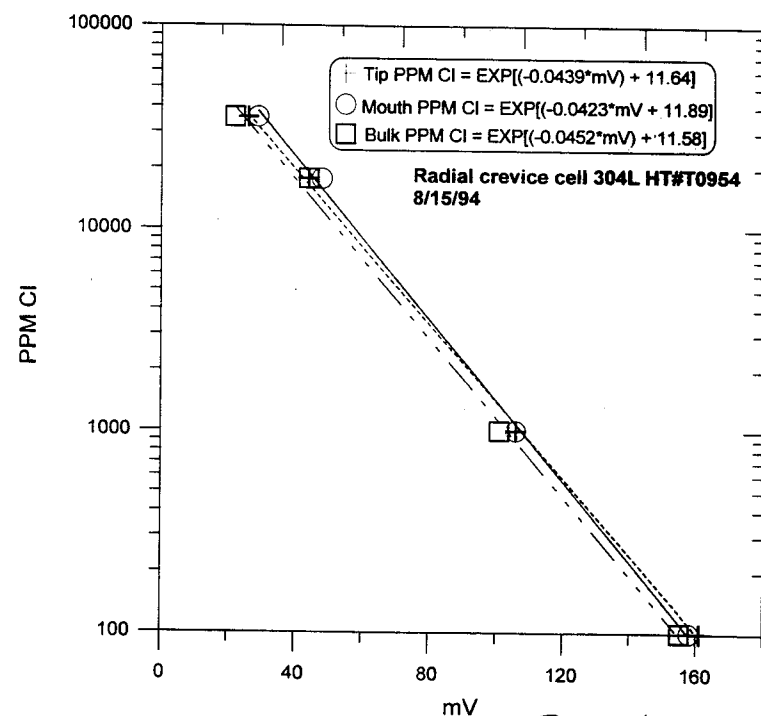
MI200 44176	MI200 47228	MI200 44447
MI403 41432	MI403 41402	MI403 41432
TIP	MOUTH	BULK
APMCl ⁻	mV	mV
100	161	158
1000	106	106
17725	44	48
35450	26	29

EQUATIONS AND CALIBRATION PLOTS P180

[Signature] 8/16/94



8/16/94



8/16/94

CREVICE CORROSION 304L-15

PH CI CONCENTRATION AND POTENTIAL MONITORED
STARTING AT 5:45 PM 8/15/94 $t=0$

CI INSIDE CREVICE CLOSE TO 1000-2000 PPM
ELECTRODES WERE SOMETIMES NOT IN CONTACT
WITH SOLUTION GIVING RISE TO ERRORS
SIMILAR TO RESULTS OBTAINED WITH 304L-14
CELL WAS PARTIALLY DISASSEMBLED AND
RE TORQUED TO SIN OR USING PROTO 6103

AT $t = 149000$ SEC $V_{SET} = 130 \text{ mV } A_1/A_2 \text{ CI}$

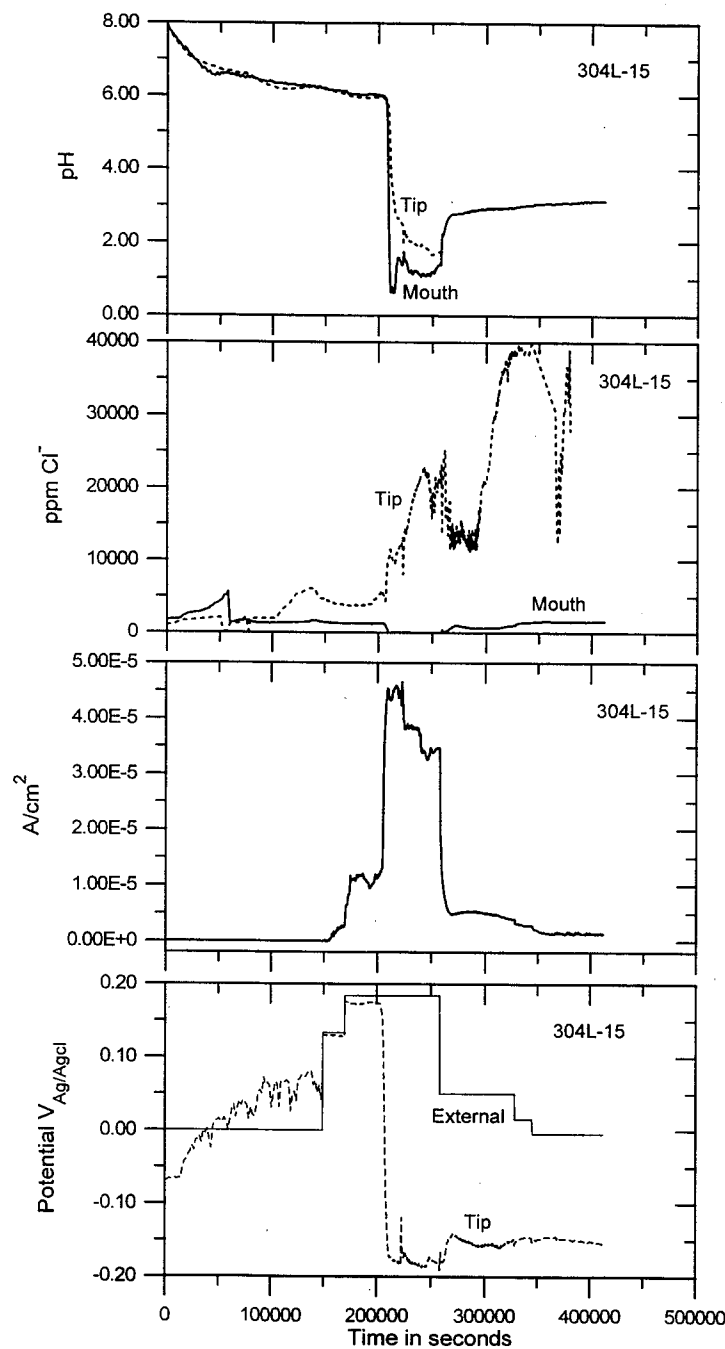
AT $t = 170000$ SEC $V_{SET} = 184 \text{ mV } A_1/A_2 \text{ CI}$

AT $t = 258000$ SEC $V_{SET} = 50 \text{ mV } A_1/A_2 \text{ CI}$

TIP CI AND PH ELECTRODES NOT READING
CORRECT VALUES AFTER POTENTIAL DECREASED
TO 50mV ALL OTHER ELECTRODES
APPEAR TO BE WORKING. PLOT
OF PH CI A/cm^2 AND POTENTIAL VS TIME
ON PAGE 182.

8/23/94

CREVICE CORROSION 304L-15



Paul
8/23/94

POTENTIOSTATIC POLARIZATION PS825C1

OBJECTIVE DETERMINING INITIATION TIME
FOR CREVICE CORROSION ON ALLOY 825
SPECIMEN ALLOY 825 NN4371FG 600S.C
FINISH SAME SPECIMENTYPE AS SHOWN ON PAGE
238 OF IWP6 045

START WT. 20.54158

SOLUTION 1000 PPM Cl⁻ 85PPM HCO₃⁻ 20PPM SO₄⁻
10 PPM NO₃⁻ 2PPM F⁻ 1000 ml MARC AS FOLLOWS
1.64825 g NaCl LOT 935535

0.12011 g NaHCO₃ LOT 897789

20 ml SO₄-8/94 STOCK SOLUTION p170

10 ml NO₃-8/94 STOCK SOLUTION p170

2 ml F⁻ 8/94 STOCK SOLUTION p170

+ DI WATER TO 1000 ml DEAERATED WITH
99.999% NITROGEN FROM LIQUID CARBONIC

TEMPERATURE = 95°C H₂ THERMOMETER 0323004 CAL DUE 21 MAR/95

REFERENCE SCE FISHER 13-620-SI SN 0165403

POTENTIOSTAT EG&G 273 SN ~~41108~~ DD 9/1/94 41108

E_{corr} - 476 mV KEITHLEY 614 SN 555368

~~E_{pt} - 430 mV KEITHLEY 614 SN 555368 DD 9/1/94~~

E_{APPLIED} +550 mV

DATA SAVED AS PS825C1.DAT

E_{pt} - 208 mV KEITHLEY 614 SN 555368

START pH 8.214

END pH 9.668

END WT. 20.52830 g

SHALLOW PIT DD 9/2/94 PITS AND

CREVICE CORROSION ON SPECIMEN SURFACE.

Paul 9/2/94

CREVICE CORROSION 316L-1

OBJECTIVE MEASURE pH Cl CONCENTRATION
POTENTIAL AND CURRENT DENSITY INSIDE
ACTIVE CREVICE

SPECIMEN 316L P80746 $d = 1.249$ $t = 0.123$
600 S.C FINISH ON TOP AND 60 S.C
FINISH ON BOTTOM

SOLUTION 1000 PPM Cl^- AS NaCl MARG
WITH 1.65044 g NaCl LOT 935535 +
DI WATER TO 1000 ml

SOLUTION AT ROOM TEMP $\approx 24^\circ C$

SETUP SAME AS 304L-11 P154

pH ELECTRODE CALIBRATION DATA

MIS06 45147	MIS06 49445	MIS06 44817
MI403 43647	MI403 44628	MI403 45860

	TIP	MOUTH	BULK
pH	mV	mV	mV
1.00	348	344	325
4.00	177	177	160
7.00	1.4	0.8	-19
10.00	-175	-173	-197

Cl ELECTRODE CALIBRATION DATA

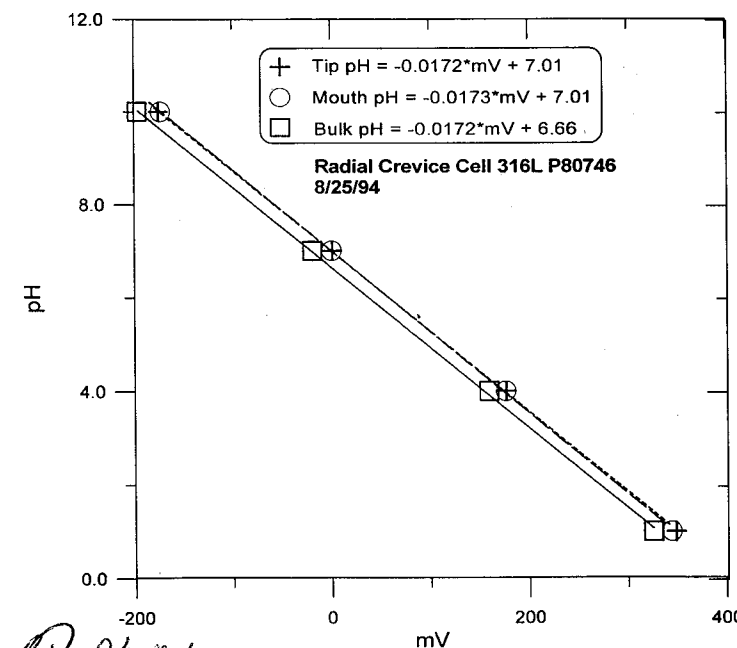
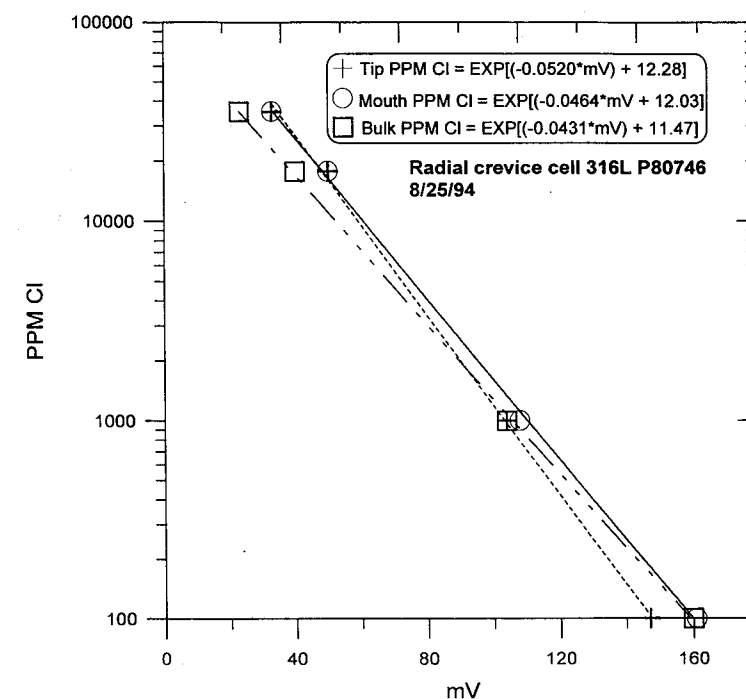
MI200 44172	MI200 47228	MI200 44447
MI402 43636	MI403 41402	MI403 41432

	TIP	MOUTH	BULK
ppm Cl^-	mV	mV	mV
100	147	161	160
1000	104	110	105
17725	50	50	40
35450	33	33	23

EQUATIONS AND CALIBRATION PLOTS
P 185.

David D 9/2/94

CREVICE CORROSION 316L-1



David D 9/2/94

David D
9/2/94

CREVICE CORROSION 316L-1
CONDITIONS AT START OF TEST

	WORK BENCH	METERS	
pH TIP	6.37	ORION	37 mV
pH MOUTH	6.30	ORION	41 mV
pH BULK			73 mV
Cl TIP	710 ppm	ORION	112 mV
Cl MOUTH	1000 ppm	ORION	105 mV
Cl BULK		ORION	101 mV
E _{CORR}		KEITHLEY 614	-25 mV

CURRENT POTENTIAL pH AND Cl MONITORED
THROUGHOUT DURATION OF TEST

WORK BENCH CALCULATION CHECK

pH TIP = 6.37 WHEN ORION = 37 mV
FROM PAGE 185 pH = $-0.0172 \text{ mV} + 7.01$

$$\text{pH} = -0.0172(37) + 7.01 = 6.37$$

pH MOUTH = 6.30 WHEN ORION = 41 mV
FROM PAGE 185 pH = $-0.0173 \text{ (mV)} + 7.01$

$$\text{pH} = -0.0173(41) + 7.01 = 6.30$$

Cl TIP = 710 ppm WHEN ORION = 112 mV
FROM PAGE 185 Cl(ppm) = $\text{Exp} [(-0.0520 \text{ mV}) + 12.28]$

$$\text{Cl ppm} = \text{Exp} [(-0.0520 \overset{112}{\cancel{720}}) + 12.28] = 636 \text{ ppm}$$

RR 9/2/94

Cl MOUTH = 1000 ppm WHEN ORION = 105 mV
FROM 185 Cl ppm = $\text{Exp} [(-0.0464 \text{ (mV)}) + 12.03]$

$$\text{Cl ppm} = \text{Exp} [-0.0464(105) + 12.03] = 1284 \text{ ppm}$$

Cmnd Q 9/2/94

CREVICE CORROSION 316L-1

$$\begin{aligned} \text{pH BULK} &= -0.0172 \text{ (mV)} + 6.66 \\ &= -0.0172(73) + 6.66 = 5.40 \end{aligned}$$

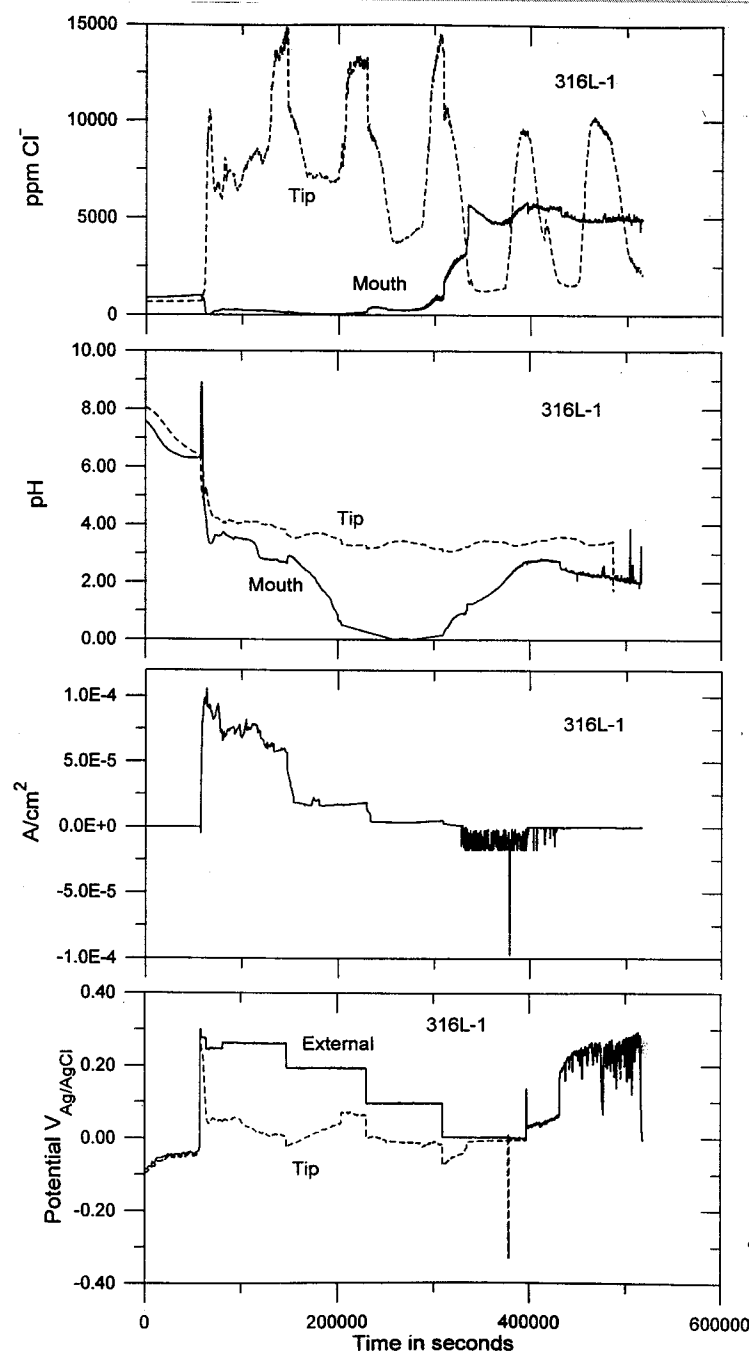
$$\begin{aligned} \text{Cl (ppm) BULK} &= \text{Exp} [(-0.0431 \text{ mV}) + 11.47] \\ &= \text{Exp} [-0.0431(101) + 11.47] \\ &= 1232 \text{ ppm Cl} \end{aligned}$$

OUTPUT OF pH AND Cl DATA WITH POTENTIAL
AND CURRENT DENSITY ON PAGE 188

REMARKS: CREVICE CORROSION OCCURRED NEAR
MOUTH ON TOP SURFACE OF SPECIMEN
AND AT MULTIPLE LOCATIONS ON BOTTOM
SIDE OF SPECIMEN. CREVICE CORROSION
WAS INITIATED QUICKLY AS DD 9/2/94
AT 300 mV. THE pH AND Cl ELECTRODES
RESPONDED WELL EXCEPT DURING THE
LATE PORTIONS OF THE TEST WHEN CORROSION
PRODUCTS INTERFERED WITH CORRECT
MEASUREMENTS OF pH. AFTER REMOVAL FROM
THE CELL THE ELECTRODES WERE REMOVED
AND CLEANED AND WERE READING CORRECTLY
IN STANDARD SOLUTIONS.

David D
9/2/94

CREVICE CORROSION 316L-1



9/2/94

9/2/94

9/6/94

STOCK SOLUTIONS 9/94

SO₄ - 9/94 1000 PPM SO₄²⁻ AS Na₂SO₄
 1.47165 g Na₂SO₄ LOT 901213 +
 DI WATER TO 1000 ml EXP 10/10/94

NO₃ - 9/94 1000 PPM NO₃⁻ AS NaNO₃
 1.39375 g NaNO₃ LOT 897183 +
 DI WATER TO 1000 ml EXP 10/10/94

F - 9/94 1000 PPM F⁻ AS NaF
 1.87051 g NaF LOT 896405 +
 DI WATER TO 1000 ml EXP 10/10/94

100 Cl - 9/94 100 PPM Cl⁻ AS NaCl
 0.16376 g NaCl LOT 935535 +
 DI WATER TO 1000 ml EXP 10/10/94

1000 Cl 9/94 1000 PPM Cl⁻ AS NaCl
~~1.64~~ 3.29951 g NaCl LOT 935535 +
 DI WATER TO 2000 ml EXP 10/10/94

0.5M Cl - 9/94 0.5 MOLAR Cl⁻ AS NaCl
~~22.00~~ 29.21940 g NaCl LOT 935535 +
 DI WATER TO 1000 ml EXP 10/10/94

1M Cl - 9/94 1 MOLAR Cl⁻ AS NaCl
 58.45208 g NaCl LOT 935535 +
 DI WATER TO 1000 ml EXP 10/10/94

9/6/94

CREVICE CORROSION 316L-2

OBJECTIVE MEASURE pH CI CONCENTRATION
CURRENT DENSITY AND POTENTIAL INDEX
ACTIVE CREVICE

SPECIMEN 316L P80746 600 S.C FINISH
ON TOP 60 S.C FINISH ON BOTTOM
START WT 24.25687 $d = 1.248"$ $d_i = 0.00$ DD 9/14/94
 $t = 0.121"$

SOLUTION 0.5 MOLAR Cl^- AS NaCl
58.43614 g NaCl LOT 935535 +
DI WATER TO 2000 ml
SOLUTION TEMPERATURE = 24°C (ROOM TEMPERATURE)
SETUP OF TEST SAME AS 304L-11 p154

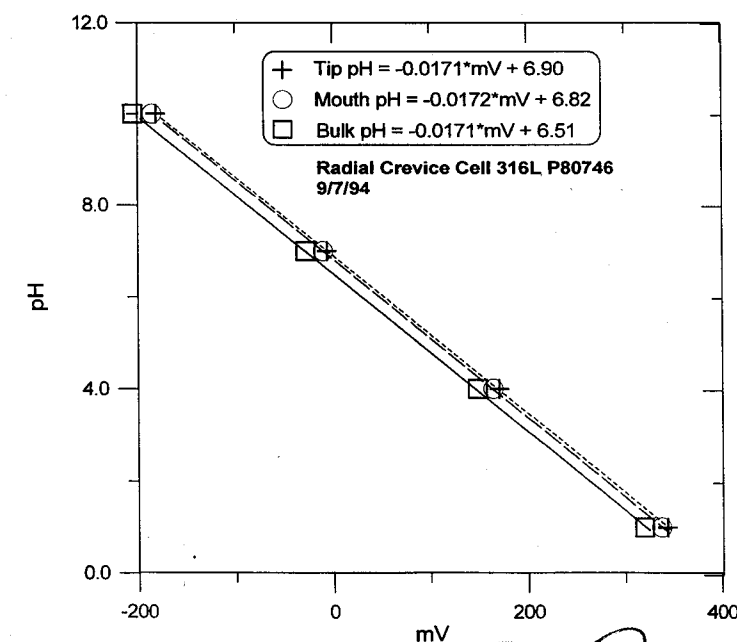
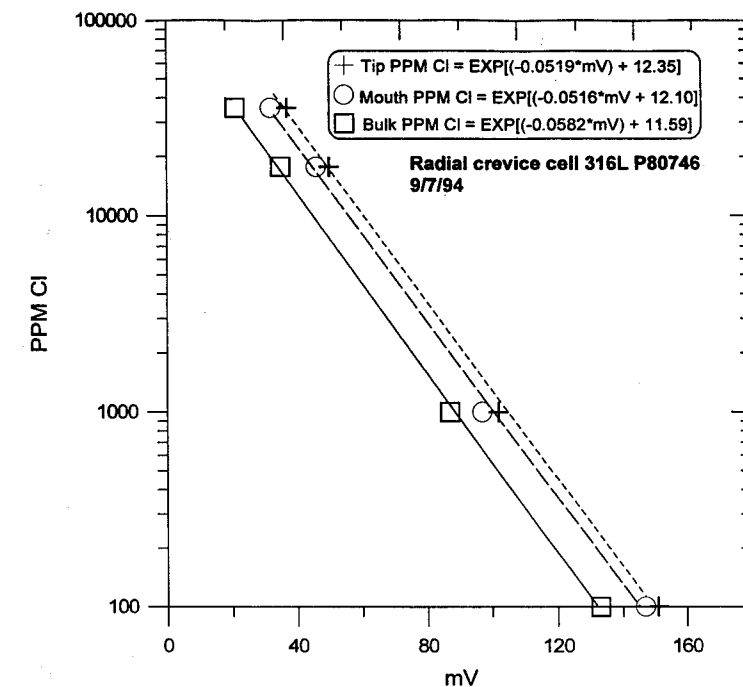
pH CALIBRATION DATA

pH TIP		pH BULK MOON DD 9/14/94		pH BULK DD 9/14/94	
MI 506	45147	MI 506	44817	MI 506	49445
MI 403	45867	MI 403	45860	MI 403	44628
pH	mV	pH	mV	pH	mV
1.00	344	3.20	338		
4.00	171	1.49	165		
7.00	-6	-28	-10		
10.00	-181	-205	-185		

Cl ELECTRODE CALIBRATION DATA

Cl TIP		Cl BULK		Cl MOON	
MI 200	44176	MI 200	44447	MI 200	47228
MI 403	43636	MI 403	41432	MI 403	41402
DD 9/14/94	mV	DD 9/14/94	mV	DD 9/14/94	mV
Cl PPM					
100	151	133	147		
1000	102	87	97		
17725	50	35	46		
35450	87	21	32		

CREVICE CORROSION 316L-2



DD 9/14/94

CONDITIONS AT START OF TEST

6:00 PM 9/7/94 t=0

	WORKBENCH	METERS
E_{CORR}	-180 mV	-189
PH TIP	8.25	-79.9 mV
PH MOUTH	8.09	+35 - 73.9 mV
PH BULK	-	+35 mV
Cl TIP	23400	47 mV
Cl MOUTH	15400	44 mV
Cl BULK	-	35 mV
E_{TIP}	-194	-191 mV

TIP Cl ELECTRODES REMOVED AT 22600 SEC TO REMOVE BUBBLE IN DOUBLE JUNCTION REFERENCE ELECTRODE.

MOUTH AND TIP Cl ELECTRODES PULLED FROM CELL AT t=158500 SEC AND PLACED IN 1000 ppm Cl^- AFTER 10 min MV READINGS WERE:

Cl TIP / 1000 ppm Cl^- = 96.9 mV
 Cl MOUTH / 1000 ppm Cl^- = 93.3 mV
 A DECREASE OF 4 TO 6 mV FROM CALIBRATION

BULK Cl ELECTRODES MV OUTPUT DECREASED FROM 35 mV AT START TO 31 mV AT 137300 SEC AND TO 25 mV AT t=400000 SEC
 BULK pH AT t=400000 = 102.5 mV

POST PH ELECTRODE CHECK PERFORMED 9/13/94

PH	TIP mV	MOUTH mV	BULK mV
1.00	339	335	316
4.00	165	162	143
7.00	-41.4	-8.4	-29.4
10.00	-181	-185	-209

9/14/94

Cl AT TIP LOCATION INCREASED UNDER O.C. AND CREVICE CORROSION WAS INITIATED UNDER O.C. CONDITIONS. Cl TIP ELECTRODE DETERIORATED AS THE TEST PROGRESSED AT t=400000 SEC ALL OF THE AgCl ON THE MI 200 AT THE TIP LOCATION WAS CONSUMED FORCING THE TERMINATION OF THE TEST.

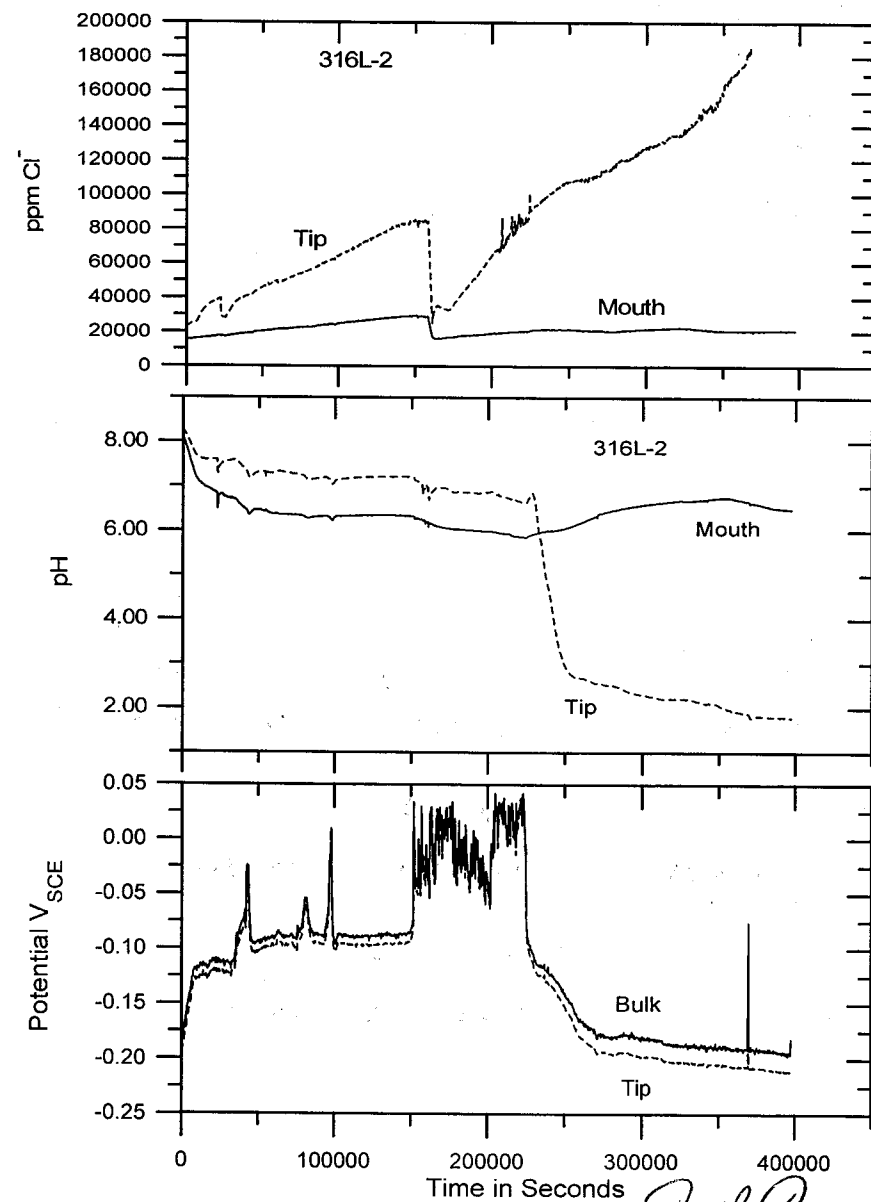
POST ELECTRODE CHECK OF Cl ELECTRODES

Cl	MOUTH	BULK
100	134	70
1000	92	68.7
17725	41	26.4
35450	27	6.2

DECREASE IN Cl BULK OUTPUT WITH TIME AS NOTED ON p192 IS NOT DUE TO INCREASE IN BULK Cl CONCENTRATION BUT RATHER THE CONSUMPTION OF AgCl ON THE MI 200 BULK Cl ISE ELECTRODE. Cl CONCENTRATION OF BULK SOLUTION REMAINS AT 0.5 MOLAR THROUGHOUT DURATION OF TEST. Cl MOUTH ELECTRODE HAD A DECREASE IN MV OUTPUT. Cl CONCENTRATION AT MOUTH LIKELY REMAINS AT OR NEAR 0.5 MOLAR DURING COURSE OF TEST. Cl TIP ELECTRODE APPEARED TO FUNCTION PROPERLY UP UNTIL 300,000 SEC. HOWEVER CONCENTRATION OF Cl ABOVE 35450 ppm ARE EXTRAPOLATED FROM CALIBRATION DATA. HIGHEST Cl CONCENTRATION USED IN CALIBRATION WAS 1.0 MOLAR = 35450 ppm Cl^- DATA SAVED AS 316L-2.DAT USING WORKBENCH OUTPUT OF DATA FILE ON p 194

9/14/94

316L-2 CREVIC CORROSION



9/14/94

9/14/94

LONG TERM POTENTIOSTATIC TEST LT82SP2L

SPECIMEN SAME AS LT82SP2K p173

START WT. 30.82226g

SOLUTION 1000 ppm Cl⁻ 85 ppm HCO₃⁻ 20 ppm SO₄⁻
10 ppm NO₃⁻ 2 ppm F⁻ 2000 ml MAKE AS FOLLOWS

3.29768 g NaCl LOT 935535

0.24989 g NaHCO₃ LOT 897789

40 ml SO₄ - 9/94 STOCK SOLUTION p 189

20 ml NO₃ - 9/94 STOCK SOLUTION p 189

4 ml F⁻ - 9/94 STOCK SOLUTION p 189

+ DI WATER TO 2000 ml T=95°C

N₂ THERMOMETER 183303 CAL DUG 28 JAN 95

START pH 7.938

POTENTIOSTAT ESC 440 #1 CHANNEL #1

DATA SAVED AS LT82SP2L.DAT USING LONGTM.WBB

REFERENCE SC6 FISHER 13-620-S1 SN 2134032

E_{corr} -57 mV REFERENCE 614 SN 555368

E_{pt} +163 mV REFERENCE 614 SN 555368

E_{app} 0 mV.

SPECIMEN STARTED 9/14/94 4:40pm

SPECIMEN STOPPED 10/12/94 4:45pm

END pH 8.939

END WT = 30.82210g

NO SIGN OF LOCALIZED CORROSION

9/14/94 10/12/94

LONG TERM POTENTIOSTATIC TEST

SPECIMEN SAME AS LT82SP7B P174

START WT 30.31561g

SOLUTION 1000 ppm Cl^- 85 ppm HCO_3^- 20 ppm SO_4^{2-}
10 ppm NO_3^- 2 ppm F^- 2000 ml MAKE AS FOLLOWS

3.29755 g NaCl LOT 935535

0.24329 g NaHCO_3 LOT 89778940 ml SO_4 -9/94 STOCK SOLUTION p18920 ml NO_3 -9/94 STOCK SOLUTION p1894 ml F^- -9/94 STOCK SOLUTION p189+ DI WATER TO 2000 ml $T=95^\circ\text{C}$

Hg THERMOMETER 183304 CML D06 28 JAN 95

START pH 8.134

9/14/94

POTENTIOSTAT ESC 440 #1 CHANNEL #2

DATA SAVED AS LT82SP7C.DAT USING LONGTM.WDB

REFERENCE SCE FISHER 13-620-S1 SN 9214074

 E_{corr} -115 mV KEITNEY 614 SN 555368 E_{pt} +144 mV KEITNEY 614 SN 555368 E_{app} 200 mV

SPECIMEN STARTED 9/14/94 4:40 pm

SPECIMEN STOPPED 10/12/94 4:45 pm

END pH 9.21

END WT 30.31204

NO SIGN OF LOCALIZED CORROSION


10/12/94

LONG TERM POTENTIOSTATIC TEST LT82SP8C

SPECIMEN SAME AS LT82SP8B P175

START WT 31.85784g

SOLUTION 1000 ppm Cl^- 85 ppm HCO_3^- 20 ppm SO_4^{2-}
10 ppm NO_3^- 2 ppm F^- 1000 ml MAKE AS FOLLOWS

1.65028 g NaCl LOT 935535

0.12366 g NaHCO_3 LOT 89778920 ml SO_4 -9/94 STOCK SOLUTION p18910 ml NO_3 -9/94 STOCK SOLUTION p1892 ml F^- -9/94 STOCK SOLUTION p189+ DI WATER TO 1000 ml $T=95^\circ\text{C}$

Hg THERMOMETER 115789 CML D06 22 JULY 95

START pH 8.129

POTENTIOSTAT ESC 440 #1 CHANNEL #3

DATA SAVED AS LT82SP8C.DAT USING LONGTM.WDB

REFERENCE SCE FISHER 13-620-S1 SN 8211163

 E_{corr} -150 mV KEITNEY 614 SN 555368 E_{pt} +134 mV KEITNEY 614 SN 555368 E_{app} 100 mV

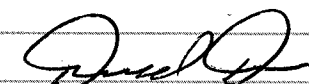
SPECIMEN STARTED 9/14/94 4:40 pm

SPECIMEN STOPPED 10/12/94 4:45 pm

END pH 9.071

END WT 31.85557g

NO SIGN OF LOCALIZED CORROSION


10/12/94

LONG TERM POTENTIOSTATIC TEST LT82SP4C

SPECIMEN SAME AS LT82SP4B p 176

AREA = 20 cm²

START WT 38.9785g

2 PTFE CRUICK BLOCKS ON 0.75" x 0.75"

SURFACES HELD WITH C276 BOLT AND NUT

TORQUED TO 40 IN·OZ WITH PROTO 6103

CALIBRATED 7/28/94 NEXT CAL DUE 1/28/95

SOLUTION 1000 PPM Cl⁻ 85 PPM HCO₃⁻ 20 PPM SO₄²⁻10 PPM NO₃⁻ 2 PPM F⁻ 1000 ml MAKE AS FOLLOWS

1.65096 g NaCl LOT 935535

0.12524 g NaHCO₃ LOT 89778920 ml SO₄²⁻ 9/94 STOCK SOLUTION p18910 ml NO₃⁻ 9/94 STOCK SOLUTION p1892 ml F⁻ 9/94 STOCK SOLUTION p189

+ DI WATER TO 1000 ml T=95°C

Hg THERMOMETER 61644 CAL DUE 22 JULY 95

POTENTIOSTAT ESC 440 #1 CHANNEL #4

DATA SAVED AS LT82SP4C.DAT USING LONGTM.CUBB

REFERENCE SCE FISHER 13-620-S1 SN 9214083

E_{CORR} -112 mV KEITHLEY 614 SN 555368E_{GRAPHITE} -6 mV KEITHLEY 614 SN 555368E_{APP} 0 mV

START pH 8.057

SPECIMEN STARTED 9/14/94 4:40 PM

SPECIMEN STOPPED 10/12/94 4:45 PM

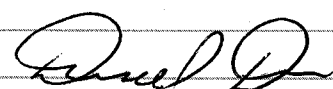
END pH 8.968

END WT 38.97153

SPECIMEN ULTRASONICALLY CLEANED TO REMOVE

SCALE ON POST REGION NO SIGN OF

LOCALIZED CORROSION

 10/19/94

LONG TERM POTENTIOSTATIC TEST LT82SP5C

SPECIMEN SAME AS LT82SP5B p 177

AREA = 20 cm²

START WT 39.11689

2 PTFE CRUICK WASHERS ON 0.75" x 0.75"

SURFACES HELD WITH C276 BOLT AND NUT

TORQUED TO 40 IN·OZ WITH PROTO 6103

CALIBRATED 7/28/94 CAL DUE 1/28/95

SOLUTION 1000 PPM Cl⁻ 85 PPM HCO₃⁻ 20 PPM SO₄²⁻10 PPM NO₃⁻ 2 PPM F⁻ 1000 ml MAKE AS FOLLOWS

1.65040 g NaCl LOT 935535

0.12404 g NaHCO₃ LOT 89778920 ml SO₄²⁻ 9/94 STOCK SOLUTION p18910 ml NO₃⁻ 9/94 STOCK SOLUTION p1892 ml F⁻ 9/94 STOCK SOLUTION p189

+ DI WATER TO 1000 ml T=95°C

Hg THERMOMETER 61771 CAL DUE 22 JULY 95

POTENTIOSTAT ESC 440 #1 CHANNEL #5

DATA SAVED AS LT82SP5C.DAT USING LONGTM.WBB

REFERENCE SCE FISHER 13-620-S1 SN 3106343

E_{CORR} -126 mV KEITHLEY 614 SN 555368E_{GRAPHITE} -51 mV KEITHLEY 614 SN 555368E_{APPLIED} -100 mV

START pH 8.213

SPECIMEN STARTED 9/14/94 4:40 PM

SPECIMEN STOPPED 10/12/94 4:45 PM

END pH 9.339

END WT 39.10965g

SPECIMEN ULTRASONICALLY CLEANED TO REMOVE

SCALE ON POST REGION NO SIGN OF

LOCALIZED CORROSION

 10/18/94

LONG TERM POTENTIOSTATIC TEST LT82SP6C

SPECIMEN SAME AS LT82SP6B P 178

AREA = 20 cm²

START WT = 38.43599 g

2 PTFE CRVICE BLOCKS ON 0.75" x 0.75"

SURFACES NGLD WITH C276 BOLT AND NUT

TORQUED TO 40 IN.OZ USING PROTO 6103

CALIBRATED 7/28/94 NGXT CAL DUE 11/28/95

SOLUTION 1000 ppm Cl⁻ 85 ppm HCO₃⁻ 20 ppm SO₄²⁻10 ppm NO₃⁻ 2 ppm F⁻ ~~10000~~ 9/14/94

1000 ml MADE AS FOLLOWS.

1.64961 g NaCl LOT 935535

0.12023 g NaHCO₃ LOT 89778920 ml SO₄ - 9/94 STOCK SOLUTION p18910 ml NO₃ - 9/94 STOCK SOLUTION p1892 ml F⁻ - 9/94 STOCK SOLUTION p189

+ DI WATER TO 1000 ml T = 95°C

H₂ THERMOMETER 115809 CAL DUE 22 JULY 95

POTENTIOSTAT ESC 440 #1 CHANNEL #6

DATA SAVER AS LT82SP6C.DAT USING LONGTM.WBS

REFERENCE SCE FISHER 13-620-S1 SN 3106337

E_{corr} -92 mV KEITHLEY 614 SN 555368E_{GRAPHITE} -14 mV KEITHLEY 614 SN 555368E_{APPLIED} 200 mV

START pH 8.197

SPECIMEN STARTED 9/14/94 4:40 pm

SPECIMEN STOPPED 10/12/94 4:45 pm

END pH 9.051

END WT: 38.43407 g

SPECIMEN ULTRASONICALLY CLEANED TO REMOVING

SCALE ON POST REGION AT SOLUTION/VAPOR

INTERFACE NO SIGN OF ADDITIONAL LOCALIZED

CORROSION

 10/19/94

LONG TERM POTENTIOSTATIC TEST LT82SP2M

SPECIMEN SAME AS LT82SP2L P195

START WT 30.82210 g

SOLUTION 1000 ppm Cl⁻ 85 ppm HCO₃⁻ 20 ppm SO₄²⁻10 ppm NO₃⁻ 2 ppm F⁻ 2000 ml MADE AS FOLLOWS

3.29558 g NaCl LOT 935535

0.24491 g NaHCO₃ LOT 89778940 ml SO₄ - 10/94 STOCK SOLUTION p 20720 ml NO₃ - 10/94 STOCK SOLUTION p 2074 ml F⁻ - 10/94 STOCK SOLUTION p 207

+ DI WATER TO 2000 ml T = 95°C

H₂ THERMOMETER 183303 CAL DUE 28 JAN 95

START pH 8.204

POTENTIOSTAT ESC 440 #1 CHANNEL #1

DATA SAVER AS LT82SP2M.DAT USING LONGTM.WBS

REFERENCE SCE FISHER 13-620-S1 SN 2134032

E_{corr} -46 mV KEITHLEY 614 SN 555368E_{pt} +133 mV KEITHLEY 614 SN 555368E_{APP} ~~200 mV~~ 10/20/94 0 mV

SPECIMEN STARTED 5:00 pm 10/20/94


SPECIMEN STOPPED 4:00 pm ~~TOT~~ 11/17/94 11/17/94

END pH 9.150

END WT 30.82117 g

RUNTIME 2419200 SEC

NO SIGN OF LOCALIZED CORROSION



11/21/94

LONG TERM POTENTIOSTATIC TEST LT82SP7D

SPECIMEN SAME AS LT82SP7C P196

START WT = 30.31204g

SOLUTION 1000 ppm Cl^- 85 ppm NaCO_3 20 ppm SO_4^{2-} 10 ppm NO_3^- 2 ppm F^- 2000 ml MAKE AS FOLLOWS

3.29892 g NaCl LOT 935535

0.24609 g NaHCO_3 LOT 89778940 ml SO_4 - 10/94 STOCK SOLUTION20 ml NO_3 - 10/94 STOCK SOLUTION4 ml F^- - 10/94 STOCK SOLUTION+ DI WATER TO 2000 ml $T=95^\circ\text{C}$ Hg THERMOMETER 183304 CAL DUE 28 JAN 95

START pH 8.284

POTENTIOSTAT ESC 440 #1 CHANNEL #2

DATA SAVED AS LT82SP7D.DAT USING LONGTM.WBB

REFERENCE SCE FISHER 13-620-S1 SN 9214074

 E_{corr} -56 mV KEITHLEY 614 SN 555368 E_{PT} +157 mV KEITHLEY 614 SN 555368 E_{APP} 200 mV

SPECIMEN STARTED 5:00 pm 10/20/94

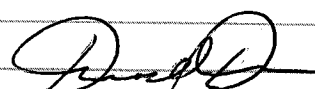
SPECIMEN STOPPED 4:00 pm 11/17/94

END pH 9.152

END WT 30.31146g

RUNTIME 2419200 SEC

NO SIGN OF LOCALIZED CORROSION


 11/21/94

LONG TERM POTENTIOSTATIC TEST LT82SP8D

SPECIMEN SAME AS LT82SP8C P197

START WT 31.85557

SOLUTION 1000 ppm Cl^- 85 ppm NaCO_3 20 ppm SO_4^{2-} 10 ppm NO_3^- 2 ppm F^- 1000 ml MAKE AS FOLLOWS

1.64492 g NaCl LOT 935535

0.12311 g NaHCO_3 LOT 89778920 ml SO_4 - 10/94 STOCK SOLUTION10 ml NO_3 - 10/94 STOCK SOLUTION2 ml F^- - 10/94 STOCK SOLUTION+ DI WATER TO 1000 ml $T=95^\circ\text{C}$ Hg THERMOMETER 115789 CAL DUE 22 JULY 95

START pH 8.151

POTENTIOSTAT ESC 440 #1 CHANNEL #3

DATA SAVED AS LT82SP8D.DAT USING LONGTM.WBB

REFERENCE SCE FISHER 13-620-S1 SN 3106337

 E_{corr} -107 mV KEITHLEY 614 SN 555368 E_{PT} +161 mV KEITHLEY 614 SN 555368 E_{APP} 100 mV

SPECIMEN STARTED 10/20/94 5:00 pm

SPECIMEN STOPPED 11/17/94 4:00 pm

END WT 31.85500g

END pH 9.128

RUNTIME 2419200 SEC

NO SIGN OF LOCALIZED CORROSION


 11/21/94

LONG TERM POTENTIOSTATIC TEST LTR2SP4D

SPECIMEN SAME AS LTR2SP4C P198

START WT = 38.97153g

DD 10/20/94

2 PTFE CREVICE BLOCKS ON ~~0.75" x 0.75"~~ 0.75" x 0.75"

SURFACES HELD WITH C276 BOLT AND NUT

TORQUED TO 40 IN. OZ USING PROTO 6103

CALIBRATED 7/28/94 NEXT CAL DUE 1/28/95

SOLUTION 1000 PPM Cl^- 85 PPM HCO_3^- 20 PPM SO_4^{2-} 10 PPM NO_3^- 2 PPM F^- 1000 ml MAKE AS FOLLOWS

1.64687 g NaCl LOT 935535

0.12074 g NaHCO_3 LOT 89778920 ml SO_4^{2-} 10/94 STOCK SOLUTION10 ml NO_3^- 10/94 STOCK SOLUTION2 ml F^- 10/94 STOCK SOLUTION+ DI WATER TO 1000 ml $T = 95^\circ\text{C}$ H_2 THERMOMETER 81644 CAL DUE 22 JULY 95

POTENTIOSTAT ESC 440 #1 CHANNEL #4

DATA SAVED AS LTR2SP4D.DAT USING LONGTM.WBB

REFERENCE SCE FISHER 13-620-SI SN 9214083

E CORN -136 mV KEITHLEY 614 SN 555368

E GRAPHITE -10 mV KEITHLEY 614 SN 555368

E APP 0 mV

START pH 8.235

SPECIMEN STARTED 10/20/94 5:00 PM

SPECIMEN STOPPED 11/17/94 4:00 PM

END pH 8.964

END WT 38.96549g

RUNTIME 2419200 SEC

NO SIGN OF LOCALIZED CORROSION

Dud 11/21/94

LONG TERM POTENTIOSTATIC TEST LTR2SP5D

SPECIMEN SAME AS LTR2SP5C P199

START WT 39.10965g

2 PTFE CREVICE BLOCKS ON 0.75" x 0.75"

SURFACES HELD WITH C276 BOLT AND NUT

TORQUED TO 40 IN. OZ USING PROTO 6103

CALIBRATED 7/28/94 NEXT CAL DUE 1/28/95

SOLUTION 1000 PPM Cl^- 85 PPM HCO_3^- 20 PPM SO_4^{2-} 10 PPM NO_3^- 2 PPM F^- 1000 ml MAKE AS FOLLOWS

1.64999 g NaCl LOT 935535

0.12921 g NaHCO_3 LOT 89778920 ml SO_4^{2-} 10/94 STOCK SOLUTION10 ml NO_3^- 10/94 STOCK SOLUTION2 ml F^- 10/94 STOCK SOLUTION+ DI WATER TO 1000 ml $T = 95^\circ\text{C}$ H_2 THERMOMETER 61771 CAL DUE 22 JULY 95

POTENTIOSTAT ESC 440 #1 CHANNEL #5

DATA SAVED AS LTR2SP5D.DAT USING LONGTM.WBB

REFERENCE SCE FISHER 13-620-SI SN 3106343

E CORN -84 mV KEITHLEY 614 SN 555368

E GRAPHITE -26 mV KEITHLEY 614 SN 555368

E APP -100 mV

START pH 8.201

SPECIMEN STARTED 10/20/94 5:00 PM

SPECIMEN STOPPED 11/17/94 4:00 PM

END pH 8.954

END WT 39.14983g

RUNTIME 2419200 SEC

NO CREVICE CORROSION SOME SCALE ON
SPECIMEN SURFACE.

Dud 11/21/94

LONG TERM POTENTIOSTATIC TEST LTR2SP6D

SPECIMEN SAME AS LTR2SP6C P200

START WT 38.43407g

2 PTFE CREVICE BLOCKS ON 0.75" x 0.75"

SURFACES HELD WITH C276 NUT AND BOLT

TORQUED TO 40 IN.-OZ WITH PROTO 6103

CALIBRATED 7/28/94 NEXT CAL DUE 1/28/95

SOLUTION 1000 PPM Cl^- 85 PPM HCO_3^- 20 PPM SO_4^{2-} 10 PPM NO_3^- 2 PPM F^- 1000 ml MAKE AS FOLLOWS

1.64911 g NaCl LOT 935535

0.12359 g NaHCO_3 LOT 89778920 ml SO_4^{2-} 10/94 STOCK SOLUTION10 ml NO_3^- 10/94 STOCK SOLUTION2 ml F^- 10/94 STOCK SOLUTION+ DI WATER TO 1000 ml $T = 95^\circ\text{C}$ H_2 TINGRAMETER 115809 CAL DUE 22 JULY 95

POTENTIOSTAT ESC 440 #1 CHANNEL #6

DATA SAVER AS LTR2SP6D.DAT USING LONGTERM.WBS

REFERENCE SCE FISHER 13-620-SI SN 8211163

 E_{CORR} -117 mV KEITHLEY 614 SN 555368 E_{GRAPHITE} -15 mV KEITHLEY 614 SN 555368 E_{APP} 200 mV

SPECIMEN STARTED 10/20/94 5:00 PM

SPECIMEN STOPPED 11/17/94 4:00 PM

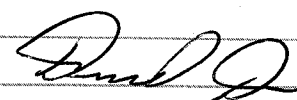
START pH 8.081

END pH 8.794

END WT. 38.41362g

RUNTIME 2419200 SEC

CREVICE CORROSION ON MILL FINISHED
SURFACE MUCH DEEPER THAN AT START
OF TEST ALSO CORROSION ON POST
AT SOLUTION/VAPOR INTERFACE

 11/21/94

STOCK SOLUTIONS 10/94

 SO_4^{2-} 10/94 1000 ppm SO_4^{2-} AS Na_2SO_4 1.47192g Na_2SO_4 LOT 901213 + DI WATER
TO 1000 ml EXP 11/7/94 NO_3^- 10/94 1000 ppm NO_3^- AS NaNO_3 1.37175g NaNO_3 LOT 897183

+ DI WATER TO 1000 ml EXP 11/7/94

 F^- 10/94 1000 ppm F^- AS NaF

1.87066g NaF LOT 896405

+ DI WATER TO 1000 ml EXP 11/7/94

 10/15/94

POTENTIOSTATIC POLARIZATION PS82SC2

OBJECTIVE DETERMINING INITIATION TIME FOR
CRACK CORROSION ON ALLOY 825
SPECIMEN ALLOY 825 NH4371F6 600 S.C.
FINISH SPECIMEN OF SAME TYPE AS SHOWN
ON p 238 OF IWRP 045

START WT. 20.94032g AREA = 15 cm²
SOLUTION 1000 ppm Cl⁻ 85 ppm HCO₃⁻ 20 ppm SO₄²⁻
10 ppm NO₃⁻ 2 ppm F⁻ 2000 ml AS FOLLOWS
3.29630g NaCl LOT 935535

0.24630g NaHCO₃ LOT 897789
40 ml SO₄ - 10/94 STOCK SOLUTION p 207
20 ml NO₃⁻ - 10/94 STOCK SOLUTION p 207
4 ml F⁻ - 10/94 STOCK SOLUTION p 207
+ DI WATER TO 2000 ml T = 95°C

19 THERMOMETER 0323007 CAL DUG 21 MAR 95

REFERENCE SCE FISHER 13-620-S1 SN 3106339

POTENTIOSTAT EG&G 273 SN 41108

DATA SAVED AS PS82SC2.DAT

E_{CORR} -534mV ~~KEITHLEY 617 SN 537418~~ 11/8/94

E_{PT} -182mV ~~KEITHLEY 617 SN 537418~~ 11/8/94

E_{APP} 550mV KEITHLEY 617 SN 537418

START PH 8.166

END PH 9.178

END WT 20.84263g

E_{CORR} AND E_{PT} MEASURED
WITH KEITHLEY 617 SN 537418

CRACK CORROSION 7 OF 24 SITES

SOME SMALL PITS

INITIATION TIME =

[Signature]
11/8/94

CHECK OF WORKBENCH AND DATASNUITLG WITH EG&G 273

POTENTIOSTAT EG&G 273 SN 41108

DATASNUITLG DS 16-8.TC SN 220 R202

COMPUTER COMPAQ MODEL 333 T

SOFTWARE WORKBENCH PC VER 2.2.1

~~PSTATINI.D~~ DD 10/28/94

PSTATINI.WBB

ELECTROMETER KEITHLEY MODEL 617 SN 537418

OBJECTIVE: CONFIRM WORKBENCH MEASUREMENTS
USING CALIBRATED ELECTROMETER

POTENTIOSTAT SETTINGS

MODE: HIGH STABILITY - POTENTIOSTAT

CELL ENABLE - ON

FILTER: OFF

CURRENT RANGE: 1 mA

OUTPUT: LINEAR

POTENTIOSTAT CONNECTED TO 1000 OHM RESISTOR

ID # 171001 POTENTIALS IN RANGE OF

0 - 1 V APPLIED CURRENT AND POTENTIAL MEASURED
WITH KEITHLEY ELECTROMETER.

V EG&G 273 V KEITHLEY V WB I KEITHLEY I WB

0 mV	-1.9mV	-1.9mV	-2.0μA	-2.1μA
10 mV	7.7mV	7.6mV	7.7μA	7.6μA
20 mV	17.6mV	17.6mV	17.6μA	17.6μA
50 mV	47.8mV	47.6mV	47.7μA	47.6μA
100 mV	97.8mV	98mV	97.8μA	97.9μA
500 mV	499mV	500mV	498μA	499μA
1000 mV	999mV	1000mV	999μA	998μA

[Signature] 11/8/94

POTENTIOSTATIC POLARIZATION PS 825C3

OBJECTIVE DETERMINING INITIATION TIME FOR
CREVICE CORROSION ON ALLOY 825
SPECIMEN ALLOY 825 NH437IFG 600 S.L.
SAME TYPE AS SHOWN ON P238 OF IWP6 045
START WT 20.00151g AREA = 15cm²
SOLUTION SAME AS PS 825 C2 P 208
Hg THERMO METER 0323007 CAL DUE 21 MARCH 95
REFERENCE SCG FISHER 13-620-SI SN 3106339
POTENTIOSTAT EG&G 273 SN 41108
DATA SAVER AS PS 825C3.DAT
E_{corr} -550 mV KEITHLEY 617 S37418
E_{pt} -249 mV KEITHLEY 617 S37418
E_{app} 500 mV KEITHLEY 617 S37418
START pH 8.166
END pH 8.975
PTFE CREVICE BLOCKS ON SPECIMEN TORQUED
TO 40 IN. OZ USING PROTO 6103
TEMPERATURE = 95°C
END WT 19.70293g
CREVICE CORROSION 11 OF 24 SITES SOME
SMALL PITS
INITIATION TIME AT 500mV = 2640 SEC
POTENTIAL DECREASED TO 150mV AT t = 74377 SEC
NO REPASSIVATION AT 150mV
POTENTIAL DECREASED TO 50mV AT t = 143734 SEC
REPASSIVATION TIME AT 50mV_{set} = 1140 SEC

[Signature]
11/16/94

POTENTIOSTATIC POLARIZATION PS825C4

OBJECTIVE : DETERMINING INITIATION TIME FOR
CREVICE CORROSION ON ALLOY 825
SPECIMEN ALLOY 825 NH437IFG 600 S.L.
SAME TYPE AS SHOWN ON P 238 OF IWP6 045
START WT 20.65993g AREA = 15cm²
SOLUTION 1000 ppm Cl⁻ 85 ppm HCO₃⁻ 20 ppm SO₄²⁻
10 ppm NO₃⁻ 2 ppm F⁻ 1000 ml ~~water~~ DD 11/16/94
MAGS AS FOLLOWS
1.64863 g NaCl LOT 935535
0.12011 g NaHCO₃ LOT 897789
20 ml SO₄ - 11/94 STOCK SOLUTION p212
10 ml NO₃ - 11/94 STOCK SOLUTION p212
2 ml F⁻ - 11/94 STOCK SOLUTION p212
+ DI WATER TO 1000ml
START pH = 8.116
TEMPERATURE = 95°C Hg THERMOMETER 0323007
POTENTIOSTAT ~~ESC 440~~ DD 11/16/94 EG&G 273 SN 41108
REFERENCE SCG FISHER 13-620-SI SN 3106339
DATA SAVER AS ~~PS~~ DD 11/16/94 PS 825C4.DAT
PTFE CREVICE BLOCKS ON SPECIMEN TORQUED
TO 40 IN. OZ USING PROTO 6103
E_{corr} -608 KEITHLEY 617 SN S37418
E_{pt} -205 KEITHLEY 617 SN S37418
E_{app} 400mV_{sc6} KEITHLEY 617 SN S37418
AT t = 71370 SEC V_{set} TO 60 mV_{sc6}
END pH 9.190
~~AT t = 256500 SEC V_{set} 80mV DD 11/22/94~~
~~SPECIMEN STOPPED 8:30 AM 11/22/94 t = 310000 SEC DD~~
~~INITIATION TIME 24958 SECONDS AT 350mV_{sc6} DD 11/22/94~~
~~REPASSIVATION TIME 538 SEC AT 80mV_{sc6} DD 11/22/94~~
END WT ~~2.8~~ DD 11/22/94 20.55863g
CREVICE CORROSION 21 OF 24 SITES

[Signature] 11/22/94

STOCK SOLUTIONS 11/94

SO₄-11/94 1000 ppm SO₄²⁻ AS Na₂SO₄
 1.47167 g Na₂SO₄ LOT 901213 + DI WATER (100 ml)
 STOCK SOLUTION SO₄-11/94 EXP 12/12/94

NO₃-11/94 1000 ppm NO₃⁻ AS NaNO₃
 1.37123 g NaNO₃ LOT 897183 +
 DI WATER TO 1000 ml EXP 12/12/94

F-11/94 1000 ppm F⁻ AS NaF
 1.86017 g NaF LOT 896405 +
 DI WATER TO 1000 ml EXP 12/12/94

1M Cl-11/94 1 molar Cl⁻ AS NaCl
 58.44191 g NaCl LOT 935535 +
 DI WATER TO 1000 ml EXP 12/12/94

0.5M Cl-11/94 0.5 molar Cl⁻ AS NaCl
 29.23010 g NaCl LOT 935535 +
 DI WATER TO 1000 ml EXP 12/12/94

1000 Cl-11/94 1000 ppm Cl⁻ AS NaCl
 3.29694 g NaCl LOT 935535 + DI
 WATER TO 2000 ml EXP 12/12/94

[Signature]
 11/16/94

LONG TERM POTENTIOSTATIC TEST LT82SP2N.

SPECIMEN: SAME AS LT82SP2m p201

START WT 30.82117g

SOLUTION 1000 ppm Cl⁻, 83 ppm HCO₃⁻, 20 ppm SO₄²⁻
 10 ppm NO₃⁻ 2 ppm F⁻ 2000 ml MAKE AS FOLLOWS

3.29890 g NaCl LOT 935535

0.24321 g NaHCO₃ LOT 897789

40 ml SO₄-11/94 STOCK SOLUTION p212

20 ml NO₃-11/94 STOCK SOLUTION p212

4 ml F-11/94 STOCK SOLUTION p212

+ DI WATER TO 2000 ml T=95°C

N₂ THERMOMETER 183303 CAL DUE 28 JAN 95

START pH 8.167

POTENTIOSTAT ESC 440 #1 CHANNEL #1

DATA SAVED AS LT82SP2N.DAT USING LONGTM.WBB

REFERENCE SC6 FISHER 13-620-51 SN 9214074

ECORR -63 mV KEITHLEY 617 SN 537418

EPT +155 mV KEITHLEY 617 SN 537418

ENPP 0 mV KEITHLEY 617 SN 537418

SPECIMEN STARTED 9:40 AM 11/22/94

SPECIMEN STOPPED 10:00 AM 12/20/94

END pH 9.541

END WT 30.82097g

RUNTIME: 242000 SEC

NO SIGN OF PITTING OR LOCALIZED
 CORROSION

[Signature]
 1/2/95

LONG TERM POTENTIOSTATIC TEST LT82SP7E

SPECIMEN SAME AS LT82SP7D P202
 START WT 30.31146 g
 SOLUTION 1000 ppm Cl^- 85 ppm NaCO_3 20 ppm SO_4^{2-}
 10 ppm NO_3^- 2 ppm F^- 2000 ml MAKE AS FOLLOWS
 3.29863 g NaCl LOT 935535
 0.23871 g NaHCO_3 LOT 897789
 40 ml SO_4 - 11/94 STOCK SOLUTION p212
 20 ml ~~SO~~ NO_3 - 11/94 STOCK SOLUTION p212
 4 ml F^- - 11/94 STOCK SOLUTION p212
 + DI WATER TO 2000 ml $T=95^\circ\text{C}$
 N₂ THERMOMETER 183304 28 JAN 95 CAL DUE
 START pH 8.230
 POTENTIOSTAT ESC 440 #1 CHANNEL #2
 DATA SAVED AS LT82SP7E.DAT USING LONGTM.WBB
 REFERENCE SCE FISHER 13-620-SI SN 9214083
 E_{CORR} +3 mV KEITNEY 617 SN 537418
 E_{PT} +168 mV KEITNEY 617 SN 537418
 E_{APP} 200 mV KEITNEY 617 SN 537418
 SPECIMEN STARTED 9:40 AM 11/22/94
 SPECIMEN STOPPED 10:00 AM 12/20/94
 END pH 9.653
 END WT 30.31165 g
 RUNTIME 242000 SECONDS

NO SIGN OF LOCALIZED CORROSION

[Signature]
 1/2/95

LONG TERM POTENTIOSTATIC TEST LT82SP8E

SPECIMEN SAME AS LT82SP8E p 215
 START WT 31.85500 g
 SOLUTION 1000 ppm Cl^- 85 ppm NaCO_3 20 ppm SO_4^{2-}
 10 ppm NO_3^- 2 ppm F^- 2000 ml AS FOLLOWS
 3.30788 g NaCl LOT 935535
 0.24210 g NaHCO_3 LOT 897789
 40 ml SO_4 - 11/94 STOCK SOLUTION p212
 20 ml NO_3 - 11/94 STOCK SOLUTION p212
 4 ml F^- - 11/94 STOCK SOLUTION p212
 + DI WATER TO 2000 ml 1000 ml OF
 ABOVE SOLUTION USED IN TEST $T=95^\circ\text{C}$
 N₂ THERMOMETER 115789 CAL DUE 22 JULY 95
 START pH 8.212
 POTENTIOSTAT ESC 440 #1 CHANNEL #3
 DATA SAVED AS LT82SP8E.DAT USING LONGTM.WBB
 REFERENCE SCE FISHER 13-620-SI SN 8211163
 E_{CORR} -116 mV KEITNEY 617 SN 537418
 E_{PT} +161 mV KEITNEY 617 SN 537418
 E_{APP} 100 mV KEITNEY 617 SN 537418
 SPECIMEN STARTED 9:40 AM 11/22/94
 SPECIMEN STOPPED 10:00 AM 12/20/94
 END WT ~~31.8597~~ DA 1/2/95 31.85472 g
 END pH 9.129
 RUNTIME 242000 SECONDS

PROBLEM WITH DATA ACQUISITION SYSTEM / POTENTIOSTAT
 OBSERVED 12/1/94 8:30 AM $t = 773800$ SEC
 CURRENT DENSITY READING 1.6×10^{-4} A/cm² ON WORKBENCH
 ACTUAL CURRENT DENSITY MEASURED WITH KEITNEY
 485 SN 509163 WAS LESS THAN 1 $\mu\text{A}/\text{cm}^2$
 POTENTIOSTAT BOARD REMOVED AND REPLACED TO CORRECT
 PROBLEM

NO SIGN OF LOCALIZED CORROSION

[Signature] 1/2/95

LONG TERM POTENTIOSTATIC TEST LT82SP4E

SPECIMEN SAME AS LT82SP4D P 204
 START WT 38.96549g
 2 PTFE CREVICE BLOCKS ON 0.75" x 0.75" SURFACES
 HELD WITH C276 NUT AND BOLT TORQUED
 TO 40 IN. OZ USING PROTO 6103
 CALIBRATED 7/28/94 NEXT CAL DUE 1/28/95
 SOLUTION 1000 ppm Cl^- 85 ppm NaCO_3 20 ppm SO_4^{2-}
 10 ppm NO_3^- 2 ppm F- 1000 ml ~~MADG AS FOLLOWS~~ DD 11/21/94
 OF SOLUTION ON PAGE 215
 START pH 8.212
 T = 95°C Hg THERMOMETER 61771 CAL DUE 22 JULY 95
 POTENTIOSTAT ESC 440 #1 CHANNEL # 4
 DATA SAVED AS LT82SP4E.DAT USING LONGTM.WBS
 REFERENCE SC6 FISHER 13-620-S1 SN 3106337
 E_{CORR} -116 mV KEITHLEY 617 SN 537418
 DD 11/21/94 ~~E_{GRAPH}~~ E_{GRAPH} -13 mV KEITHLEY 617 SN 537418
 E_{APP} 0 mV KEITHLEY 617 SN 537418
 SPECIMEN STARTED 9:40 AM 11/22/94
 SPECIMEN STOPPED 10:00 AM 12/20/94
 END pH 8.890
 END WT 38.96298g
 RUNTIME. 242000 SECONDS

NO SIGN OF LOCALIZED CORROSION

Paul D

1/2/95

LONG TERM POTENTIOSTATIC TEST LT82SP5E

SPECIMEN SAME AS LT82SP5D P 205
 START WT 39.14983g
 2 PTFE CREVICE BLOCKS ON 0.75" x 0.75" SURFACES
 HELD WITH C276 NUT AND BOLT TORQUED TO
 40 IN. OZ USING PROTO 6103
 CALIBRATED 7/28/94 NEXT CAL DUE 1/28/95
 SOLUTION 1000 ppm Cl^- 85 ppm NaCO_3 20 ppm SO_4^{2-}
 10 ppm NO_3^- 2 ppm F- 2000 ml MADG AS FOLLOWS.
 3.29851 g NaCl LOT 935535
 0.24391 g NaHCO_3 LOT 897789
 40 ml SO_4 - 11/94 STOCK SOLUTION p212
 20 ml NO_3 - 11/94 STOCK SOLUTION p212
 4 ml F- 11/94 STOCK SOLUTION p212
 + DI WATER TO 2000 ml, T = 95°C, START pH 8.234
 Hg THERMOMETER 61644 CAL DUE 28 JULY 95
 POTENTIOSTAT ESC 440 #1 CHANNEL #5
 DATA SAVED AS LT82SP5E.DAT USING LONGTM.WBS
 REFERENCE SC6 FISHER 13-620-S1 SN 3106343
 E_{CORR} -93 mV KEITHLEY 617 SN 537418
 E_{GRAPH} -31 mV KEITHLEY 617 SN 537418
 E_{APP} -100 mV KEITHLEY 617 SN 537418
 SPECIMEN STARTED 9:40 AM 11/22/94
 SPECIMEN STOPPED 10:00 AM 12/20/94
 END pH 8.949
 END WT 39.09469g
 RUNTIME. 242000 SECONDS

NO SIGN OF LOCALIZED CORROSION

Paul D 1/2/95

LONGTERM POTENTIOSTATIC TEST LT82SP9A

SPECIMEN ALLOY 825 H4371FG 600SIC FINISH
 SAME ~~TD~~ 11/21/94 TYPE AS SHOWN ON
 P235 OF IWR 045

START WT 37.52732g

2 PTFE CRACK BLOCKS ON 0.75" x 0.75"

SURFACES HELD WITH C276 BOLT AND NUT

TORQUED TO 40 IN-OZ USING PROTO 6103

CALIBRATED 7/28/94 NEXT CAL DUE 1/28/95

SOLUTION 1000 PPM Cl^- 85 PPM HCO_3^- 20 PPM SO_4^{2-}
 10 PPM NO_3^- 2 PPM F^- 1000 ml OF SOLUTION

ON P217

START PH 8.234

T=95°C Na^+ THERMOMETER 115808 CAL DUE 22 JULY 95

DATA SAVER AS LT82SP9A.DAT USING LONGTERM.WBS

POTENTIOSTAT ESC 440 #1 CHANNEL #6

REFERENCE SCC FISHER 13-620-SI SN 2134032

Ecorr -250 mV KEITHLEY 617 SN 537418

EGRAPHITE -22 mV KEITHLEY 617 SN 537418

EAPP 250 mV KEITHLEY 617 SN 537418

SPECIMEN STARTED 9:40 AM 11/22/94

SPECIMEN STOPPED 10:00 AM 12/20/94

8 DD 11/21/94 END PH 8.782

END WT 37.47398g

RUNTIME 242000 SECONDS

NO CRACK CORROSION ON SPECIMEN

HOWEVER LOCALIZED CORROSION IS

PRESENT AT SOLUTION/VAPOR INTERFACE

[Signature] 11/22/94

POTENTIOSTATIC POLARIZATION P582SCS

SPECIMEN ALLOY 825 H4371FG 600SIC FINISH

SAME TYPE AS SHOWN ON PAGE 235 OF IWR 045

START WT 20.64990g

2 PTFE CRACK BLOCKS ON 0.75" x 0.75" SURFACES

HELD WITH C276 BOLT AND NUT TORQUED

TO 40 IN-OZ USING PROTO 6103

SOLUTION 1000 PPM Cl^- 85 PPM HCO_3^- 20 PPM SO_4^{2-}

10 PPM NO_3^- 2 PPM F^- 2000 ml MAKE AS FOLLOWS

3.2969g NaCl LOT 955535

0.24041g Na_2HCO_3 LOT 897789

40 ml SO_4^{2-} 11/94 STOCK SOLUTION P212

20 ml NO_3^- 11/94 STOCK SOLUTION P212

4 ml F^- 11/94 STOCK SOLUTION P212

+ DI WATER TO 2000 ml T=95°C

800 ml OF ABOVE SOLUTION USED IN TEST

THERMOMETER 0823007

POTENTIOSTAT EG&G 273 SN 41108

REFERENCE SCC FISHER 13-620-SI SN 3106339

DATA SAVER AS P582SCS.DAT

Ecorr -445 mV KEITHLEY 617 SN 537418

EAT -128 mV KEITHLEY 617 SN 537418

EAPP +350 mV KEITHLEY 617 SN 537418

AT T= 256500 SEC USED TO 80 mV

SPECIMEN STOPPED 8:30 AM 11/22/94 @ 310000 SEC

INITIATION TIME 24958 SEC AT 350 mV

REPASSIVATION TIME 538 SECONDS AT 80 mV

START PH 8.216

END PH 8.968

END WT = 20.58291g

CRACK CORROSION ON 4 OF 24 SITES

[Signature] 11/22/94

Pages 1 through 219 of this Scientific Notebook were reviewed for compliance with QAP-001 in response to Corrective Action Request 94-02. Corrections and clarifications were made as appropriate. In some cases, the date of a change will reflect the date of this review rather than the date of the original Scientific Notebook entry.

Randy J. Jek
Swire - Qs
11/28/94

PS 825C6

SPECIMEN ALLOT 825 ~~HAZ~~ DP 12/8/94 HH437IF6

SAME TYPE AS SHOWN ON PAGE 235 OF JWRG 045

START WT = ~~19.27224g~~ DP 12/8/94 A. 27224g

2 PTFE CREVICE BLOCKS ON 0.75" x 0.75" SURFACES
HELD WITH C276 BOLT AND NOT TORQUED TO

40 IN. OZ USING PROTO 6103

SOLUTION: 1000 PPM Cl^- 85 PPM NO_3^- 20 PPM SO_4^{2-}
10 PPM NO_3^- 2 PPM F- 2000 ml MAKE AS

FOLLOWS

3.29694g NaCl LOT 935535

0.24041g NaHCO_3 LOT 897789

40 ml SO_4 - 11/94 STOCK SOLUTION p212

20 ml NO_3 - 11/94 STOCK SOLUTION p212

4 ml F- 11/94 STOCK SOLUTION p212

+ DE WATER TO 2000 ml

800 ml OF ABOVE SOLUTION USED IN TEST

THERMOMETER 0323007 T = 95°C

POTENTIAL STAT EG&G 273 SN 41108

REFERENCE SCE FISHER 13-620-SI SN 3106339

DATA SAVED AS PS825C6.DAT

E_{CORR} -543 mV REFERENCE 614 SN 467374

E_{PT} -23 mV REFERENCE 614 SN 467374

E_{APPLIED} +300 mV REFERENCE 614 SN 467374

START pH 8.214

END pH 8.901

AT t = 81,000 SEC CREVICE CORROSION PRODUCTS
VISIBLE ON SPECIMEN $I = 4 \times 10^{-5} \text{ A/cm}^2$

AT t = 604100 SEC EXTERNAL POTENTIAL CHANGED
TO ALLOW REPASSIVATION $V_{\text{APPLIED}} = 100 \text{ mV/SEC}$

C = 75 C/cm^2 $I = 2.5 \times 10^{-4} \text{ A}$

CREVICE CORROSION ON 3 SITES

END WT 18.96550g

INITIATION TIME AT 300 mV 66915 SEC ($I > 1 \times 10^{-5} \text{ A/cm}^2$)

REPASSIVATION TIME AT 100 mV 1244 SEC

[Signature] 12/18/94

~~PS 825 P1~~ DD 12/15/94 PS 825 P1

SPECIMEN ALLOY 825 NN4371FG 6005.C

CYLINDRICAL SPECIMEN 1.910" x 0.248"

SOLUTION 1000 PPM Cl⁻ 83 PPM HCO₃⁻ 20 PPM SO₄²⁻
10 PPM NO₃⁻ 2 PPM F⁻ 1000 ml PREPARED AS FOLLOWS
1.64912 g NaCl LOT 935535

0.12128 g NaHCO₃ LOT 897789

20 ml SO₄-12/94 STOCK SOLUTION P223

10 ml NO₃-12/94 STOCK SOLUTION P223

2 ml F⁻-12/94 STOCK SOLUTION P223

+ DI WATER TO 1000 ml T=95°C

N₂ THERMOMETER 0323007

800 ml SOLUTION USED IN TEST

START pH 8.217

END pH 8.811

POTENTIOSTAT EG&G 273 SN 41108

REFERENCE SCE FISHER 13-620-S1 SN 3106339

DATA SAVED AS ~~PS~~ DD 12/15/94 PS 825 P1.DAT

E_{corr} -771 mV KEITHLEY 614 SN 555368

E_{pt} -418 mV KEITHLEY 614 SN 555368

E_{app} 500 mV KEITHLEY 614 SN 555368

[Signature] 12/18/94

STOCK SOLUTIONS 12/94

SO₄-12/94 1000 PPM SO₄ AS Na₂SO₄
LOT 901213 1.48561 g Na₂SO₄ + DI
WATER TO 1000 ml EXP 1/10/95

NO₃-12/94 1000 PPM NO₃ AS NaNO₃
1.37336 g NaNO₃ LOT 897183
+ DI WATER TO 1000 ml EXP 1/10/95

F⁻-12/94 1000 PPM F⁻ AS NaF
1.86212 g NaF LOT 896405
+ DI WATER TO 1000 ml EXP 1/10/95

[Signature] 12/18/94

1/11/95

STOCK SOLUTIONS 1/95

SO₄ - 1/95 1000 ppm SO₄ AS Na₂SO₄
 1.48404 g Na₂SO₄ LOT 901213
 + DI WATER TO 1000 ml EXP 2/10/95

NO₃ - 1/95 1000 ppm NO₃ AS NaNO₃
 1.37403 g NaNO₃ LOT 897183
 + DI WATER TO 1000 ml EXP 2/10/95

F⁻ - 1/95 1000 ppm ~~NaF~~ 1/11/95 F⁻ AS NaF
 1.86421 g NaF LOT 896405
 + DI WATER TO 1000 ml EXP 2/10/95

David D 1/11/95

LONG TERM POTENTIOSTATIC TEST LT825P20

SPECIMEN SAME AS LT825P2N P213

START WT = 30.82077g

SOLUTION 1000 ppm Cl⁻ 85 ppm HCO₃⁻ 20 ppm SO₄²⁻
 10 ppm NO₃⁻ 2 ppm F⁻ 2000 ml MADE AS FOLLOWS

3.30966 g NaCl LOT 935535

0.24317 g NaHCO₃ LOT 89778940 ml SO₄ - 1/95 STOCK SOLUTION p22420 ml NO₃ - 1/95 STOCK SOLUTION p2244 ml F⁻ - 1/95 STOCK SOLUTION p224

+ DI WATER TO 2000 ml T = 95°C

Hg THERMOMETER 0323007 CAL DUG 21 MAR '95

START pH 8.248

POTENTIOSTAT ESC 440 #1 CHANNEL #1

DATA SAVED AS LT825P20.DAT USING LONGTM, WBB

REFERENCE SEE FISHER 13-620-S1 SN 9214083

E_{CORR} - 37 mV KESTINLEY GIL SN 467374E_{PT} + 155 mV "E_{APP} 0 mV "

SPECIMEN STARTED 6:00 PM 1/11/95

SPECIMEN STOPPED 6:00 PM 2/8/95

END pH 9.40

END WT 30.82063g

RUNTIME 2419200 SEC

NO SIGN OF LOCALIZED CORROSION

David D 2/15/95

LONG TERM POTENTIOSTATIC TEST LT82SP7F

SPECIMEN SAME AS LT82SP7E P 214

START WT 30.31165g

SOLUTION 1000 PPM Cl^- 85 PPM HCO_3^- 20 PPM SO_4^{2-} 10 PPM NO_3^- 2 PPM F^- 2000 ml MADE AS FOLLOWS

3.29873 g NaCl LOT 935535

0.24374 g NaHCO_3 LOT 89778840 ml SO_4^{2-} 1/95 STOCK SOLUTION P22420 ml NO_3^- 1/95 STOCK SOLUTION P2244 ml F^- 1/95 STOCK SOLUTION P224+ DI WATER TO 2000 ml $T=95^\circ\text{C}$

Hg THERMOMETER 0323004 DUG 21 MAR '95

START pH = 8.295

POTENTIOSTAT ESC 440 #1 CHANNEL #2

DATA SAVED AS LT82SP7F.DAT USING LONGTM.WBB

REFERENCE SCE FISHER 13-620-S1 SN 9214074

Ecorr -97 mV KESTNLET 614 SN 467374

EPT +137 mV KESTNLET 614 SN 467374

EAPP +200 mV "

SPECIMEN STARTED 6:20 pm 1/11/95

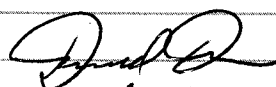
SPECIMEN STOPPED 6:20 pm 2/8/95

END pH 9.52

END WT 30.31018g

RUNTIME 2419200 SECONDS

NO SIGN OF LOCALIZED CORROSION


2/15/95

LONG TERM POTENTIOSTATIC TEST LT82SP8F

SPECIMEN SAME AS LT82SP8E P 215

START WT 31.85472g

SOLUTION 1000 PPM Cl^- 85 PPM HCO_3^- 20 PPM SO_4^{2-} 10 PPM NO_3^- 2 PPM F^- 2000 ml MADE AS FOLLOWS

3.29781 g NaCl LOT 935535

0.24374 g NaHCO_3 LOT 89778840 ml SO_4^{2-} 1/95 STOCK SOLUTION P22420 ml NO_3^- 1/95 STOCK SOLUTION P2244 ml F^- 1/95 STOCK SOLUTION P224+ DI WATER TO 2000 ml $T=95^\circ\text{C}$

Hg THERMOMETER 61644 DUG 22 JULY 95

1000 ml SOLUTION USED FOR THIS TEST

START pH 8.189

POTENTIOSTAT ESC 440 #1 CHANNEL #3

DATA SAVED AS LT82SP8F.DAT USING LONGTM.WBB

REFERENCE SCE FISHER #6 DA 11/1/95 13-620-S1 SN 2134032

Ecorr +25 mV KESTNLET 614 SN 467374

EPT +151 mV "

EAPP 100 mV "

SPECIMEN STARTED 6:20 pm 1/11/95


SPECIMEN STOPPED 2/8/95 6:20 pm

END pH 8.80

END WT 31.85467g

RUNTIME 2419200 SECONDS

NO SIGN OF LOCALIZED CORROSION


2/15/95

LONG TERM POTENTIOSTATIC TEST LTR2SP 4F

SPECIMEN SAME AS LTR2SP 4F A 216

START WT 38.96298g

2 PTFE CREVICE BLOCKS ON 0.75" x 0.75" SURFACES

HELD WITH C276 BOLT AND NUT TORQUED

TO 40 IN. OZ USING PROTO 6103

CALIBRATED 7/28/94 NEXT CAL DUE 1/28/95

SOLUTION 1000 PPM Cl^- 88 PPM HCO_3^- 20 PPM SO_4^{2-} 10 PPM NO_3^- 2 PPM F^- 2000 ml MARK AS FOLLOWS

1000 ml FROM SOLUTION ON PAGE 227

START pH 8.189

T = 95°C H_2 THERMOMETER 61771 DUE 22 JULY 95

POTENTIOSTAT ESC 440 #1 CHANNEL #4

DATA SAVED AS LTR2SP 4F.DAT USING LONGTM.WAB

REFERENCE SCE FISHER 13-620-SI SN 3106343

E_{CORR} -107 mV RESISTANCE 614 SN 467374E_{GRAPHITE} -12 mV "E_{APP} 0 mV "

SPECIMEN STARTED 6:20 PM 1/11/95


SPECIMEN STOPPED 2/8/95 6:20 PM

END pH 8.68

END WT 38.95882g

RUNTIME 2419200 SECONDS

NO SIG OF LOCALIZED CORROSION


2/15/95

LONG TERM POTENTIOSTATIC TEST LTR2SP 5F

SPECIMEN SAME AS LTR2SP 5F A 217

START WT 39.09469g

2 PTFE CREVICE BLOCKS ON 0.75" x 0.75" SURFACES

HELD WITH C276 NUT AND BOLT TORQUED TO

40 IN. OZ USING PROTO 6103

CALIBRATED 7/28/94 DUE 1/28/95

SOLUTION 1000 PPM Cl^- 88 PPM HCO_3^- 20 PPM SO_4^{2-} 10 PPM NO_3^- 2 PPM F^- 2000 ml MARK AS FOLLOWS3.30138g NaCl LOT 9355350.24960g NaHCO_3 LOT 89778940 ml SO_4^{2-} 1/95 STOCK SOLUTION p22420 ml NO_3^- 1/95 STOCK SOLUTION p2244 ml F^- 1/95 STOCK SOLUTION p224

+ DI WATER TO 2000 ml T = 95°C

 H_2 THERMOMETER 115809 CAL DUE 22 JULY 95

1000 ml OF ABOVE SOLUTION USED IN TEST

POTENTIOSTAT ESC 440 #1 CHANNEL #5

DATA SAVED AS LTR2SP 5F.DAT USING LONGTM.WAB

REFERENCE SCE FISHER 13-620-SI SN 3106337

E_{CORR} -160 mV RESISTANCE 614 SN 467374E_{GRAPHITE} -19 mV "E_{APP} -100 mV

SPECIMEN STARTED 6:20 PM 1/11/95

START pH 8.296

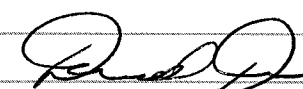
SPECIMEN STOPPED 2/8/95 6:20 PM

END pH 8.72

END WT 39.09115g

RUNTIME 2419200 SECONDS

NO SIG OF LOCALIZED CORROSION


2/15/95

LONG TERM OPEN CIRCUIT TEST OC 825C1A

OBJECTIVE DETERMINE OPEN CIRCUIT POTENTIAL
WITH TIME FOR ALLOY 825

SPECIMEN SWING TYPE AS CT825P4A P 151

OR ILWPG 045 p 238 WITH ONE MILL-FINISHED
SURFACE. AREA = 20 cm²

START WT = 39.30620g

SOLUTION 1000 PPM Cl⁻ 85 PPM HCO₃⁻ 20 PPM SO₄²⁻

10 PPM NO₃⁻ 2 PPM F⁻ 1000 ml OF SOLUTION

ON PAGE 229 T=95°C N₂ THERMOMETER 115789

START pH 8.296

2 PTFE CIRCLE BLOCKS ON 0.75" x 0.75" SURFACES
HELD WITH C276 NUT AND BOLT TORQUED

TO 40 IN. OZ USING PROTD 6103 CAL PK 1/28/95

OPEN CIRCUIT POTENTIAL MEASURED WITH

KEITHLEY ELECTROMETER AND WITH ESC440 #1

POTENTIOSTAT USING CHANNEL #6

DATA SAVED AS OC825C1A.DAT USING CONVTM.W88

REFERENCE CG JCG FISHER 13-620-S1 SN 8211163

~~BEAD ARE~~ DD 1/11/95 ~~BEAD ARE~~ DD 1/11/95

ZERO AIR PURGED THROUGH SOLUTION FOR

24 HOURS PRIOR TO INITIAL MEASUREMENTS

AND START OF TEST

E_{CORR} -263 mV KEITHLEY 614 SN 467374

E_{PT} +66 mV KEITHLEY 614 SN 467374

TEST STARTED 6:20 pm 1/11/95

SPECIMEN STOPPED 2/8/95 6:20 pm

END pH 8.93

END WT 39.29749 g

RUNTIME 241200 SECONDS

NO SIGN OF LOCALIZED CORROSION

QuelD 2/15/95

STOCK SOLUTIONS 2/95

1000 PPM SO₄ AS Na₂SO₄

STOCK SOLUTION SO₄ - 2/95

1.48384 g Na₂SO₄ LOT 901213 + DI

WATER TO 1000 ml EXP 3/10/95

NO₃ - 2/95 1000 PPM NO₃ AS NaNO₃

1.37190 g NaNO₃ LOT 897183 + DI WATER

TO 1000 ml EXP 3/10/95

F - 2/95 1000 PPM F⁻ AS NaF

1.86241 g NaF LOT 896405 + DI WATER

TO 1000 ml EXP 3/10/95

QuelD 2/15/95

LONG TERM POTENTIOSTATIC TEST LT82SP2P

SPECIMEN SAME AS LT82SP20 P225

START WT = 30.82063g

SOLUTION 1000 ppm Cl^- 85ppm HCO_3^- 20 ppm SO_4^{2-}
10 ppm NO_3^- 2ppm F^- 2000 ml MAKE AS
FOLLOWS

3.29637g NaCl LOT 935535

0.24551g NaHCO_3 LOT 89778940 ml SO_4^{2-} 2/95 STOCK SOLUTION p23120 ml NO_3^- 2/95 STOCK SOLUTION p2314 ml F^- 2/95 STOCK SOLUTION p231+ DI WATER TO 2000 ml $T=95^\circ\text{C}$

Hg THERMO METER 0323004 CAL DUE 21 MARCH 95

START pH = 8.16

POTENTIOSTAT ESC 440 #1 CHANNEL #1

DATA SAVED AS LT82SP2P.DAT

REFERENCE SCE FISHER 13-620-S1 SN 9214083

Ecorr + 0.012V on + 12 mV KEITHLEY 614 SN 555368

EPT + 165 mV KEITHLEY 614 SN 555368

EAPPLIED 0.1 mV

SPECIMEN STARTED 2/15/95 4:50pm

SPECIMEN STOPPED 3/15/95 4:50pm

END pH 9.44

RUNTIME 2419200 SECONDS

END WT 30.82769g

NO SIGN OF LOCALIZED CORROSION

Dunn D 3/23/95

LONG TERM POTENTIOSTATIC TEST LT82SP7G

SPECIMEN SAME AS LT82SP7F P226

START WT = 30.31018g

SOLUTION 1000 ppm Cl^- 85ppm HCO_3^- 20 ppm SO_4^{2-}
10 ppm NO_3^- 2ppm F^- 2000 ml MAKE AS FOLLOWS
3.29920g NaCl LOT 9355350.24537g NaHCO_3 LOT 89778940 ml SO_4^{2-} 2/95 STOCK SOLUTION p23120 ml NO_3^- 2/95 STOCK SOLUTION p2314 ml F^- 2/95 STOCK SOLUTION p231+ DI WATER TO 2000 ml $T=95^\circ\text{C}$

Hg THERMO METER 0323007 CAL DUE 21 MARCH 1995

START pH 8.24

POTENTIOSTAT ESC 440 #1 CHANNEL 2

DATA SAVED AS LT82SP7G.DAT

REFERENCE SCE FISHER 13-620-S1 SN 2134032

Ecorr + 3 mV KEITHLEY 614 SN 555368

EPT + 166 mV KEITHLEY 614 SN 555368

EAPPLIED +200 mV

SPECIMEN STARTED 2/15/95 4:50pm

SPECIMEN STOPPED 3/15/95 4:50pm

END pH 9.108

RUNTIME 2419200 SECONDS

END WT 30.30771g

NO SIGN OF LOCALIZED CORROSION

Dunn D
3/23/95

LONG TERM POTENTIOSTATIC TEST LT82SP8G

SPECIMEN SAME AS LT82SP8F P227

START WT 31.85467g

SOLUTION 1000 ppm Cl^- 85 ppm HCO_3^- 20 ppm SO_4^{2-}
10 ppm NO_3^- 2 ppm F^- 2000 ml MAKE AS FOLLOWS

3.30281 g NaCl LOT 935535

0.24555 g NaHCO_3 LOT 89778940 ml SO_4^{2-} 2/95 STOCK SOLUTION p23120 ml NO_3^- 2/95 STOCK SOLUTION p2314 ml F^- 2/95 STOCK SOLUTION p231+ DI WATER TO 2000 ml $T = 95^\circ\text{C}$

Hg THERMOMETER 61644 DUE 22 JULY 95

1000 ml SOLUTION USED IN THIS TEST

START pH 8.09

POTENTIOSTAT ESC 440 #1 CHANNEL #3

DATA SAVED AS LT82SP8G.DAT USING CONSTM.WBB

REFERENCE SCE FISHER 13-62D-S1 SN 9214074

 $E_{\text{CORR}} = -52\text{mV}$ KEITHLEY 614 SN 555368 $E_{\text{PT}} = +172\text{mV}$ KEITHLEY 614 SN 555368 $E_{\text{APPLIED}} = 100\text{mV}$

SPECIMEN STARTED 2/15/95 4:50pm


SPECIMEN STOPPED 3/15/95 4:50pm

END pH 9.029

RUNTIME 2419200 SECONDS

END WT 31.85438g

NO SIGN OF LOCALIZED CORROSION


3/23/95

LONG TERM POTENTIOSTATIC TEST LT82SP4G

SPECIMEN SAME AS LT82SP4F P228

START WT 38.95882g

2 PTFE CRAWLER BLOCKS ON 0.75" x 0.75" SURFACES

HELD WITH C-276 BOLT & NUT TORQUED TO
40 IN-OB USING PROTO 6103

CALIBRATED 1/24/95 NEXT CAL DUE 7/24/95

SOLUTION 1000 ppm Cl^- 85 ppm HCO_3^- 20 ppm SO_4^{2-} 10 ppm NO_3^- 2 ppm F^- 1000 ml OF SOLUTION

ON PAGE 234

START pH 8.09

 $T = 95^\circ\text{C}$ Hg THERMOMETER

POTENTIOSTAT ESC 440 #1 CHANNEL #4

DATA SAVED AS LT82SP4G.DAT

REFERENCE SCE FISHER 13-62D-S1 SN 3106337

 $E_{\text{CORR}} = -102\text{mV}$ KEITHLEY 614 SN 555368 $E_{\text{APPLIED}} = -16\text{mV}$ KEITHLEY 614 SN 555368 $E_{\text{APPLIED}} = 0\text{mV}$

SPECIMEN STARTED 2/15/95 4:50pm


SPECIMEN STOPPED 3/15/95 4:50pm

END pH 8.738

RUNTIME 2419200 SECONDS

END WT 38.95387g

NO SIGN OF LOCALIZED CORROSION


3/23/95

LONG TERM POTENTIOSTATIC TEST LT82SPSG

SPECIMEN SAME AS LT82SPSF p229

START WT: 39.09115g

2 PTFE CRAWLER BLOCKS ON SPECIMEN HELD WITH

C276 BOLT & NUT TORQUED TO 40 IN.OZ USING

PROTO 6103 CALIBRATED 1/24/95 DUG 7/24/95

SOLUTION 1000 PPM Cl^- 85 PPM HCO_3^- 20 PPM SO_4^{2-} 10 PPM NO_3^- 2 PPM F^- 2000 ml MAKE AS FOLLOWS

3.27742 g NaCl LOT 93SS3S

0.24219 g NaHCO₃ LOT 89778940 ml SO_4^{2-} 2/95 STOCK SOLUTION p23120 ml NO_3^- 2/95 STOCK SOLUTION p2314 ml F^- 2/95 STOCK SOLUTION p231+ DI WATER TO 2000 ml $T=95^\circ\text{C}$ H_2 THERMOMETER 115809 CAL DUG 22 JULY 1995

1000 ml SOLUTION USED IN THIS TEST

START pH 8.03

POTENTIOSTAT ESC 440 #1 CHANNEL #5

DATA SAVED AS LT82SPSG.DAT

REFERENCE SCE FISHER 13-620-S1 SN 3106343

 $E_{\text{CORR}} = -128 \text{ mV}$ KEITHLEY 614 SN 555368 $E_{\text{APPLIED}} = -26 \text{ mV}$ KEITHLEY 614 SN 555368 E_{APPLIED}

SPECIMEN STARTED 2/15/95 4:50 PM

SPECIMEN STOPPED 3/15/95 4:50 PM

END pH 8.755

RUNTIME 2419200 SECONDS

END WT 39.08826g

NO SIGN OF LOCALIZED CORROSION

Dug
3/23/95

LONG TERM OPEN CIRCUIT TEST OC82SC1B

OBJECTIVE DETERMINING OPEN CIRCUIT POTENTIAL WITH
TIME FOR ALLOY 825

SPECIMEN SAME AS OC82SC1A p230

START WT = 39.29749g

2 PTFE CRAWLER BLOCKS ON SPECIMEN HELD WITH

C276 BOLT AND NUT TORQUED TO 40 IN.OZ USING

PROTO 6103 CALIBRATED 1/24/95 DUG 7/24/95

SOLUTION 1000 PPM Cl^- 85 PPM HCO_3^- 20 PPM SO_4^{2-} 10 PPM NO_3^- 2 PPM F^- 1000 ml OF SOLUTION ONPAGE 236 $T=95^\circ\text{C}$ H_2 THERMOMETER 115789

CALIBRATION DUG 22 JULY 95

START pH 8.03

POTENTIOSTAT ESC 440 #1 CHANNEL #6

DATA SAVED AS OC82SC1B.DAT

REFERENCE SCE FISHER 13-620-S1 SN 821163

 $E_{\text{CORR}} = -229 \text{ mV}$ KEITHLEY 614 SN 555368 $E_{\text{PC}} = +90 \text{ mV}$ KEITHLEY 614 SN 555368 $E_{\text{APPLIED}} = 0 \text{ V}$

SPECIMEN STARTED 4:50 PM 2/15/95

SPECIMEN STOPPED 3/15/95 4:50 PM

RUNTIME 2419200 SECONDS

END pH 9.139

END WT 39.30771g DO 3/21/95 39.28885g

SOLUTION PURGED WITH 79 N_2 / 21 O_2 DURING TEST

NO SIGN OF LOCALIZED CORROSION

Dug
3/23/95

STOCK SOLUTIONS 3/95

1000 ppm SO_4^{2-} AS Na_2SO_4
~~1.370~~ ^{DD} 3/20/95 1.48430 g Na_2SO_4
 LOT 901213 + DI WATER TO 1000 ml
 EXP 4/10/95 STOCK SOLUTION SO_4 - 3/95

NO_3 - 3/95 1000 ppm NO_3^- AS NaNO_3
 1.37053 g NaNO_3 LOT 897183 +
 DI WATER TO 1000 ml EXP 4/10/95

F- 3/95 1000 ppm F^- AS NaF
 1.86347 g NaF LOT 896405
 + DI WATER TO 1000 ml EXP 4/10/95

David D
 3/23/95

LONG TERM POTENTIOSTATIC TEST LT825 P2Q.DAT

^{DD 3/23/95}
 SPECIMEN SAME AS ~~LT825 P2P~~ LT825 P2P p232
 START WT = 30.82769 g
 SOLUTION 1000 ppm Cl^- 85 ppm HCO_3^- 20 ppm SO_4^{2-}
 10 ppm NO_3^- 2 ppm F^- 2000 ml MAKE AS FOLLOWS
 3.30556 g NaCl LOT 941616
 0.24167 g NaHCO_3 LOT 897789
 40 ml SO_4 - 3/95 STOCK SOLUTION p238
 20 ml NO_3 - 3/95 STOCK SOLUTION p238
 4 ml F^- - 3/95 STOCK SOLUTION p238
 + DI WATER TO 2000 ml $T = 95^\circ\text{C}$
 Hg THERMOMETER 183302
 START pH 8.305
 POTENTIOSTAT ESC440 #1 CHANNEL #1
 DATA SAVED AS LT825 P2Q.DAT
 REFERENCE SCE FISHER 13-620-S1 SN 2134032
 $E_{\text{CORR}} + 27 \text{ mV}$ RESISTANCE 6.14 SN 467374
 $E_{\text{PL}} + 181 \text{ mV}$
 APPLIED 0 mV
 SPECIMEN STARTED 4:45 pm 3/23/95
 SPECIMEN STOPPED 9:45 pm 4/20/95 ~~DD~~ 4/20/95
 RUNTIME 2433600 SECONDS OR 676 HOURS
 END pH 9.471
 END WT 30.82052 g

NO SIGN OF LOCALIZED CORROSION

David D 5/1/95

LONG TERM POTENTIOSTATIC TEST LT82SP7H

SPECIMEN SAME AS LT82SP7G P233

START WT 30.30971g

SOLUTION 1000 ppm Cl⁻ 85 ppm HCO₃⁻ 20 ppm SO₄²⁻
10 ppm NO₃⁻ 2 ppm F⁻ 2000 ml MAKE AS FOLLOWS
3.30152g NaCl LOT 9416160.24070g NaHCO₃ LOT 89778940 ml SO₄ - 3/95 STOCK SOLUTION p23820 ml NO₃ - 3/95 STOCK SOLUTION p2384 ml F⁻ - 3/95 STOCK SOLUTION p238

+ DI WATER TO 2000 ml T=95°C

Hg THERMOMETER 183304

START pH 8.495

POTENTIOSTAT ESC 440 #1 CHANNEL #2

DATA SAVER AS LT82SP7H.DAT

REFERENCE SCE FISHER 13-620-51 SN 9214083

E_{corr} +1 mV KEITHLEY 614 SN 467374E_{pe} +167 mV "E_{applied} 200 mV "

SPECIMEN STARTED 4:45 pm 3/23/95


SPECIMEN STOPPED 9:45 pm ~~3/20/95~~ 4/20/95

RUNTIME 2433600 OR 676 HOURS

END pH 9.245

END WT 30.31230g

NO SIGN OF LOCALIZED CORROSION


5/1/95

LONG TERM POTENTIOSTATIC TEST LT82SP8H

SPECIMEN SAME AS LT82SP8G P234

START WT 31.85438g

SOLUTION 1000 ppm Cl⁻ 85 ppm HCO₃⁻ 20 ppm SO₄²⁻
10 ppm NO₃⁻ 2 ppm F⁻ 2000 ml MAKE AS FOLLOWS
3.30250g NaCl LOT 9416160.24014g NaHCO₃ LOT 89778940 ml SO₄ - 3/95 ~~PREP 3/23/95~~ STOCK SOLUTION p23820 ml NO₃ - 3/95 STOCK SOLUTION p2384 ml F⁻ - 3/95 STOCK SOLUTION p238

+ DI WATER TO 2000 ml T=95°C

Hg THERMOMETER 61771

START pH 8.514

1000 ml OF THIS SOLUTION USED IN THIS TEST

POTENTIOSTAT ESC 440 #1 CHANNEL #3

DATA SAVER AS LT82SP8H.DAT

REFERENCE SCE FISHER 13-620-51 SN 3106343

E_{corr} -68 mV KEITHLEY 614 SN 467374E_{pe} +152 mV "E_{applied} 100 mV "

SPECIMEN STARTED 4:45 pm 3/23/95

SPECIMEN STOPPED 2433600 SECONDS ~~676 HOURS~~ 4/20/95


SPECIMEN STOPPED 9:45 pm 4/20/95

RUNTIME 2433600 SECONDS OR 676 HOURS

END pH 9.229

END WT 31.85461g

NO SIGN OF LOCALIZED CORROSION


5/1/95

LONG TERM POTENTIOSTATIC TEST LT82SP4H

SPECIMEN SAME AS LT82SP4G P 235

START WT 38.95387g

2 PTFE CERAMIC BLOCKS ON 0.75" x 0.75"

SURFACES HELD WITH C276 BOLT & NOT TORQUED
TO 40 IN-OZ USING PROTO 6103SOLUTION 1000 PPM Cl^- 85 PPM HCO_3^- 20 PPM SO_4^{2-} 10 PPM NO_3^- 2 PPM F^- 1000 ml OF SOLUTION

PAGE 241

START pH 8.514

T = 95°C N₂ THERMOMETER 115789

POTENTIOSTAT ESC 440 #1 CHANNEL #4

DATA SAVER AS LT82SP4H, DAT

REFERENCE SCE FISHER 13-620-SI SN 3106337

E_{corr} -93 mV KEITHLEY 614 SN 467374E_{pt} -8 mV (GRAPHITE) "E_{APPLIED} 0 mV "

SPECIMEN STARTED 4:45 pm 3/23/95

SPECIMEN STOPPED 9:45 pm 4/20/95

RUNTIME 2433600 SECONDS OR 676 HOURS

END pH 8.837

END WT 38.95387g

NO SIGN OF LOCALIZED CORROSION

5/1/95

LT82SP5H

LONG TERM POTENTIOSTATIC TEST ~~LT82SP5G~~ DD

3/23/95

SPECIMEN SAME AS LT82SP5G P 236

START WT 39.08826g

2 PTFE CERAMIC BLOCKS ATTACHED TO 0.75" x 0.75"

SURFACES HELD WITH C-276 BOLT & NOT TORQUED
TO 40 IN-OZ USING PROTO 6103SOLUTION 1000 PPM Cl^- 85 PPM HCO_3^- 20 PPM SO_4^{2-} 10 PPM NO_3^- 2 PPM F^- 2000 ml MAKE AS FOLLOWS

3.29056 g NaCl LOT 941616

0.23854 g Na_2HCO_3 LOT 89778940 ml SO_4 -3/95 STOCK SOLUTION P23820 ml NO_3 -3/95 STOCK SOLUTION P2384 ml F^- -3/95 STOCK SOLUTION P238

+ DI WATER TO 2000 mL T = 95°C

N₂ THERMOMETER 115809

1000 ml OF SOLUTION USED IN THIS TEST

START pH 8.330

POTENTIOSTAT ESC 440 #1 CHANNEL #5

DATA SAVER AS LT82SP5H

REFERENCE SCE FISHER 13-620-SI SN 9214074

E_{corr} -126 mV KEITHLEY 614 SN 467374E_{pt} +13 mV (GRAPHITE) "E_{APPLIED} -100 mV "

SPECIMEN STARTED 4:45 pm 3/23/95

~~SPECIMEN STOPPED 2433600 SECONDS OR 676 HOURS~~ DD 4/20/95

SPECIMEN STOPPED 9:45 pm 4/20/95

RUNTIME 2433600 SECONDS OR 676 HOURS

END pH 9.088

END WT 39.08765g

NO SIGN OF LOCALIZED CORROSION

5/1/95

LONG TERM POTENTIOSTATIC TEST - OPEN CIRCUIT

SPECIMEN SAME AS OC825C1B p 237

START WT 39.28885g

2 PTFE CREVICE BLOCKS ON SPECIMEN HELD

WITH C276 NUT & BOLT TORQUED TO

110 IN-OZ USING PROTO 6103

SOLUTION 1000 PPM Cl^- 85 PPM HCO_3^- 20 PPM SO_4^{2-} 10 PPM NO_3^- 2 PPM F^- 1000 ml OF

SOLUTION p 243

T = 95°C Hg THERMOMETER 61644

START pH 8.330

POTENTIOSTAT ESC 440 #1 CHANNEL #6

DATA SAVED AS OC825C1C.DAT

REFERENCE SCE FISHER 13-620-SI SN 8211163

ECONA -22.3mV REF#61 614 SN 467374

EPE +60 mV

EAPPLIED O.C.

SOLUTION PURGED WITH ZERO AIR 79 N_2 /21 O_2

THROUGHOUT TEST

SPECIMEN STARTED 4:45 pm 3/23/95


SPECIMEN STOPPED 9:45 pm 4/20/95

RUNTIME 2433600 SECONDS OR 676 HOURS

END pH 9.292

END WT 39.28914g

NO SIGN OF LOCALIZED CORROSION


 5/1/95

STOCK SOLUTIONS 4/95

1000 PPM SO_4^{2-} AS NaF
 SO_4 - 4/95 1.48342 g Na_2SO_4 LOT 901213
 + DI WATER TO 1000 ml EXP 5/10/95

 NO_3 - 4/95 1000 PPM NO_3^- AS NaNO_3
 1.37151 g NaNO_3 LOT 897183

+ DI WATER TO 1000 ml EXP 5/10/95

 F^- - 4/95 1000 PPM F^- AS NaF
 2.21209 g NaF LOT 896405

+ DI WATER TO 1000 ml EXP 5/10/95

 4/21/95

LONG TERM POTENTIOSTATIC TEST LT825 P2R.DAT

SPECIMEN SAME AS LT825 P2Q P 239

START WT = 30.82052 g

SOLUTION 1000 PPM Cl^- 85 PPM NaCO_3^- 20 PPM SO_4^-
 10 PPM NO_3^- 2 PPM F^- 2000 ml MAKE AS FOLLOWS
 3.29761 g NaCl LOT 935535

0.24674 g NaHCO_3 LOT 89778940 ml SO_4^- 5/1/95 ~~WD~~ 5/1/95 SO_4^- 4/95 p 24520 ml NO_3^- 4/95 STOCK SOLUTION p 2454 ml F^- 4/95 STOCK SOLUTION p 245+ DI WATER TO 2000 ml $T = 95^\circ\text{C}$

Hg THERMOMETER 183304

START pH = 8.461

POTENTIOSTAT ESC 440 #1 CHANNEL #1

DATA SAVED AS LT825 P2R.DAT

REFERENCE SCE FISHER 13-620-SI SN 821163

Ecorr -53 mV KEITHLEY 614 SN 467374

Epe +177 mV "

EAPPLIED = 0 mV "

SPECIMEN STARTED 5/3/95 9:30 AM


SPECIMEN STOPPED 5/31/95 9:30 AM

RUNTIME 2419200 SECONDS OR 28 DAYS

END pH 8.920

END WT 30.82021 g

NO SIGN OF LOCALIZED CORROSION


 6/5/95

LONG TERM POTENTIOSTATIC TESTS LT825 P7I

SPECIMEN SAME AS LT825 P7H P 240

START WT = 30.31230 g

SOLUTION 1000 PPM Cl^- 85 PPM NaCO_3^- ~~20 PPM~~ ~~AL~~ ^{DP} 5/1/95
 20 PPM SO_4^- 10 PPM NO_3^- 2 PPM F^- 2000 ml AS FOLLOWS
 3.29767 g NaCl LOT 935535

0.24567 g NaHCO_3 LOT 89778940 ml SO_4^- 4/95 STOCK SOLUTION p 24520 ml NO_3^- 4/95 "4 ml F^- 4/95 "+ DI WATER TO 2000 ml $T = 95^\circ\text{C}$

Hg THERMOMETER 183302

START pH 8.270

POTENTIOSTAT ESC 440 #1 CHANNEL #2

DATA SAVED AS LT825 P7I.DAT

REFERENCE SCE FISHER 13-620-SI SN 3106343

Ecorr -5 mV KEITHLEY 614 SN 467374

Epe +144 mV "

EAPPLIED 200 mV "

SPECIMEN STARTED: 5/3/95 9:30 AM

SPECIMEN STOPPED 5/31/95 9:30 AM

RUNTIME 2419200 SECONDS OR 28 DAYS

END pH 8.852

END WT 30.30965 g

NO SIGN OF LOCALIZED CORROSION


 6/5/95

LONG TERM POTENTIOSTATIC TEST ~~LT82SP8H~~ ^{LT82SP8I} DD 5/1/95

SPECIMEN SAME AS LT82SP8H P 241

START WT 31.85461g

SOLUTION 1000 PPM Cl^- 85 PPM HCO_3^- 20 PPM SO_4^{2-}
10 PPM NO_3^- 2 PPM F^- 2000 ml MAKE AS FOLLOWS

3.29627 g NaCl LOT 935535

0.24046 g Na_2HCO_3 LOT 897789

40 ml SO_4^{2-} 4/95 STOCK SOLUTION p245

20 ml NO_3^- 4/95 "

4 ml F^- 4/95 "

+ DI WATER TO 2000 ml ONLY 1000 ml OF SOLUTION USED IN THIS TEST

T = 95°C N_2 THERMOMETER 61771

START pH = 8.136

POTENTIOSTAT ESC 440 #1 CHANNEL #3

DATA SAVED AS LT82SP8I.DAT

REFERENCE SCE FISHER 13-620-SI SN 3106337

Ecorr -107 mV KEITHLEY 614 SN 467374

E_{pt} +166 mV "

EAPPLIED +100 mV "

SPECIMEN STARTED 5/3/95 9:30 AM


SPECIMEN STOPPED 5/31/95 9:30 AM

RUNTIME 2419200 SECONDS OR 28 DAYS

END pH 9.056

END WT 31.85447g

NO SIGN OF LOCALIZED CORROSION


6/5/95

LONG TERM POTENTIOSTATIC TEST LT82SP4I

SPECIMEN SAME AS LT82SP4H P 242

START WT 38.95387g

SOLUTION 1000 PPM Cl^- 85 PPM HCO_3^- 20 PPM SO_4^{2-}
10 PPM NO_3^- 2 PPM F^- 1000 ml OF SOLUTION
ON PAGE 248

START pH 8.136

T = 95°C N_2 THERMOMETER 115789

2 PTFE CREVICE BLOCKS ATTACHED TO SPECIMEN
WITH C276 NUT AND BOLT TORQUED TO 40 IN-OZ
USING PROTO 6103 TORQUE WRENCH

POTENTIOSTAT ESC 440 #1 CHANNEL #4

DATA SAVED AS LT82SP4I.DAT

REFERENCE SCE FISHER 13-620-SI SN 2134032

Ecorr ^{DO 5/3/95} -107 mV ^{-115 mV} KEITHLEY 614 SN 467374

E_{pt} +27 (GRAPHITE) "


EAPPLIED 0 mV "

SPECIMEN STARTED 5/3/95 9:30 AM

END pH 8.751

END WT 38.95346g

NO SIGN OF LOCALIZED CORROSION


6/5/95

LONG TERM POTENTIOSTATIC TEST LT82SPSI

SPECIMEN SAME AS LT82SP5H P 243

START WT: 39.08765g

2 PTFE CREVICE BLOCKS ATTACHED TO SPECIMEN
USING C276 NUT AND BOLT TORQUED TO
40 IN-OZ USING PROTO 6103SOLUTION 1000 PPM Cl^- 85PPM HCO_3^- 20PPM SO_4^{2-} 10 PPM NO_3^- 2PPM F^- 2000 ml AS FOLLOWS

3.29808g NaCl LOT 935535

0.24333g NaHCO_3 LOT 89778940 ml SO_4 - 4/95 STOCK SOLUTION P24520 ml NO_3 - 4/95 "4 ml F^- - 4/95 "

+ DI WATER TO 2000 ml 1000 ml OF

SOLUTION USED IN THIS TEST

T=95°C Hg THERMOMETER 61644

START pH 8.214

POTENTIOSTAT ESC 440 #1 CHANNEL #5

DATA SAVED AS LT82SPSI.DAT

REFERENCE SCE FISHER 13-620-S1 SN 9214074

Ecorr +122mV 5/3/95 -122mV KEITHLEY 614 SN 467374

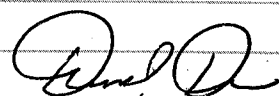
E_{pt} +6mV (GRAPHITE) KEITHLEY 614 SN 467374E_{APPLIED} -100mV "

SPECIMEN STARTED 5/3/95 9:30am

END pH 8.954

END WT 39.08730g

NO SIGN OF LOCALIZED CORROSION


6/5/95

LONG TERM POTENTIOSTATIC TEST - OPEN CIRCUIT OC82SC1D

SPECIMEN SAME AS OC82SC1C P 244

START WT 39.28914g

2 PTFE CREVICE BLOCKS ATTACHED TO SPECIMEN
WITH C276 NUT AND BOLT TORQUED TO
40 IN-OZ USING PROTO 6103SOLUTION 1000 PPM Cl^- 85PPM HCO_3^- 20PPM SO_4^{2-} 10 PPM NO_3^- 2PPM F^- 1000 ml OF

SOLUTION FROM PAGE 250. T=95°C

 Hg THERMOMETER 115809

START pH 8.214

POTENTIOSTAT ESC 440 #1 CHANNEL #6

DATA SAVED AS ~~LT82SPSI.DAT~~ 5/1/95

OC82SC1D.DAT

REFERENCE SCE FISHER 13-620-S1 SN 9214083

Ecorr -185mV KEITHLEY 614 SN 467374

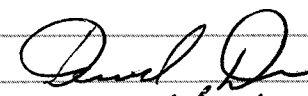
E_{pt} +81mV "E_{APPLIED} O.C.SOLUTION PURGED WITH ZERO AIR (79% N_2 /21% O_2)
THROUGHOUT TEST

SPECIMEN STARTED 5/3/95 9:30am

END pH 9.187

END WT 39.28767

NO SIGN OF LOCALIZED CORROSION


6/5/95

E_{corr} VS. TIME FOR 316L

OBJECTIVE MEASURE E_{corr} WITH TIME
FOR 316L IN 1000 PPM Cl⁻ AT 95°C
UNDER AERATED CONDITIONS
SPECIMEN 316L P80746 CYLINDRICAL SPECIMEN
l = 1.909" d = 0.246

START WT = 11.57576g
600 SiC FINISH

SOLUTION 1000 PPM Cl⁻ 85 PPM HCO₃⁻ 20 PPM SO₄²⁻
10 PPM NO₃⁻ 2 PPM F⁻ 700 ml OF SOLUTION
ON PAGE 246

START pH = 8.461

T = 95°C H₂ THERMOMETER 0323005

SOLUTION AERATED WITH ZERO AIR FROM
LIQUID CARBONIC TANK # 632778 DURING TEST

E_{corr} MEASURED WITH KEITHLEY 614 SN 467374
AND RECORDED WITH TIME USING ABB STRIP
CHART RECORDER MODEL # SE120 SN 0515265

E_{pe} +80mV AT START KEITHLEY 614 SN 467374
E_{corr} -405mV 5min AFTER IMMERSION USING
KEITHLEY 614 SN 467374 t=0 FOR

CHART RECORDER

SPECIMEN STARTED 5/4/95 11:45 AM

REFERENCE SCG FISHER 13-620-51 SN 4280302

SPECIMEN STOPPED 2:30 PM 5/12/95

END pH 9.184

E_{pe} AT END +140mV

END WT = 11.57722g SOME WHITE

SCALE ON UPPER PART OF SPECIMEN
EXPOSED TO AIR ABOVE SOLUTION/VAPOR
INTERFACE NO SIGN OF LOCALIZED
CORROSION.

DATA PLOT p254

Paul D 5/15/95

E_{corr} WITH TIME FOR C-22

OBJECTIVE MEASURE E_{corr} WITH TIME
FOR C-22 IN 1000 PPM Cl⁻ AT 95°C
UNDER AERATED CONDITIONS.
SPECIMEN C22 2277-8-3175 ^{NO 5/3/95} ~~ETAR~~ CYLINDRICAL
l = 1.913 d = 0.250

START WT = 12.32025g
600 SiC FINISH

SOLUTION 1000 PPM Cl⁻ 85 PPM HCO₃⁻ 20 PPM SO₄²⁻
10 PPM NO₃⁻ 2 PPM F⁻ 700 ml OF SOLUTION
ON PAGE 247

START pH 8.270

T = 95°C H₂ THERMOMETER 0323004

SOLUTION AERATED WITH ZERO AIR (79% N₂ / 21% O₂)
FROM LIQUID CARBONIC TANK # 632778 DURING TEST

E_{corr} MEASURED WITH KEITHLEY 617 SN 579628
AND RECORDED WITH TIME USING ABB
STRIP CHART RECORDER MODEL # SE120 SN 0515265

E_{pe} +107mV AT START USING KEITHLEY 617 SN 579628
E_{corr} -393mV 5min AFTER IMMERSION USING
KEITHLEY 617 t=0 FOR CHART RECORDER

SPECIMEN STARTED 5/4/95 11:45 AM

REFERENCE SCG FISHER 13-620-51 SN 0165403

SPECIMEN STOPPED 2:30 PM 5/12/95

END pH 9.242

E_{pe} AT END +155mV

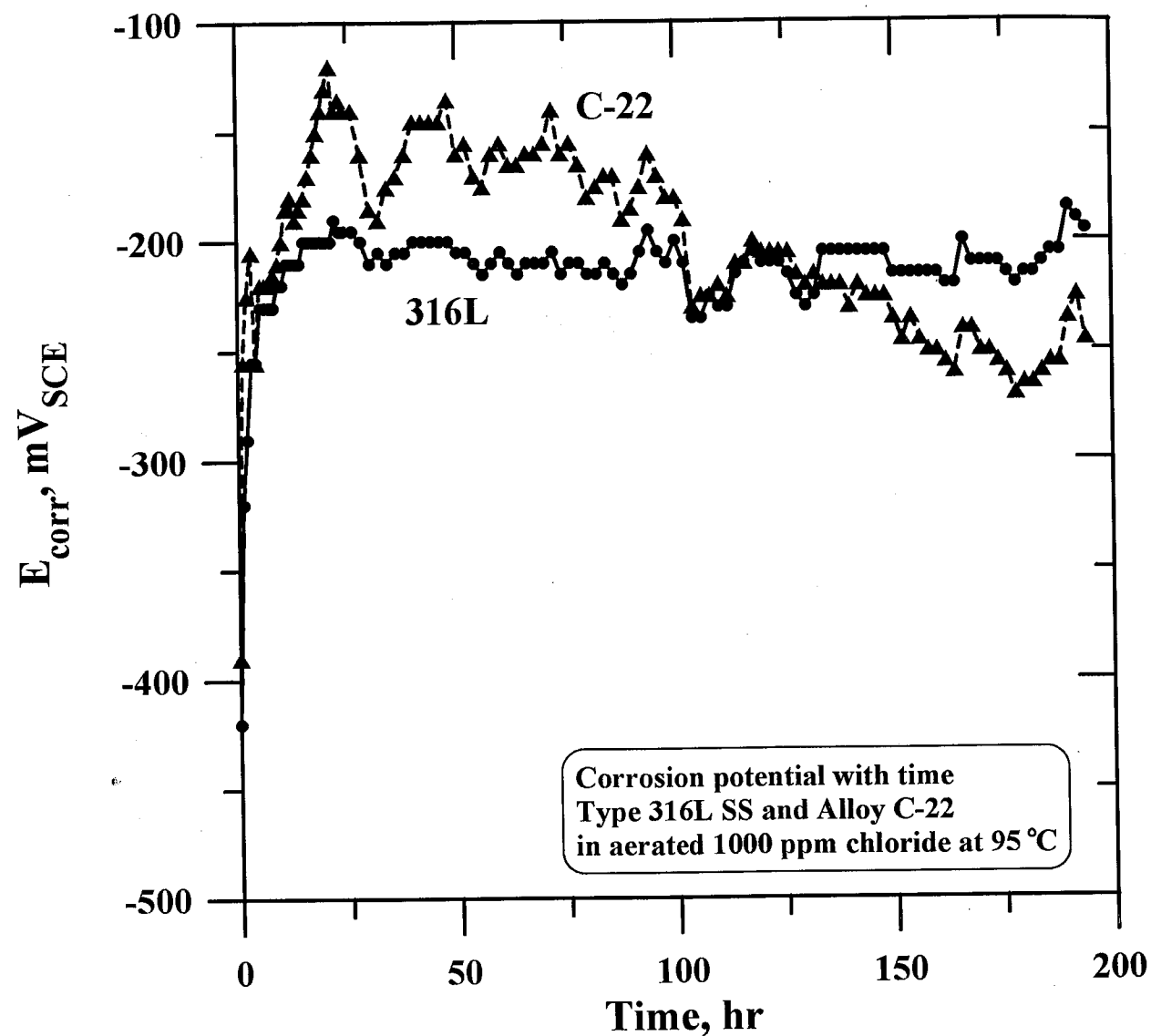
END WT = 12.32200g SOME WHITE

SCALE ON UPPER PART OF SPECIMEN
EXPOSED TO AIR ABOVE SOLUTION/VAPOR
INTERFACE NO SIGN OF LOCALIZED
CORROSION.

DATA PLOT p254

Paul D 5/15/95

E_{corr} 316L C22 p 252 253



Paul D 5/15/95

GALVANIC CORROSION 316L GC316LC1

OBJECTIVE DETERMINING DEGREE OF GALVANIC CORROSION
OF 316L WITH AND WITHOUT CRACKS

SPECIMEN 316L P80746 TOTAL AREA = 24 cm²
IMMERSED AREA = 21 cm² TWO PTFE CRACK
BLOCKS TORQUED TO 50 IN. OZ USING PROTO
6103 AND ~~C27~~ DP 7/12/95 C276 NUT & BOLT
START WT 34.65474 g

SOLUTION 1 MOLAR Cl⁻ AS NaCl PREPARED
WITH 116.88011 g NaCl LOT 941616
+ DI WATER TO 2000 mL
START pH 6.295
SOLUTION AERATED WITH ZERO AIR DP 7/12/95 AIR
FROM LIQUID CARBONIC TANK 632778
T = 95 °C Hg THERMOMETER 183303

SETUP SPECIMEN AND COUNTER ELECTRODE
HOOKED TO EG&G VERSASTAT SN 20104
EG&G 352 SOFTWARE USED TO ACQUIRE
DATA IN GALVANIC CORROSION SETUP
REFERENCE FISHER SC6 13-620-S1 SN 0165403
COUNTER ELECTRODE 316L P80746 TOTAL
AREA = 40 cm² IMMERSED AREA = 28 cm²

E_{pt} +14 mV REMOVED AND REPLACED W/ 316L COUNTER
MEASUREMENT MADE WITH FLUKE 8050A SN 5005110

E_{corr} -237 mV FLUKE 8050A SN 5005110

$E_{316L \text{ COUNTER}}$ -197 mV FLUKE 8050A SN 5005110

TEST STARTED 7/12/95 9:20 AM

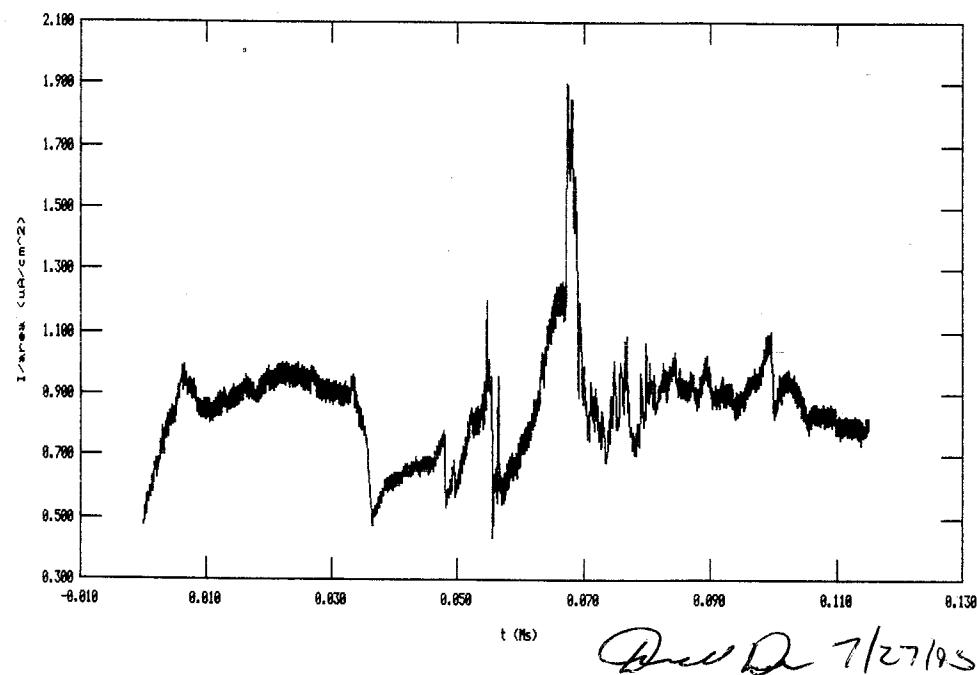
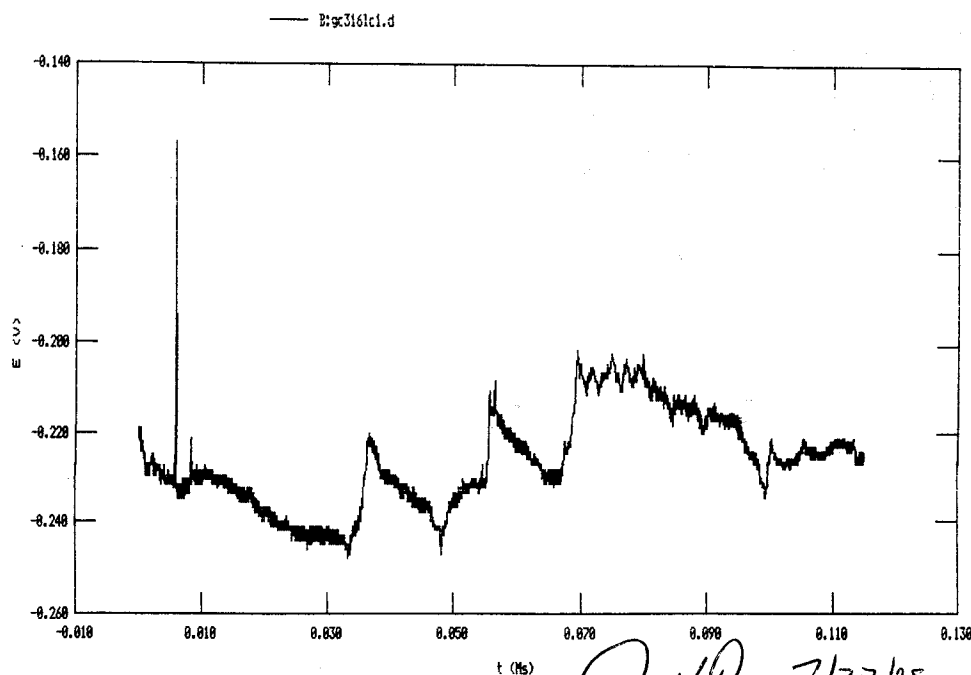
END pH 7.199

END WT 34.64661 g

CRACK CORROSION ON 8 OF 24 LOCATIONS

MAXIMUM DEPTH = 180 MICRONS

RUN PARAMETERS & PLOTS p 256 Paul D 7/27/95



Model 352/252 Corrosion Analysis Software, v. 2.01
 Filename: Bgc316lcl.d
 Pstat: VStat1 Ver 2
 GC GALVANIC CORROSION
 Date Run: 04-10-95

File Status: NORMAL
 Time Run: 00:10:34

Time/Pt.	TP	57.50	s	Time Step 1	T1	0.1150E6	s
No. of Points	WP	2000		Curr. Range	CR	Auto	
Line Sync.	LS	no		Filter	FL	Off	
Rise Time	RT	high stability		Ref. Elec.	RE	SCE 0.2415	V
Working Elec.	WE	Solid		Equiv. Wt.	EW	0.0000	g
Sample Area	AR	21.00	cm ²	Open Circuit	OC	-0.2190	V
Density	DE	8.000	g/ml				

Comment: 316L P80746 with crevice

7/27/95

GALVANIC CORROSION GC316LC2.DAT

OBJECTIVE Same as PAGE 255

SPECIMEN 316L P80746 TOTAL AREA = 24 cm²

IMMERSION AREA = 21 cm² TWO CREVICE
 BLOCKS ON SPECIMEN SURFACE HELD BY C276
 BOLT AND NUT TORQUED TO 50 IN-LB USING
 PROTO 6103

START WT. 34.66712 g

SOLUTION 1000 ppm Cl⁻ as NaCl

3.2 QD 7/27/95 3.30501 g NaCl LOT 941616
 + DI WATER TO 2000 ml

START PH 5.637 QD 7/27/95

SOLUTION ~~PREPARED WITH~~ 99 AERATED WITH
 2600 AIR FROM LIQUID CARBONIC TANK 632778

T = 95°C N₂ THERMOMETER

POTENTIOSTAT EG&G VERSASTAT SN 20104

REFERENCE FISHER SCE SN 0165403

SETUP Same as PAGE 255

E_{pk} +589 mV

E_{316L} CORROSION -95 mV

E_{CORR} -127 mV

TEST STARTED 2:30 PM 7/27/95

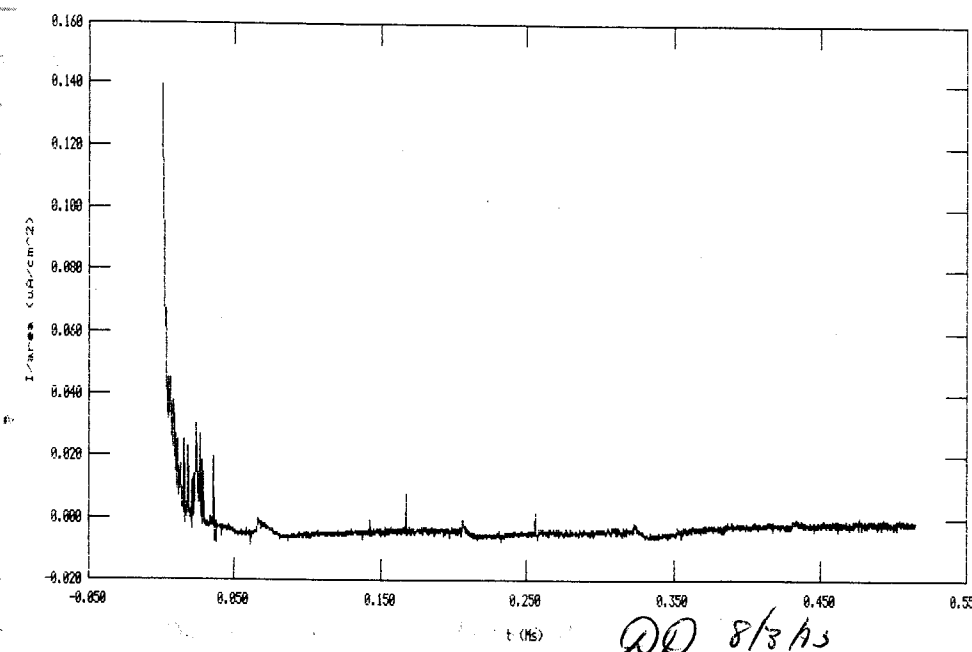
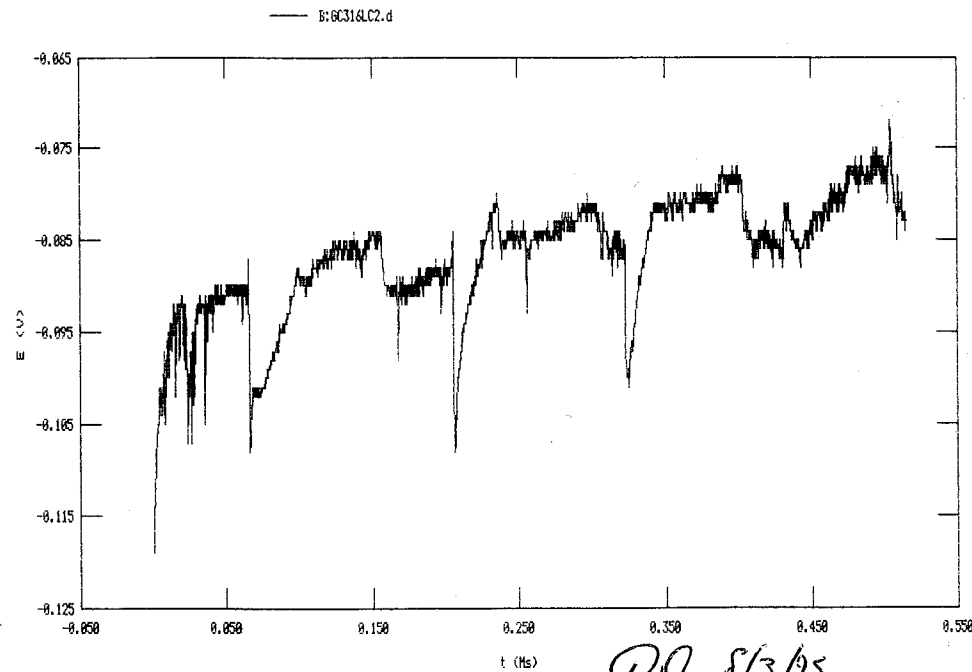
END PH 7.020

END WT. 34.66677 g

END PH QD 8/3/95

SOME VERY SMALL AREAS OF CREVICE CORROSION

8/3/95



Model 352/252 Corrosion Analysis Software, v. 2.01
 Filename: B:\GC316LC2.dat
 Pstat: VStat[] Ver 2
 GC GALVANIC CORROSION
 Date Run: 07-27-95

File Status: NORMAL
 Time Run: 14:24:50

Time/Pt.	TP	0.2574E3	s	Time Step 1	T1	0.5148E6	s
No. of Points	NP	2000		Curr. Range	CR	Auto	
Line Sync.	LS	yes		Filter	FL	Off	
Rise Time	RT	high stability		Ref. Elec.	RE	SCE 0.2415 V	
Working Elec.	WE	Solid		Equiv. Wt.	EW	0.0000 g	
Sample Area	AR	21.00	cm²	Open Circuit	OC	-0.1170 V	
Density	DE	8.000	g/ml				

DD 8/3/95

DD 8/3/95

LONG TERM POTENTIOSTATIC TEST LT82SP2S.DAT

SPECIMEN SAME AS LT82SP2R P246

START WT. 30.82021g

SOLUTION 1000 PPM Cl^- 85 PPM NO_3^- 20 PPM SO_4^{2-}

10 PPM NO_3^- 2 PPM F- 2000 mL AS FOLLOWS

3.30477 g NaCl LOT 941616

0.24271 g NaNO_3 LOT 897789

40 mL SO_4 - 8/95 STOCK SOLUTION P 265

20 mL NO_3 - 8/95 " P 265

4 mL F- 8/95 " P 265

+ DI WATER TO 2000 mL $T = 75^\circ\text{C}$

Hg THERMOMETER 0323007

START pH 8.251

POTENTIOSTAT ESC 440 #1 CHANNEL #1

DATA SAVED AS ~~LT82SP2J~~^{DD} 8/1/95 LT82SP2S.DAT

REFERENCE FISHER SCE 13-220-51 SN 3106343

$E_{\text{corr}} = -56 \text{ mV}$

$E_{\text{pt}} = +164 \text{ mV}$

$E_{\text{APPLIED}} = 0 \text{ mV}$

TEST STARTED 8/2/95 6:10 pm

TEST STOPPED 8/31/95 12:10 pm

RUNTIME:

END pH 9.467

END WT 30.82026g

NO SIGN OF LOCALIZED CORROSION

DD 9/5/95

LONG TERM POTENTIOSTATIC TEST LT82SP7J

SPECIMEN SAME AS LT82SP7I.DAT p247

START WT = 30.30965g

SOLUTION 1000 ppm Cl^- 85 ppm HCO_3^- 20 ppm SO_4^{2-}
10 ppm NO_3^- 2 ppm F- 2000 mL AS FOLLOWS

3.30105 g NaCl LOT 941616

0.24458 g NaHCO_3 LOT 89778940 mL SO_4 - 8/95 STOCK SOLUTION p 26520 mL NO_3 - 8/95 "

4 mL F - 8/95 "

+ DI WATER TO 2000 mL $T=95^\circ\text{C}$ N₂ THERMOMETER 0323008

START pH 8.317

POTENTIOSTAT ESC 440 #1 CHANNEL #2

DATA SAVED AS LT82SP7I.DAT

REFERENCE FISHER SC6 13-620-S1 SN 9214074

E_{corr} - 5 mVE_{pt} +156 mVE_{APPLIED} 200 mV

SPECIMEN STARTED 8/2/95 6:10 pm

TEST STOPPED 8/31/95

"RUNTIME

END pH 9.055

END WT 30.30950g

NO SIGN OF LOCALIZED CORROSION

Paul D 9/5/95

LONG TERM POTENTIOSTATIC TEST LT82SP8J

SPECIMEN SAME AS LT82SP8I p248

START WT = 31.85447g

SOLUTION 1000 ppm Cl^- 85 ppm HCO_3^- 20 ppm SO_4^{2-}
10 ppm NO_3^- 2 ppm F- 2000 mL MANG AS FOLLOWS

3.30331 g NaCl LOT 941616

0.24438 g NaHCO_3 LOT 89778940 mL SO_4 - 8/95 STOCK SOLUTION p 26520 mL NO_3 - 8/95 "

4 mL F - 8/95 "

+ DI WATER TO 2000 mL $T=95^\circ\text{C}$ N₂ THERMOMETER 183308

pH = 8.362

1000 mL OF SOLUTION USED IN THIS TEST

POTENTIOSTAT ESC 440 #1 CHANNEL #3

DATA SAVED AS LT82SP8I.DAT

REFERENCE FISHER SC6 13-620-S1 SN 9214083

E_{corr} - 70 mVE_{pt} +168 mVE_{APPLIED} 100 mV

TEST STARTED 8/2/95 6:10 pm

TEST STOPPED 8/31/95

RUNTIME

END pH 9.080

END WT 31.85436 g

NO SIGN OF LOCALIZED CORROSION

Paul D 9/5/95

LONG TERM POTENTIOSTATIC TEST LT82SP4J

SPECIMEN SAME AS LT82SP4I p249

START WT = 38.95346 g

SOLUTION 1000 ppm Cl^- 85 ppm HCO_3^- 20 ppm SO_4^{2-}
10 ppm NO_3^- 2 ppm F^- 1000 mL OF SOLUTION
ON p 261

START pH 8.362

T = 95 °C H_2 THERMOMETER 1833032 PTFE CRUICK BLOCKS ATTACHED TO
SPECIMEN WITH C276 NUT AND BOLT
TORQUED TO 40 IN-OZ USING PROTO 6103

POTENTIOSTAT ESC 440 #1 CHANNEL #4

DATA SAVED AS LT82SP4J.DAT

REFERENCE SCE FISHER 13-620-SI SN 3106337

 E_{corr} - 114 mV E_{pt} - 21 mV (GRAPHITE) E_{APPLIED} 0 mV

TEST STARTED 8/2/95 6:10 pm

TEST STOPPED 8/31/95

RUNTIME

END pH 9.163

END WT 38.95323 g

NO SIGN OF LOCALIZED CORROSION

Qm Q 9/5/95

LONG TERM POTENTIOSTATIC TEST LT82SP5J

SPECIMEN SAME AS LT82SP5I p 250

START WT = 39.08730 g

2 PTFE CRUICK BLOCKS ATTACHED TO SPECIMEN
AND TORQUED TO 40 IN-OZ USING PROTO 6103
C-276 NUT AND BOLT USED TO HOLD BLOCKSSOLUTION 1000 ppm Cl^- 85 ppm HCO_3^- 20 ppm SO_4^{2-}
10 ppm NO_3^- 2 ppm F^- 2000 mL AS FOLLOWS3.30383 g NaCl LOT 9416160.24885 g NaHCO_3 LOT 89778940 mL SO_4 - 8/95 STOCK SOLUTION p 26520 mL NO_3 - 8/95 "~~40 mL~~ 8/1/95 4 mL F^- - 8/95 "+ DI WATER TO 2000 mL 1000 mL OF SOLUTION
USED IN THIS TESTT = 95 °C H_2 THERMOMETER 183301

START pH = 8.308

POTENTIOSTAT ESC 440 #1 CHANNEL #5

DATA SAVED AS LT82SP5J.DAT

REFERENCE SCE FISHER SCE 13-620-SI SN 8211163

 E_{corr} - 120 mV E_{pt} - 12 mV (GRAPHITE) E_{APPLIED} - 100 mV

TEST STARTED 8/2/95 6:10 pm

TEST STOPPED 8/31/95

RUNTIME

END pH 8.951

END WT 39.08714 g

NO SIGN OF LOCALIZED CORROSION

Qm Q 9/5/95

LONG TERM TEST - OPEN CIRCUIT OC825C1E

SPECIMEN SAME AS OC825C1D PZS1

START WT. 39.28767g

2 PTFE CIRCULAR BLOCKS ATTACHED TO SPECIMEN
USING C276 BOLT AND NUT TORQUED TO
40 IN.OZ USING PROTO 6103

SOLUTION 1000 ppm Cl⁻ 85 ppm NO₃⁻ 20 ppm SO₄²⁻
10 ppm NO₃⁻ 2 ppm F⁻ 1000 mL OF SOLUTION
FROM P 263

T: 95 °C H₂ THERMOMETER 183302

START pH: 8.308

SOLUTION PURGED WITH ZERO AIR DURING TEST

POTENTIOSTAT ESC 440 #1 CHANNEL #6

REFERENCE FISHER SEC 13-620-S1 SN 2134032

DATA SAVED AS OC825C1E.DAT

E_{CORR} -120 mV

E_{PE} +68 mV

E_{APPLIED} O.C.

TEST STARTED 8/2/95 6:10 pm

TEST STOPPED 8/31/95

RUNTIME

END pH 9.218

END WT 39.28746g

NO SIGN OF LOCALIZED CORROSION

QDD 9/5/95

STOCK SOLUTIONS 8/95

F - 8/95 1000 ppm F⁻ AS NaF
2.21128g NaF LOT 896405 + DI WATER
TO 1000 mL EXP 8/31/95

NO₃ - 8/95 1000 ppm NO₃⁻ AS NaNO₃
1.37228g NaNO₃ LOT 897183
+ DI WATER TO 1000 mL EXP 8/31/95

SO₄ - 8/95 1000 ppm SO₄²⁻ AS Na₂SO₄
1.48197g ~~Na₂SO₄~~ 8/2/95 Na₂SO₄ LOT
901213 + DI WATER TO 1000 mL EXP 8/31/95

QDD 8/2/95

STOCK SOLUTIONS 9/95

F- 9/95

1000 PPM F⁻ AS NaF21.66 g NaF LOT 896405 + DI WATER
TO 1000 ml EXP 9/31/95NO₃- 9/951000 PPM NO₃⁻ AS NaNO₃1.37731 g NaNO₃ LOT 897183
+ DI WATER TO 1000 ml EXP 9/31/95SO₄- 9/951000 PPM SO₄ AS Na₂SO₄1.47119 g Na₂SO₄ LOT 901213
+ DI WATER TO 1000 ml EXP 9/31/95

D. D. 9/7/95

LONG TERM POTENTIOSTATIC TEST LT82SP2T

SPECIMEN SAME AS p 259 ALLOY 82S H4437IFG

START WT: 30.82026 g

SOLUTION 1000 PPM Cl⁻ 85 PPM NO₃⁻ 20 PPM SO₄⁻10 PPM NO₃⁻ 2 PPM F⁻ 2000 mL MAKE AS FOLLOWS

3.30955 g NaCl LOT 941616

0.24681 g NaNO₃ LOT 89778940 mL SO₄- 8/95 ~~DO 9/6/95 - SO₄-~~ SO₄- 9/95 p26620 mL NO₃- 9/95 p266

4 mL F- 9/95 p266

+ DI WATER TO 2000 mL T = 95°C

H₂ THERMOMETER 0323003

START pH = 8.177

POTENTIOSTAT ESC 440 #1 CHANNEL #2

DATA SAVER AS LT82SP2T.DAT

REFERENCE FISHER 13-620-SI SN 9214083

E_{CORR} -61 mV KEITHLEY 614 SN 467374E_{PE} +141 mV "E_{APPLIED} 0 mV "

TEST STARTED 9/7/95 9:20 AM

TEST STOPPED 10/9/95 10:00 AM

END pH 9.001

END WT 30.82028 g

NO SIGN OF LOCALIZED CORROSION

D. D. 10/9/95

LONG TERM POTENTIOSTATIC TEST LT82SP7K

SPECIMEN SAME AS p 260 ALLOT 825 NH437FG
 START WT: 30.30950g
 SOLUTION 1000 PPM Cl^- 85PPM HCO_3^- 20PPM SO_4^{2-}
 10 PPM NO_3^- 2PPM F^- 2000 mL MAKE AS FOLLOWS
 3.30524 g NaCl LOT 941616
 0.24110 g NaHCO_3 LOT 897789
 40 mL SO_4 - 9/95 p 266
 20 mL NO_3 - 9/95 p 266
 4 mL F^- - 9/95 p 266
 + DI WATER TO 2000 mL $T=95^\circ\text{C}$
 Hg THERMOMETER 0323008
 START pH 8.168
 POTENTIOSTAT ESC 440 #1 CHANNEL #2
 DATA SAVED AS LT82SP7K.DAT
 REFERENCE FISHER 13-620-SI SN 3106337
 E_{corr} -4 mV KEITHLEY 614 SN 467374
 E_{pe} +160 mV "
 E_{APPLIED} 200 mV "
 TEST STARTED 9:20 AM 9/7/95
 TEST STOPPED 10:00 AM 10/9/95
 END pH 9.361
 END WT 30.30907g

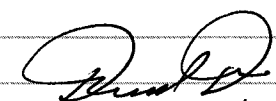
NO SIGN OF LOCALIZED CORROSION

 10/9/95

LONG TERM POTENTIOSTATIC TEST LT82SP8K

SPECIMEN SAME AS p 261 ALLOT 825 NH437FG
 START WT: 31.85436g
 SOLUTION 1000 PPM Cl^- 85PPM HCO_3^- 20PPM SO_4^{2-}
 10 PPM NO_3^- 2PPM F^- 2000 mL MAKE AS FOLLOWS
~~3.0127~~ OR 9/6/95 3.30127 g NaCl LOT 941616
 0.24025 g NaHCO_3 LOT 897789
 40 mL SO_4 - 9/95 p 266
 20 mL NO_3 - 9/95 p 266
 4 mL F^- - 9/95 p 266
 + DI WATER TO 2000 mL 1000 mL OF
 THIS SOLUTION USED IN THIS TEST $T=95^\circ\text{C}$
 Hg THERMOMETER 183302
 START pH = 8.208
 POTENTIOSTAT ESC 440 #1 CHANNEL #3
 DATA SAVED AS LT82SP8K.DAT
 REFERENCE FISHER 13-620-SI SN 2134032
 E_{corr} -81 mV KEITHLEY 614 SN 467374
 E_{pe} +150 mV "
 E_{APPLIED} 100 mV "
 TEST STARTED 9/7/95 9:20 AM
 TEST STOPPED 10/9/95 10:00 AM
 END pH 9.036
 END WT 31.85443g

NO SIGN OF LOCALIZED CORROSION

 10/9/95

LONG TERM POTENTIOSTATIC TEST LT82SP4K

SPECIMEN SAME AS p 262 ALLOY 825 HN437FC

START WT 38.95323g

SOLUTION 1000 PPM Cl^- 85 PPM HCO_3^- 20 PPM SO_4^{2-}
10 PPM NO_3^- 2 PPM F^- 1000 mL OF SOLUTION
FROM p. 269T = 95°C N_2 THERMOMETER 183301

START pH = 8.208

2 PTFE CREVICE BLOCKS ATTACHED TO
SPECIMEN WITH C276 NUT AND BOLT
TORQUED TO 40 IN-OZ USING PROTO 6103

POTENTIOSTAT ESC 440 #1 CHANNEL #4

DATA SAVED AS LT82SP4K.DAT

REFERENCE SCE FISHER 13-620-SI SN 821163

E_{corr} -95 mV KEITHLEY 614 SN 467374E_{pe} +61 mV (GRAPHS) "E_{APPLIED} 0 mV "

TEST STARTED 9/7/95 9:20 AM

TEST STOPPED 9/26/95

" BROKEN LOGGED PROBE.

END pH 8.822

END WT 38.95319g

NO SIGN OF LOCALIZED CORROSION

D. D. 10/9/95

LONG TERM POTENTIOSTATIC TEST LT82SP5K

SPECIMEN SAME AS p. 263 ALLOY 825 HN437FC

START WT = 39.08714g

2 PTFE CREVICE BLOCKS ATTACHED TO SPECIMEN
USING C276 NUT AND BOLT TORQUED TO
40 IN-OZ USING PROTO 6103SOLUTION 1000 PPM Cl^- 85 PPM HCO_3^- 20 PPM SO_4^{2-}
10 PPM NO_3^- 2 PPM F^- 2000 mL MADE AS FOLLOWS

3.30014g NaCl LOT 941616

0.24673g NaHCO_3 LOT 89778940 mL SO_4 - 9/95 p26620 mL NO_3 - 9/95 p2664 mL F^- - 9/95 p266T = 95°C N_2 THERMOMETER 183303

START pH = 8.211

1000 mL SOLUTION USED IN THIS TEST

POTENTIOSTAT ESC 440 #1 CHANNEL #5

DATA SAVED AS LT82SP5K.DAT

REFERENCE FISHER SCE 13-620-SI SN 9214074

E_{corr} -105 mV KEITHLEY 614 SN 467374E_{pe} -3 mV (GRAPHS) "E_{APPLIED} -100 mV "

TEST STARTED 9/7/95 9:20 AM

TEST STOPPED 10/9/95 10:00 AM

END WT 39.08715g

END pH 8.856

NO SIGN OF LOCALIZED CORROSION

D. D. 10/9/95

LONG TERM POTENTIOSTATIC TEST OC82SC1F

SPECIMEN SAME AS OC82SC1F p 264

START WT: 39.28746 g

2 PTFE CRUICK BLOCKS ATTACHED TO
SPECIMEN USING ~~PROTO 90~~ 9/6/95 C276
NUT AND BOLT TORQUED TO 40 IN.OZ USING
PROTO 6103

SOLUTION 1000 ppm Cl^- 85 ppm NO_3^- 20 ppm SO_4^{2-} 10 ppm NO_3^- 2 ppm F^-

1000 mL OF SOLUTION P271

T=95°C H₂ THERMO 183305

START pH = 8.211

SOLUTION BUBBLED WITH ZERO AIR (79% N_2 / 21% O_2)
FROM LIQUID CARBONIC TANK # 228274

POTENTIOSTAT ESC 440 #1 CHANNEL #6

REFERENCE SCE FISHER 13-620-SI SN 3106343

DATA SAVER AS OC82SC1F.DAT

E_{corr} -172 mV KEITHLEY 614 SN 467374E_{pt} +62 mVE_{APPLIED} O.C.

TEST STARTED. 9/7/95 9:20 AM

BUBBLE IN LUGGED PROBES OBSERVED 9/14/95 8:00 AM

t = 60000 SECONDS DATA IN LAST 15

HOURS t = 535,000 TO t = 604000 SECONDS

IS SUSPECT. INCORRECT O.C. WAS +362 mV

TEST STOPPED 9/26/95 3:00 PM t = 1663600 s

MANY SOAP LIKE BUBBLES AT TOP OF
SOLUTION.

END pH 9.046

END WT 39.28746 g

NO SIGN OF LOCALIZED CORROSION

 10/9/95

Initial Scientific notebook entry for Pit Propagation Experiments.

Title: Pit Propagation

Tests Performed by: Darrell S. Dunn and Narasi Sridhar

Objectives: Determine the effect of potential and environment on the propagation of pitting corrosion

Equipment: Keithley 614 # 467374, Keithley 614 # 555368, Keithley 485 # 509163, Strawberry Tree Data Shuttle 16 bit, 8 channel data acquisition board, Workbench software, 386 computer, Mettler umt2 211001-142 balance. ESC Potentiostat Model 440.

Materials: Alloy 825 HH4371FG, and heat HH8882F 316L P80746. Other materials and heats to be added and identified prior to testing.

Specimen specifications:: Cylindrical rod. dimensions and weight to be provided in individual tests.

Measurement Parameters: Potential and Current of specimen during test. Weight of specimen prior to and after conclusion of test. solution pH prior to and at conclusion of test.

Required level of accuracy: Potentials \pm 1mV, Current down to 0.1 microamps. Specimen weight to 0.05 milligrams. Solution pH to 0.01 pH units.

Uncertainty and Sources of Error: Limitation of balance used to measure specimen weight.

 9/8/95

PIT PROPAGATION 8ZSPP1.DAT

OBJECTIVE SAME AS P 273

SPECIMEN ALLOT 825 NN 8882F COVERED IN HEAT SHRINK TUBING WITH INITIAL AREA OF 0.041 cm^2 AND PIT DEPTH OF 2.0 mm ~~2.0 mm~~ $9/11/95$ 2.0 mm

START WT MEASURED WITH METTLER UMT 2 211001-142

1. 1364764 μg	AVERAGE 1364773.8 μg
2. 1364778	STANDARD DEV 8.5 μg
3. 1364786	
4. 1364772	
5. 1364769	

SOLUTION 1000 ppm Cl^- 85 ppm NO_3^- 20 ppm SO_4^{2-}
 10 ppm NO_3^- 2 ppm F^- 1000 mL MAKE
 AS FOLLOWS

1.64931 g NaCl LOT 941616
 0.12807 g NaHCO_3 LOT 897789
 20 mL SO_4^{2-} 9/95 p266
 10 mL NO_3^- 9/95 p266
 2 mL F^- 9/95 p266

+ DI WATER TO 1000 mL pH = 8.263

PROCEDURE RECORD OPEN CIRCUIT POTENTIALS
 POLARIZE SPECIMEN RECORD CURRENT
 CALCULATE CURRENT DENSITY CHARGE DENSITY
 WEIGHT LOSS PIT DEPTH ANM PROPAGATED RATE

POTENTIOSTAT ESC 440 #3 CHANNEL #4

SOLUTION TEMP = 95°C N₇ THERMO METER 115814

DATA FILES 8ZSPP1.DAT & 8ZSPP1B.DAT

REFERENCE FISHER SC6 13-620-S1 SN 3106339

E_{corr} - 42 mV KEITHLEY 614 SN 467374E_{pe} +122 mV "E_{applied} +500 mV "

TEST STARTED 9/11/95

9/11/95

PIT PROPAGATION 8ZSPP2.DAT

OBJECTIVE SAME AS P 273

SPECIMEN ALLOY 825 NN 8882F COVERED IN
 HEAT SHRINK AREA = 0.041 cm^2 DEPTH = 2 mm

START WT MEASURED WITH METTLER UMT 2 211001-142

1. 1344868 μg	AVERAGE 1344868.8 μg
2. 1344871 μg	STANDARD DEV: 4.2 μg
3. 1344873 μg	
4. 1344862 μg	
5. 1344870 μg	

SOLUTION SAME AS P 274

T = 95°C N₇ THERMO METER 115847

START pH = 8.263

PROCEDURE SAME AS P 274

POTENTIOSTAT ESC 440 #3 CHANNEL #5

REFERENCE FISHER SC6 13-620-S1 SN 0165403

DATA FILES 8ZSPP2.DAT AND 8ZSPP2B.DAT

E_{corr} - 54 mV KEITHLEY 614 SN 555368E_{pe} +152 mV "E_{applied} +400 mV "

TEST STARTED 9/11/95

TEST STOPPED 9/14/95

END WT 1344833	AVERAGE 1344826.4
1344824	STANDARD DEV 5.4
1344821	
1344820	
1344831	

WEIGHT LOSS MEASURED $42.4 \pm 9.6 \mu\text{g}$ WEIGHT LOSS CALCULATED $2.64 \times 10^{-6} \text{ g}$ OR $2.6 \mu\text{g}$
 9/14/95

825PP1.DAT CONT FROM p 274

I MEASURED THROUGH 10 Ω RESISTOR
 CURRENT RESOLUTION 5×10^{-6} A
 PROPAGATION RATE RESOLUTION 2.5×10^{-9} cm/s
 EMF LOWERS TO 100 mV AT 325000 SECONDS

ERROR IN THE CALCULATION OF TOTAL PIT
 DEPTH MADE BY WORKBOOK. DELTA PIT
 DEPTH WAS CALCULATED CORRECTLY TOTAL
 DEPTH WAS CALCULATED (INCORRECTLY) AS
 $2 \text{ cm} + \text{DELTA DEPTH cm}$. HOWEVER ORIGINAL
 PIT DEPTH WAS 2 mm. CORRECT CALCULATION
 OF PIT DEPTH SHOULD BE $0.2 \text{ cm} + \text{DELTA DEPTH, cm}$
 ALL OTHER CALCULATED VALUES ARE CORRECT

FINAL CORRECTLY CALCULATED PIT DEPTH = 0.89 cm
 FINAL MEASURED PIT DEPTH = 0.80 cm

CALCULATED WEIGHT LOSS 0.2304 grams
 FINAL MEASURED WEIGHT ~~LOSS~~ DD 9/21/95

1	1138663 μg	
2	1138660 μg	AVG 1138661.6
3	1138655 μg	SD = 6.5
4	1138658 μg	
5	1138672 μg	

WEIGHT LOSS 0.2261 g

OBSERVATIONS LOW PROPAGATION RATES
 ONLY OBTAINED AT POTENTIALS BELOW
 -100 mV SOME CRACK CORROSION
 ON SIDES OF SPECIMEN.

DD 9/22/95

825PP2.DAT CONT FROM p275

I MEASURED THROUGH 100 Ω RESISTOR
 CURRENT RESOLUTION 5×10^{-7} A
 PROPAGATION RATE RESOLUTION 2.5×10^{-10} cm/s

ERROR IN CALCULATION OF PIT DEPTH SEE NOTE
 PAGE 276

FINAL CORRECTLY CALCULATED PIT DEPTH = 0.8652 cm
 FINAL MEASURED PIT DEPTH

CALCULATED WEIGHT LOSS
 FINAL MEASURED WEIGHT

DD 9/21/95

WEIGHT LOSS

DD 9/22/95

GALVANIC CORROSION GC825C1.DAT

OBJECTIVE DETERMINING INITIATION TIME
FOR CRACK CORROSION AT OPEN CIRCUIT

SPECIMEN ALLOY 825 NH4371F6 600 S.C FINISH
AREA = 20 cm² 2 PTFE CRACK BLOCKS
TORQUE TO 40 IN-OZ USING PRTO 6103
WITH C276 NUT AND BOLT

START WT 27.86303 g

SOLUTION 1000 PPM Cl⁻ AS FeCl₃·6H₂O
2.54993 g FeCl₃·6H₂O LOT 897791
+ DI WATER TO 1000 mL

0.01 ~~0.014~~ MOL/L Fe³⁺

T = 95°C H₂ THERMOMETER

SOLUTION PURGED W/ ZERO AIR FROM
LIQUID CARBONIC TANK # 632778

SETUP SAME AS GC 316L C1 p255
COUNTER ELECTRODE ALLOY 825 TOTAL AREA = 40 cm²
IMMERSED AREA = 30 cm²

E_{pe} +645 mV FLURG 8050A 5005110

E_{corr} + DD 9/12/95 -100 mV

E_{825 counter} +120 mV

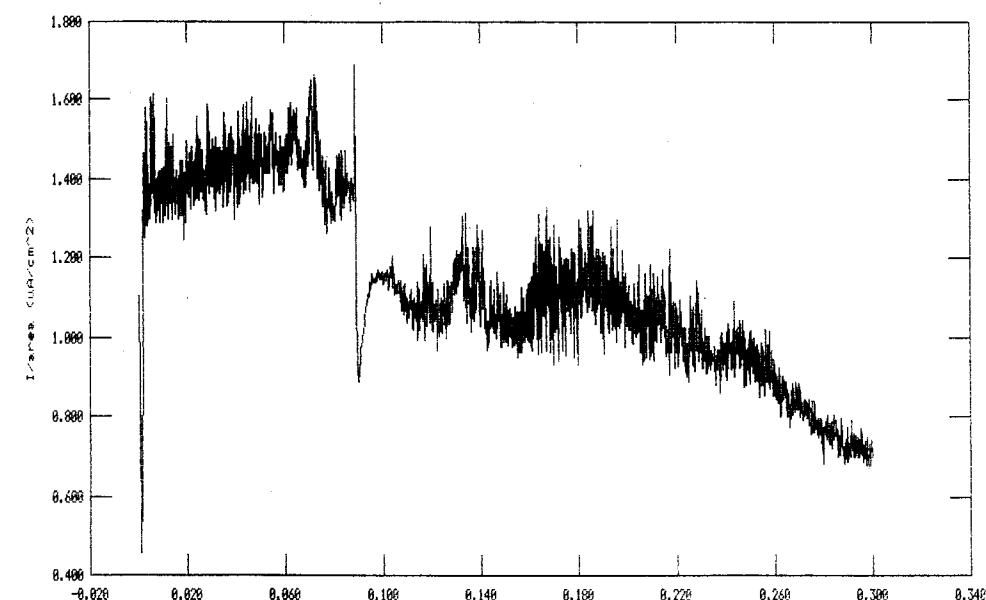
TEST STARTED 9/12/95 3:10 pm

END WT = 27.86020 g

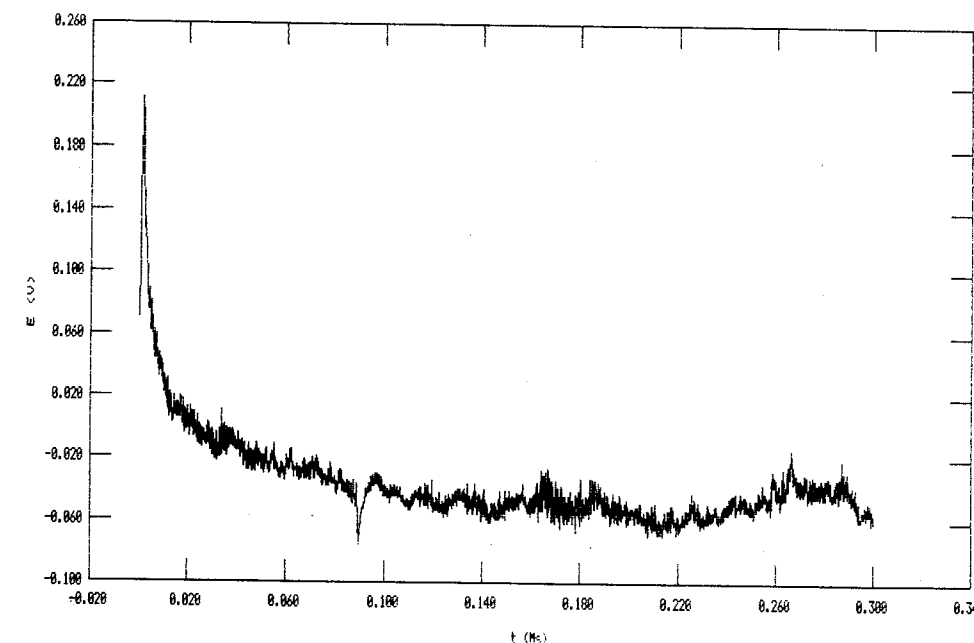
SOME CRACK CORROSION UNDER
CRACK WASHER. 16 OF 24 SITES

DD
9/22/95

GALVANIC CORROSION GC825C1.DAT



DD 9/22/95



DD 9/22/95

DD 9/22/95

PIT PROPAGATION 825PP3.DAT

OBJECTIVE SAME AS p 273

SPECIMEN ALLOY 825 HN 8882F COVERED IN
NEAT SNRINK AREA 0.041 cm^2 DEPTH = 2mm

START WT MEASURED WITH METTLER UMT2 211001-142

1. 1610150
 2. 1610138
 3. 1610143
 4. 1610148
 5. 1610151

AVERAGE - ~~16104~~ ^{DD 9/14/95} 1610146.0
 STANDARD DEV: 5.4

SOLUTION SAME AS p 274
 $T = 95^\circ\text{C}$ Hg THERMOMETER 115847
 START pH = 8.263

PROCEDURE SAME AS p 274

POTENTIOSTAT 440 #3 CHANNEL #5

REFERENCE FISHER SLC 13-620-SI SW 0165403

DATAFILES 825PP3.DAT & 825PP3B.DAT

Ecorr -700 mV KEITHLEY 614 SW 555368

E_{pt} +171 mVE_{APPLIED} 600 mV

TEST STARTED 9/14/95

POTENTIAL DECREASED TO 200 mV AT T=10100 SECONDS

ERROR IN CALCULATION OF PIT DEPTH SEE NOTE p 276

PIT DEPTH (CORRECTED, CALCULATED) 0.5652 cm

PIT DEPTH MEASURED 0.53 cm

END WT ~~CALCULATED~~ NR 9/21/95 1485283 ± 9

CALCULATED WEIGHT LOSS (CORRECTION) 0.1219g

MEASURED WEIGHT LOSS 0.1249g

DD 9/22/95

PIT PROPAGATION 825PP4

OBJECTIVE SAME AS p 273

SPECIMEN ALLOY 825 HN 8882F COVERED
IN NEAT SNRINK PIT DEPTH = 5mm AREA = 0.041 cm^2

START WT MEASURED WITH METTLER UMT 2

1. 1559255 μg
 2. 1559254 μg
 3. 1559255 μg
 4. 1559256 μg
 5. 1559247 μg

AVERAGE 1559253.4 μg
 STDV 3.6 μg

SOLUTION 1000 ppm Cl^- 83 ppm HCO_3^- 20 ppm SO_4^{2-} 10 ppm
 NO_3^- 2 ppm F^- 1000 mL ~~MORE~~ AS FOLLOWS DD 9/21/95
 SAME AS SOLUTION ON p 282
 $T = 95^\circ\text{C}$ Hg THERMOMETER
 START pH 8.357

PROCEDURE SAME AS p 274

POTENTIOSTAT CSC 440 CHANNEL #4

REFERENCE FISHER 13-620-SI SW 3106339

DATAFILES 825PP4.DAT & 825PP4B.DAT

Ecorr -85 mV KEITHLEY 467374

E_{pt} +91 mVE_{APPLIED} 500 mV

TEST STARTED 9/21/95 END pH = 9.176

END DEPTH CALCULATED 5.35 mm

END DEPTH MEASURED 5.30 mm

WEIGHT LOSS CALCULATED 0.01193 g

WEIGHT LOSS MEASURED 0.01150 g

END WT 1. 1547765 μg 5. 1547757 μg 2. 1547759 μg 3. 1547740 μg 4. 1547765 μg

AVERAGE 1547757.2

STDV 10.2

DD 9/27/95

CONT. p 285

PI PROPAGATION 82SPPS

OBJECTIVE SAME AS P 273

SPECIMEN ALLOT 82S NH 888ZF COVERED IN
N6AT SINK AREA = 0.041 cm^2 DEPTH = 5mm

START WT MEASURED w/ METTLER UMT2

1. 1574283
2. 1574268 AVERAGE 1574277.2
3. 1574281 SDG 5.8
4. 1574278
5. 1574276

SOLUTION 1000 ppm Cl^- 85 ppm NaCO_3 20 ppm SO_4^{2-}
10 ppm NO_3^- 2 ppm F^- 1000 mL MIXED AS FOLLOWS1.64931 g NaCl LOT 9416160.12806 g NaHCO_3 LOT 89778920 mL SO_4 - 9/95 p26610 mL NO_3 - 9/95 p2662 mL F^- - 9/95 p266T = 95°C N_2 THERMOMETER
START PN 8.357

POTENTIOSTAT ESC 440 #3 CHANNEL #5

REFERENCE FISHER 13-620-S1 SN 0165403

DATAFILES 82SPPS.DAT AND 82SPPSB.DAT

 E_{CORR} - 68 mV E_{PE} + 81 mV E_{APPLIED} 500 mV

TEST STARTED 9/21/95

END DEPTH CALCULATED $\phi = 0.00926/95$ 6.01 mm

END DEPTH MEASURED 5.3 mm

CALCULATED WEIGHT LOSS 0.03374 g

MEASURED WEIGHT LOSS 0.03398 g

CONT p286

9/27/95

GALVANIC CORROSION GC82SC2.DT

OBJECTIVE SAME AS 278

SPECIMEN SAME TYPE AS P278 ALLOT 82S
NH437IFG 20 cm^2 WITH CR6163 TORQUES
TO 40 IN-OZ USING PROTO 6103

START WT 27.90521 g

SOLUTION 1000 ppm Cl^- 2 LITERS MADE AS FOLLOWS3.17120 g CuCl_2 9/22/95 $\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$ LOT 8977131.84206 g CuCl LOT 951307

+ DI WATER TO 2000 mL

CONTAINS 0.0093 M Cu^{2+} & 0.0093 M Cu^+ T = 95°C N_2 THERMOMETER 0323004SOLUTION AERATED w/ ZERO AIR $21\text{O}_2/79\text{N}_2$

START PN 4.10

SETUP SPECIMEN AND COUNTER ELECTRODES MOORED
TO EG & G VERSASTAT SN 20104

DATA ACQUIRED USING EG & G MODEL 352

SOFTCORR SOFTWARE IN GALVANIC CORROSION
SETUPCATNO65 (2) ALLOT 82S NH437IFG 2000 GRIT FINISH
TOTAL IMMERSION AREA = 180 cm^2 E_{CORR} + 198 mV FLUKE 8050A 5005110 E_{PE} + 202 mV FLUKE 8050A 5005110 E_{CATNO65} + 200 mV

TEST STARTED 9/22/95

END PE POTENTIAL + 355 mV

END PN 4.295

END WT 27.85088 g

CR6163 CORROSION ON 19 OUT OF 24 POSSIBLE SITES

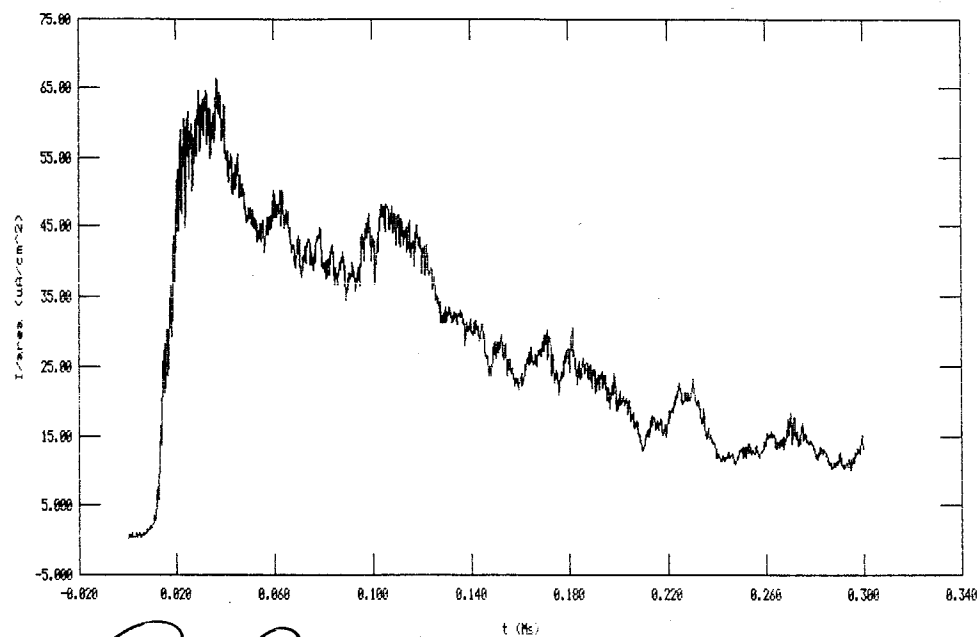
DEEPEST PENETRATION. 200 μm METNOD PAGE 115PENETRATION DATA DATA 200, 189, 110, 140, 100, 190, 185 μm

FOR 7 OF THE 19 CORROSION SITES

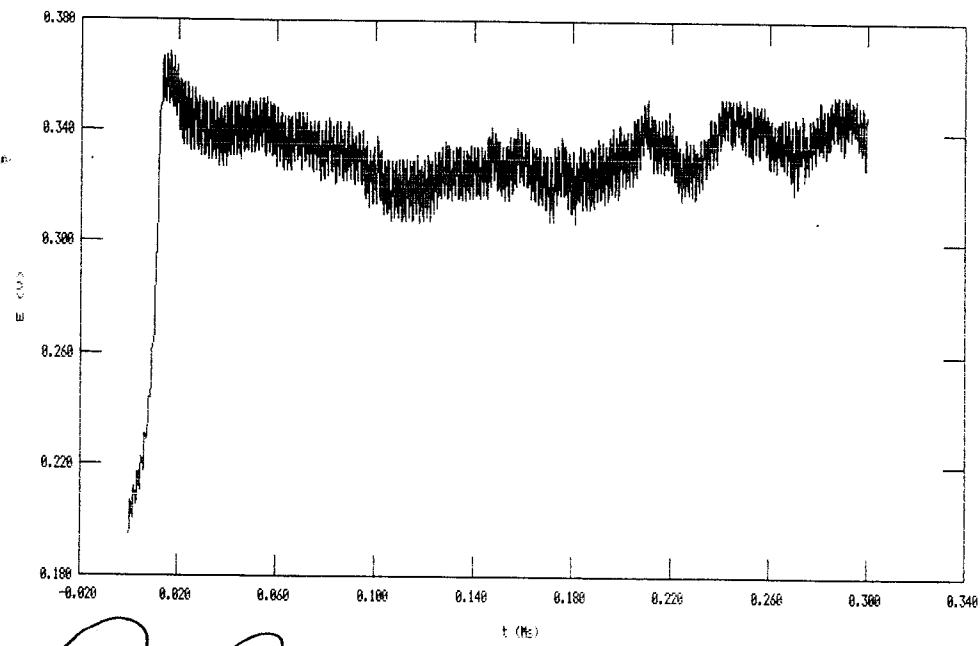
IMMERSION TIME = 0.01 - 0.02 MS

9/27/95

GALVANIC CORROSION GC825C2



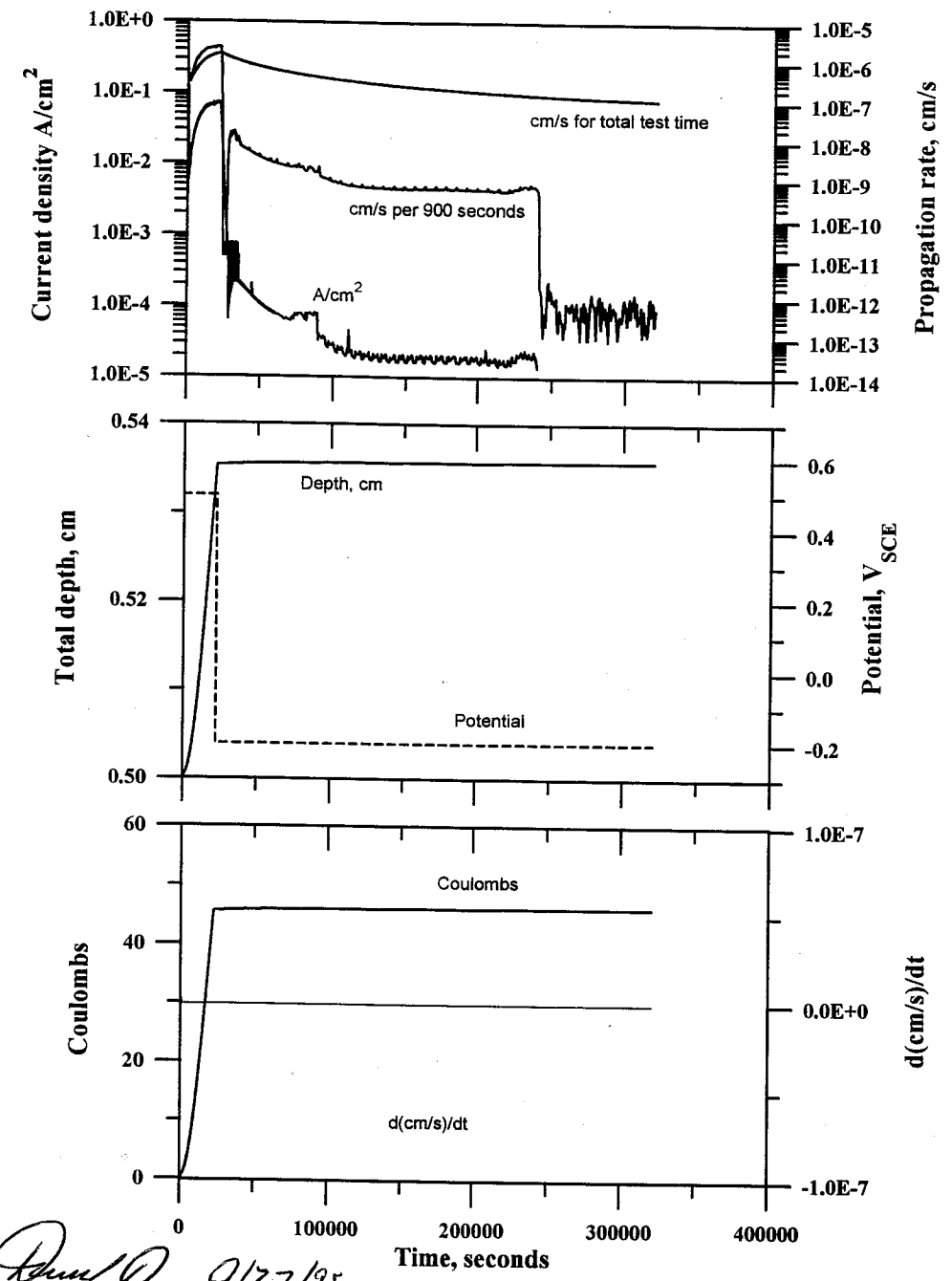
David D 9/26/95



David D 9/26/95

David D 9/26/95

PIT PROPAGATION 825PP4.DAT (CONT FROM p281)



David D 9/27/95

PIT PROPAGATION 825PP5.DAT (CONT FROM p282)

END WT ~~9/25/95~~

END pH 8.870

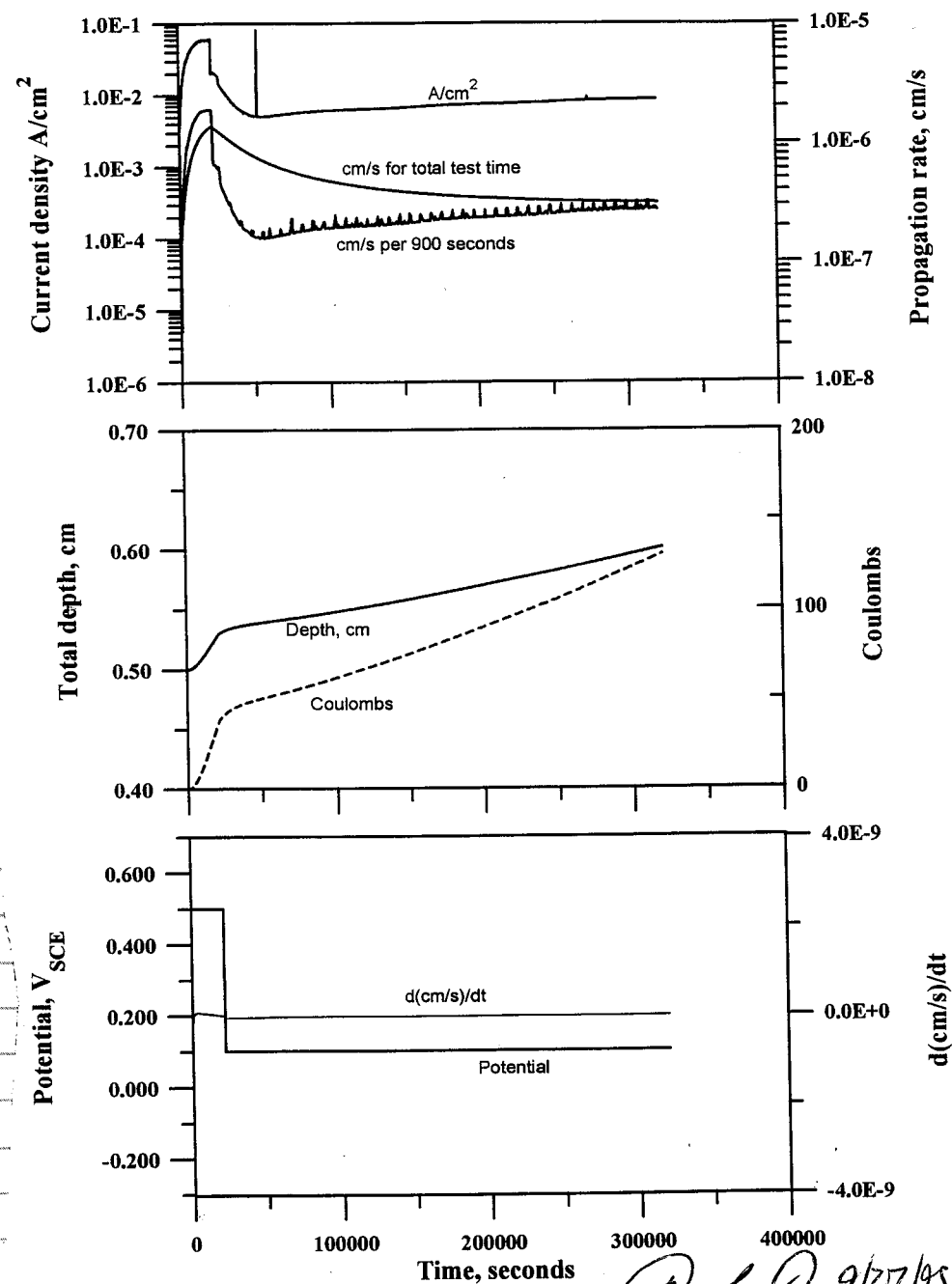
END WT. 1. 1540294

2. 1540308

3. 1540285

4. 1540312

5. 1540297

AVERAGE = 1540299.2 μg STDEV = 10.9 μg 

9/27/95

PIT PROPAGATION 825PP6.DAT

OBJECTIVE SAME AS PAGE 273

SPECIMEN ALLOY 825 HN 8882F COUGLED IN
NGAT SPRINK AREA = 0.041 cm^2 DEPTH = 5 mm

START WT MEASURED WITH METTLER UMT 2

1. 1455823 μg 2. 1455817 μg 3. 1455837 μg 4. 1455818 μg 5. 1455812 μg

AVERAGE 1455821.4

STANDARD DEV 9.5

SOLUTION 1000 ppm Cl^- 85 ppm NaCO_3 20 ppm SO_4^{2-}
10 ppm NO_3^- 2 ppm F^- 2000 mL MAKE AS FOLLOWS

3.30171 g NaCl LOT 941616

0.23805 g NaCl LOT 897789

40 mL SO_4^{2-} 9/95 p 26620 mL NO_3^- 9/95 p 2664 mL F^- 9/95 p 266

START pH = 8.112

T = 95°C N_2 THERMO METER 115814POTENTIOSTAT ESC 440 #2 ~~CHANGE #3~~ CHANNEL #4

REFERENCE FISHER 13-620-SI SN 3106339

DATAFILES 825PP6.DAT & 825PP6B.DAT

 $E_{\text{corr}} + 39 \text{ mV}$ $E_{\text{pe}} + 128 \text{ mV}$ $E_{\text{APPLIED}} 500 \text{ mV}$

TEST STARTED 9/26/95

AT $t = 77700$ POTENTIAL DECREASED AT 5 mV/s TO -100 mV

TEST STOPPED 9/28/95 NOISY CURRENT SIGNAL

END pH 9.185

9/28/95

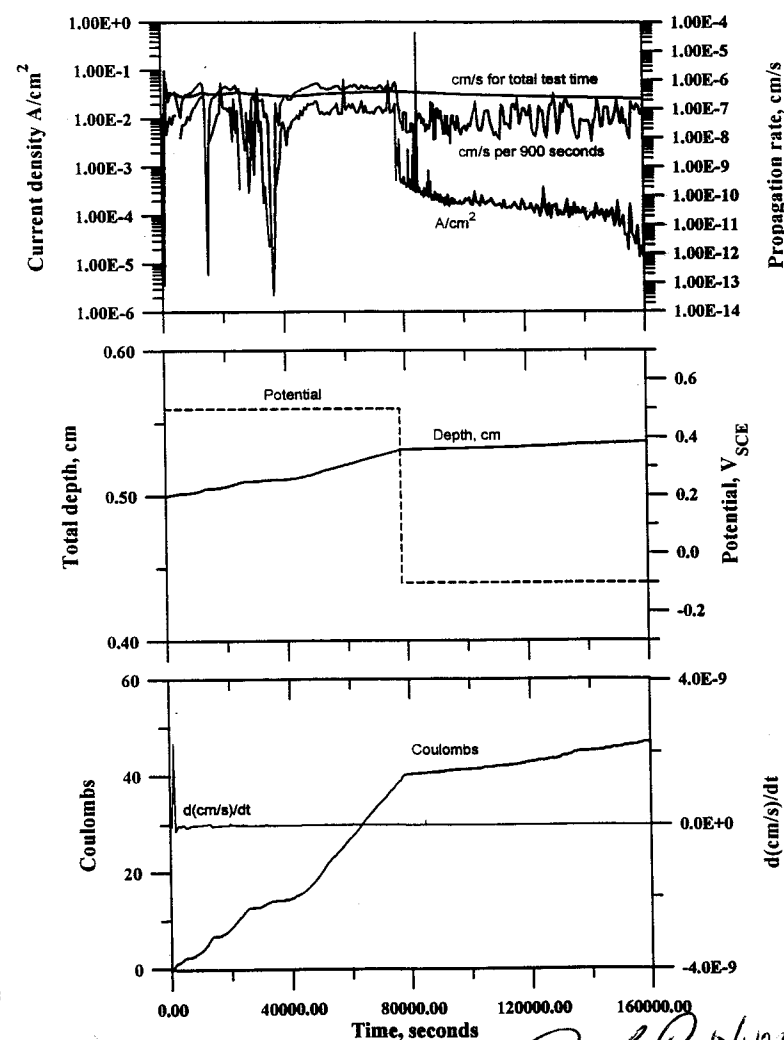
825PP6.DAT

END DGPTN MEASURED 5.3mm

END DGPTN CALCULATED 5.4mm

END ~~DE~~ DD 9/29/95 WEIGHT MEASURED

1. 1447641
 2. 1447633 AVERAGE 1447630.4
 3. 1447624 SDEV 6.8
 4. 1447627
 5. 1447627

WEIGHT LOSS MEASURED 8191 μg WEIGHT LOSS CALCULATED 12400 μg 

10/1/95

10/1/95

825PP7.DAT

OBJECTIVE SAME AS P 273

SPECIMEN ALLOT 825 HN 882F COVERED IN
 NEAT SINK AREA = 0.041 cm^2 DGPTN = 5mm

START WT MEASURED WITH METTLER UMT2

1. 1491599 μg
 2. 1491631 μg MEAN 1491618.8
 3. 1491613 μg STANDARD DEV 12.9
 4. 1491624 μg
 5. 1491627 μg

SOLUTION 1000 PPM Cl^- 85PPM NaCO_3 20PPM SO_4^{2-}
 10 PPM NO_3^- 2PPM F SAME AS P 287

T = 95°C N₂ THERMOMETER 32992

START pH 8.112

POTENTIOSTAT ESC 440 #3 CHANNEL #5

REFERENCE FISHER SCE 13-620-S1 SN 0165403

DATA FILES 825PP7.DAT & 825PP7B.DAT

E_{CORR} +32 mVE_{PE} +142 mVE_{APPLIED} 500 mV

TEST STARTED 9/26/95

AT $t = 77700$ POTENTIAL REDUCED AT 5 mV/s
 TO -250 mV

TEST STOPPED 9/28/95 NOISY CURRENT SIGNAL

NOISE WAS APPARENTLY THE RESULT OF
 2 SIGNALS INTO DATASOURCE (825PP6 & 825PP7)

END pH 8.934

9/28/95

823 PP7.DAT

END DEPTH MEASURED ~~5.0 mm~~ DD 9/29/95 5.0 mm

END DEPTH CALCULATED 5.26 cm

END WT MEASURED

1. 1483642

2. 1483650

AVERAGE 1483643.8

3. 1483652

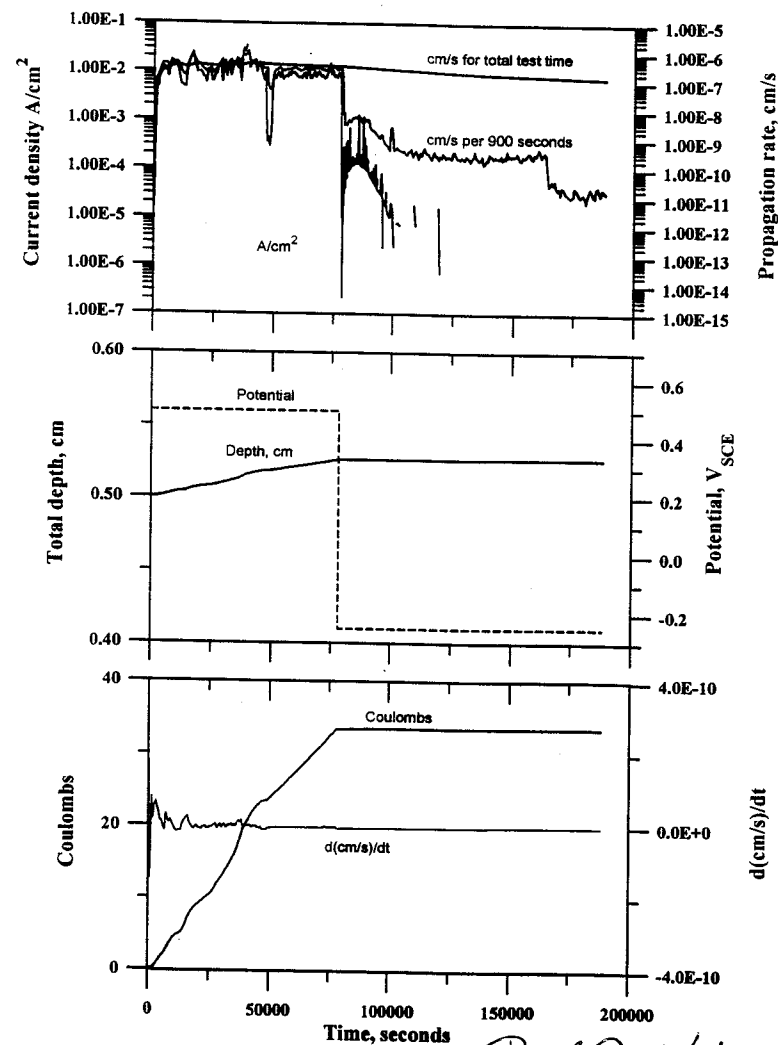
STANDARD DEV = 7.6

4. 1483633

5. 1483642

WEIGHT LOSS MEASURED 7975 μg WEIGHT LOSS CALCULATED 7268 μg DD 9/29/95 8836 μg

SPECIMEN REUSED FOR LATER TEST



Paul D 10/1/95

Paul D 10/1/95

GALVANIC CORROSION GC825C3.DAT

OBJECTIVE SAME AS p278

SPECIMEN SAME TYPE AS p278 ALLOY 825 NN4371FG

PTFG CREVICE BLOCKS TORQUED TO
40 IN-OZ WITH PROTO 6103 AREA = 20 cm²

START WT 28.14485 g

SOLUTION 1000 PP1CI- 2000 mL

3.04471 g NaCl LOT 941616

0.12813 g CuCl LOT 951307

0.22046 g CuCl₂ · 2H₂O LOT 8977130.0007 M Cu⁺ / 0.0007 M Cu⁺⁺T = 95°C N₂ THERMOMETER 0323004

START pH 5.255

SETUP SAME AS p283 EXCEPT SOLUTION

WAS NOT AERATED

CATNORGS ALLOY 825 TOTAL AREA = 180 cm²E_{CORR} +90 mVE_{CATNORGS} +112 mV AND +300 mVE_{PE} RANGE 120 - 260 mV

TEST STARTED 9/27/95 2:40 pm

END pH 5.685

INTENTION TIME 0.01 - 0.03 ms

POTENTIAL START 260 mV AT START

AT T = 0.062 ms POTENTIAL IS NOISY

MAXIMUM CURRENT AT 0.0524 ms

END WT 28.07960 g

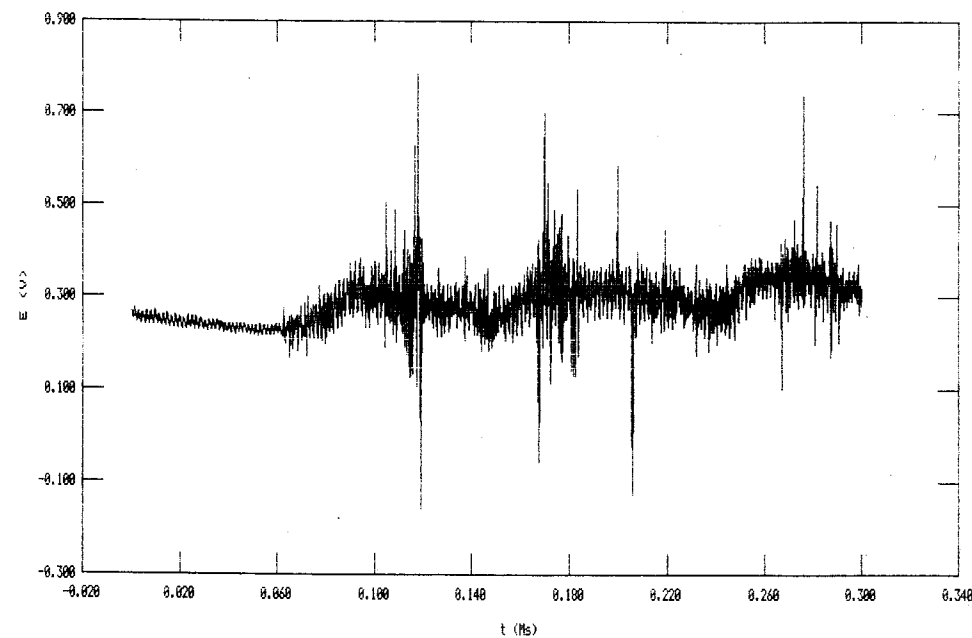
CREVICE CORROSION ON 22 OF 24 SITES

CREVICE CORROSION DEPTHS MEASURED ON p 115

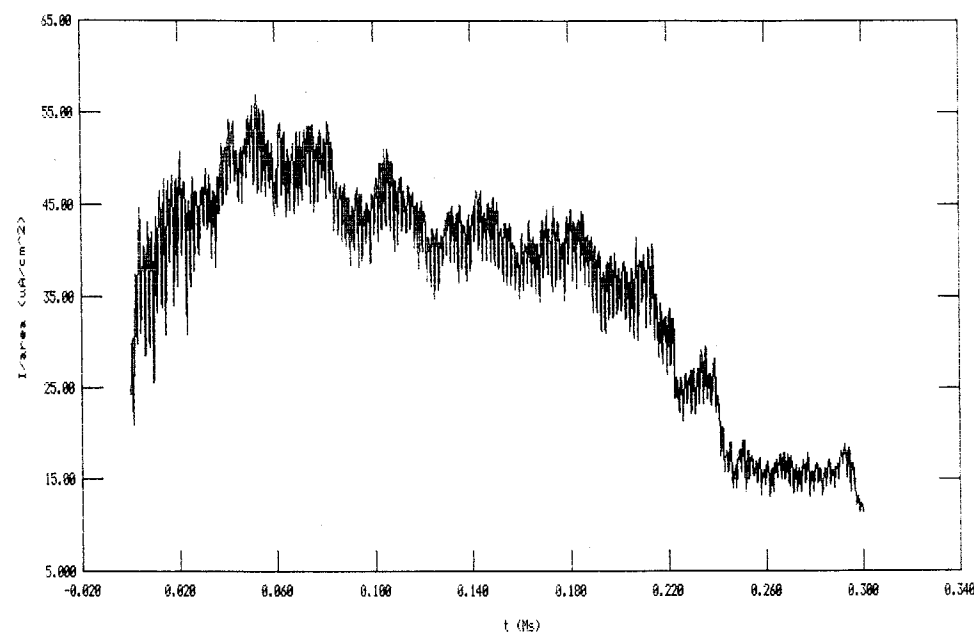
125 μm , 55 μm , 120 μm , 200 μm , 85 μm , 220 μm 85 μm , 160 μm , 165 μm , 185 μm , 85 μm , 175 μm , 105 μm 190 μm , 92 μm , 150 μm , 30 μm DEEPEST PENETRATION 220 μm

Paul D 10/5/95

GC 825C3



D. D. 10/5/95



D. D. 10/5/95

825PP8 PIT PROPAGATION

OBJECTIVE SAME AS P273

SPECIMEN ALLOT 825 NH 8882F COVERED IN
 NGAT SHRINK AREA = 0.041 cm² DEPTH = 5mm

START WT MEASURED WITH METTLER UMT2

1. 1479978 μ g	AVERAGE 1479973.8 μ g STANDARD DEV. 4.7 μ g
2. 1479966 μ g	
3. 1479973 μ g	
4. 1479976 μ g	
5. 1479976 μ g	

SOLUTION 1000 ppm Cl⁻ 85PPM HCO₃⁻ 20PPM SO₄⁼
 10 ppm NO₃⁻ 2PPM F⁻ SAME AS P 287

START pH 8.112

T=95°C Hg THERMOMETER 115814

POTENTIOSTAT ESC 440 # 3 CHANNEL #5

REFERENCE FISON SC 13-620-SA SN 3106339

DATAFILES 825PP8.DAT & 825PP8B.DAT

DD 9/29/95

ECORR ~~+79mV~~ -79mV KEITHLEY 614 SN 553368

EPR +129mV

E APPLIED +600mV

TEST STARTED 9/29/95

CURRENT MEASURED WITH KEITHLEY 614 SN 467374

AS POTENTIAL DROP THROUGH 150 Ω RESISTOR.

POTENTIAL REDUCED TO -300mV AT A RATE
 OF 5mV/s

END pH 9.226

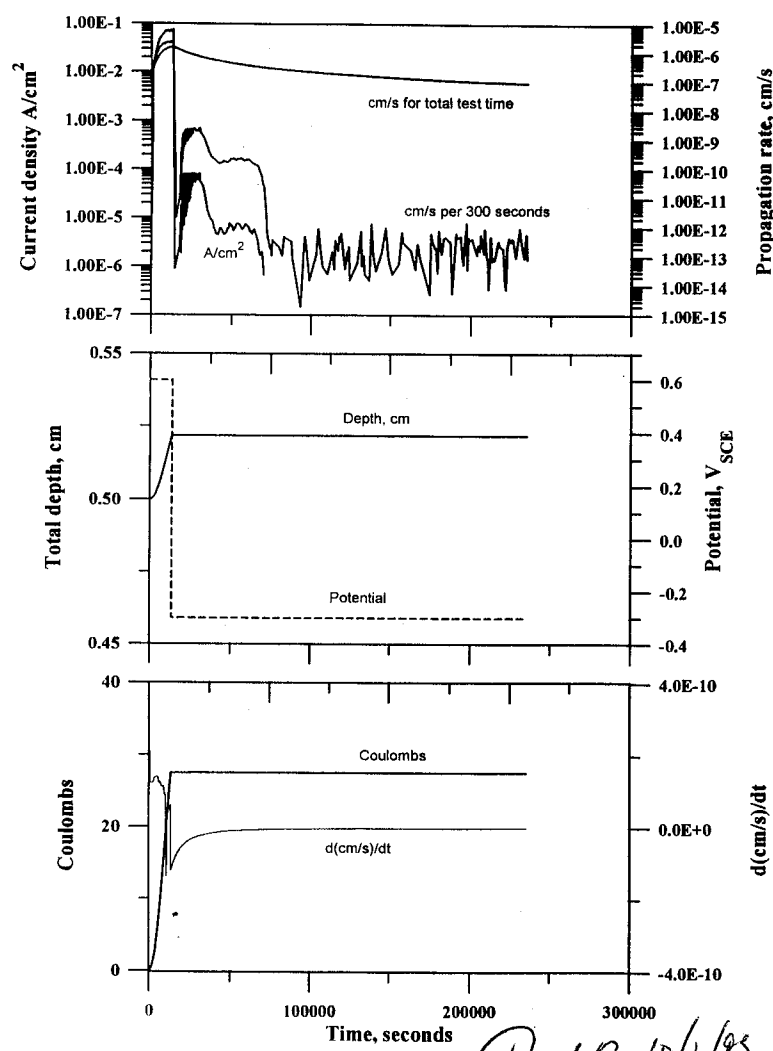
PLOT P294

D. D. 10/6/95

END WT MEASURED WITH METTLER UMT2

- 1. 1473109
- 2. 1473126 AVERAGE 1473124.8
- 3. 1473133 SD6U 10.1
- 4. 1473134
- 5. 1473122

WEIGHT LOSS MEASURED 6849 μg
WEIGHT LOSS CALCULATED 7268 μg



PIT PROPAGATION 825PP9

OBJECTIVE SAME AS p273

SPECIMEN ALLOY 825 NN8882F COVERED FN
NGAT SPRINK AREA = 0.041 cm^2 DEPTH = 5mm

START WT MEASURED WITH METTLER UMT2

- 1. 1470410 μg
- 2. 1470401 μg AVERAGE 1470404.0
- 3. 1470400 μg STANDARD DEV 4.1
- 4. 1470403 μg
- 5. 1470406 μg

SOLUTION 1000 PPM Cl^- 85PPM HCO_3^- 20PPM SO_4^{2-}
10PPM NO_3^- 2PPM F^- SAME AS PAGE 287

T = 95°C N₂ INGRANDMETER 32992

START pH 8.112

POTENTIOSTAT ESC440 #3 CHANNEL #5

REFERENCE FISHER SCS 13-620-S1 SW

DATAFILES 825PP9.DAT & 825PP9B.DAT

E_{corr} -81

E_{pc} +129

E_{APPLIED} +600mV

TEST STARTED 10/12/95

POTENTIAL REDUCED TO -0.2 V_{SCE} AT A RATE
OF 5mV/s

END pH 8.811

PLOT p 296

Handwritten signature 10/6/93

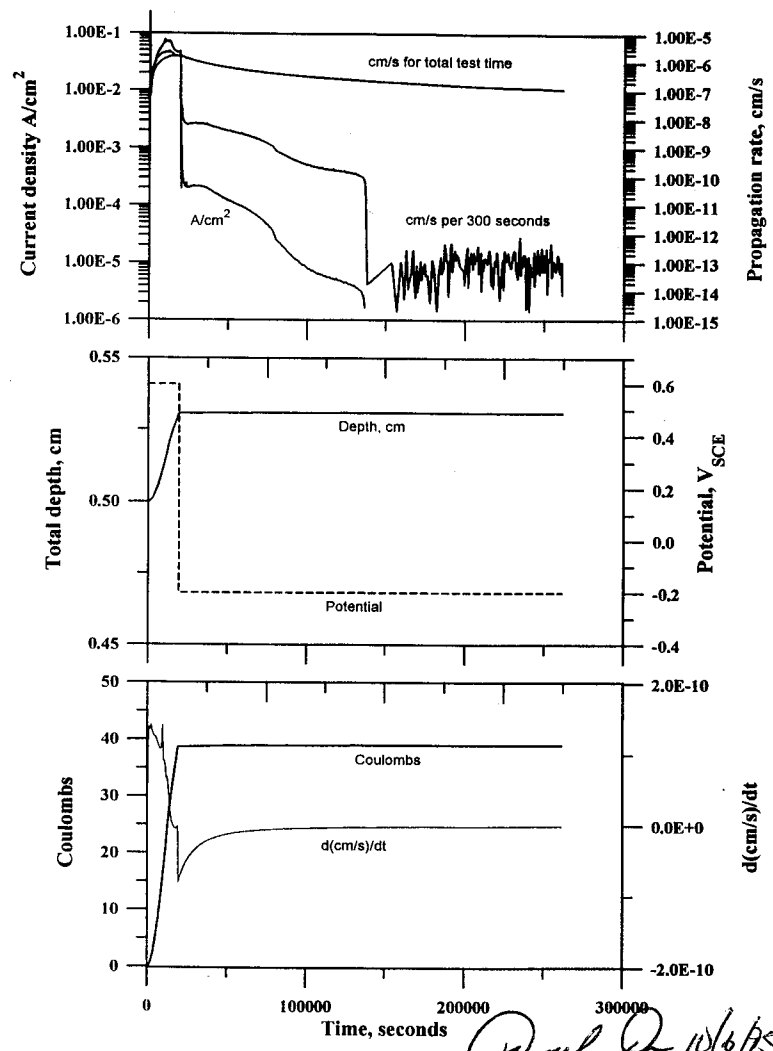
PIT PROPAGATION 825PP9

ENV WT

- 1. 1460676
- 2. 1460682
- 3. 1460679
- 4. 1460661
- 5. 1460670

AVERAGE 1460673.6
SDG 8.3

WEIGHT LOSS MEASURED 9728 μg
WEIGHT LOSS CALCULATED 10290 μg



Paul D 10/6/95

GALVANIC CORROSION GC825C4.DAT

OBJECTIVE SAME AS p278

SPECIMEN ALLOY 825 NH 4371FG AREA = 20 cm^2
2 PTFE CREVICE BLOCKS ATTACHED TO SPECIMEN
USING C276 NUT & BOLT TORQUED TO 40 IN-OZ
USING PROTD 6103

START WT 28.2606

SOLUTION 1000 PPM Cl^- 0.0007 M Cu^+ 0.0001 M Cu^{++}
2000 mL MAKE AS FOLLOWS

- 3.22231 g NaCl LOT 941616
- 0.12894 g CuCl LOT 951307
- 0.03164 g $\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$ LOT 897713
- T = 95°C N₂ THERMOSTATION 0323004

START PN 51528

SETUP SAME AS p283 WITHOUT SOLUTION
AERATION

CATHODES ALLOY 825 TOTAL AREA = 180 cm^2

E_{CORR} + 276 mV
 E_{CATHODES} + 304 / + 310 mV
 E_{PE} + 313 mV

TEST STARTED 3:00 PM 10/3/95

E_{PE} AT END OF TEST + 330 mV

POTENTIAL RANGE MAXIMUM + 313 mV MINIMUM + 232 mV

MAXIMUM CURRENT 11.6 $\mu\text{A}/\text{cm}^2$ AT $t = 0.056 \text{ MS}$

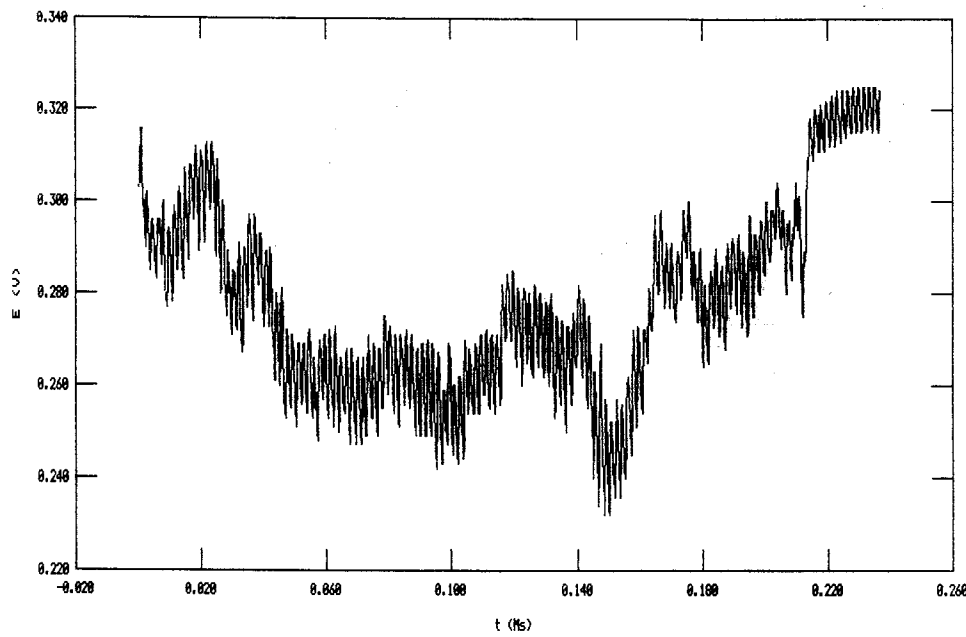
END WT 28.25013g

CREVICE CORROSION ON 3 OF 24 SITES

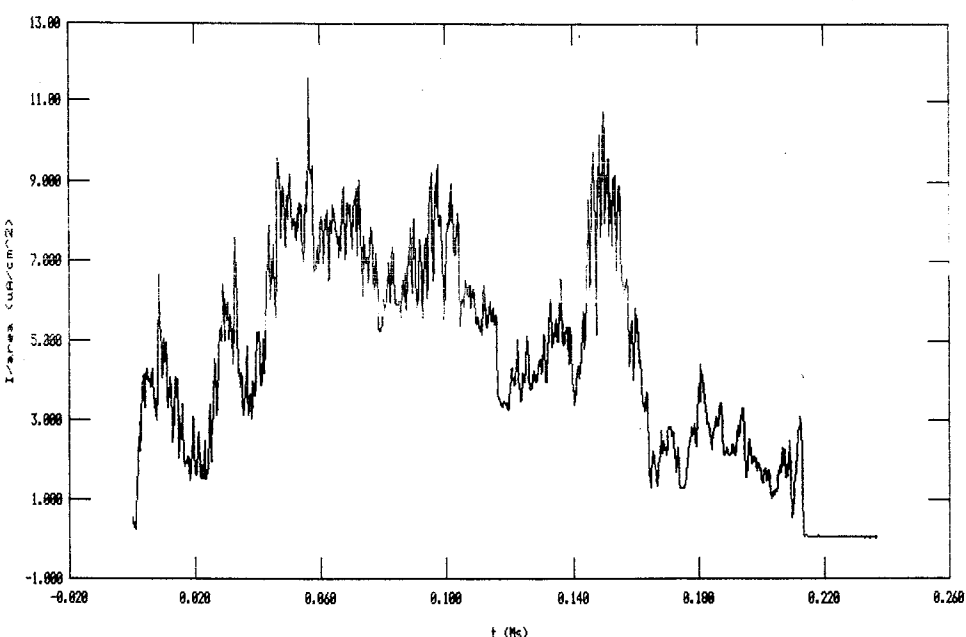
PENETRATION DEPTHS 120 μm , 120 μm , 110 μm

Paul D 10/24/95

GC825C4



10/6/95



10/6/95

PIT PROPAGATION 82SPPI0

OBJECTIVE SAME AS p 273

SPECIMEN ALLOY 825 HX882F COVERED
IN NEXT SPRINK AREA = 0.041 cm² D_{PTN} = 5mm

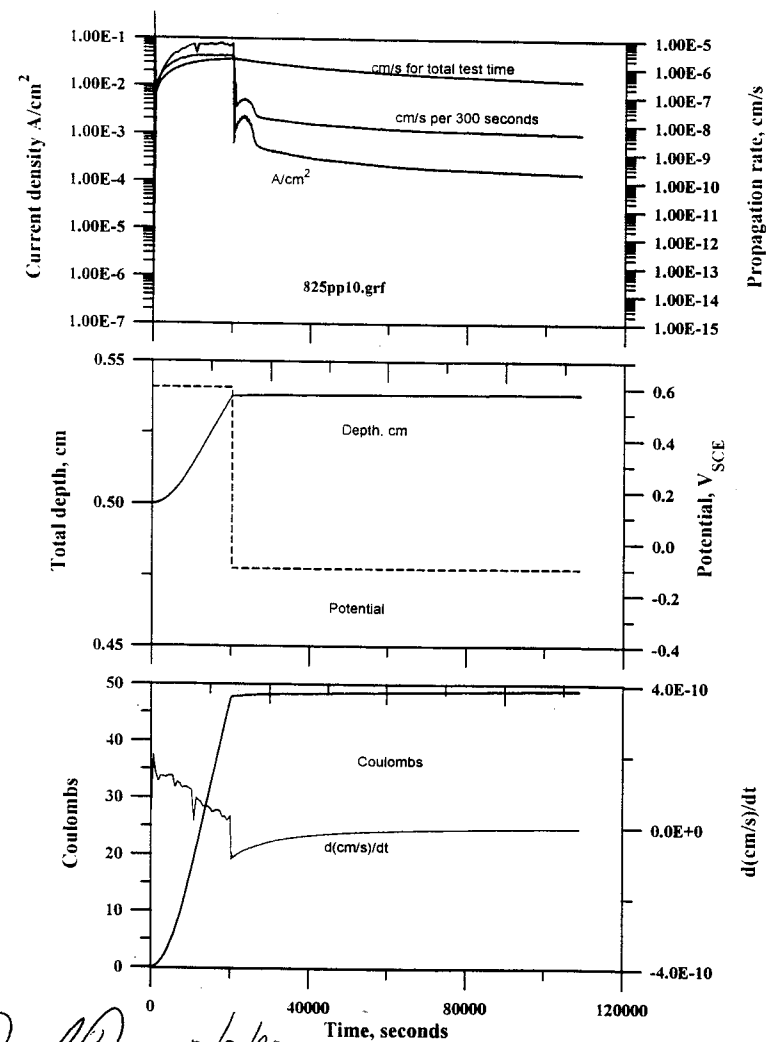
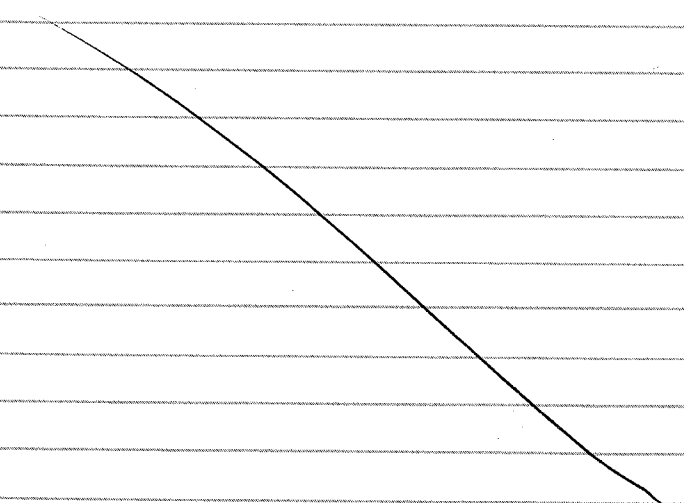
START WT MEASURED WITH METTLER UMT2
1. 1605688
2. 1605673 AVERAGE 1605680.2
3. 1605679 STANDARD DEV 5.6
4. 1605678
5. 1605683

SOLUTION 1000 ppm Cl⁻ 85ppm HCO₃⁻ 20ppm SO₄²⁻
10 ppm NO₃⁻ 2ppm F⁻ SAME AS p287
START pH 8.112
T = 95 °C N₂ THERMOMETER 115814
POTENTIOSTAT ESC 440 #3 CANNING #5
REFERENCE FISHER SCG 13-620-SI SN 3106339
DATAFILES 82SPPI0.DAT & 82SPPI0B.DAT

E_{corr} -33mV
E_{pt} +118mV
E_{APPLIED} +600mV
TEST STARTED 10/6/95
TEST STOPPED 10/8/95

SPECIMEN DID NOT REPRESENTATIVE
SPECIMEN END WT NOT RECORDED AND
SPECIMEN WAS RE USED IN LATER TEST

10/8/95



10/8/95

825PP11

OBJECTIVE SAME AS P273

SPECIMEN ALLOY 825 HH882F COVERED IN DD 10/7/95
NEAT SHRINK AREA = 0.041 cm² DEPTH = 5mm
INITIAL DEPTH = 1.8mm

START WT MEASURED WITH METTLER UMT2

- 1. 1596638
- 2. 1596643 AVERAGE 1596637
- 3. 1596640 STANDARD DEV 4.9
- 4. 1596632
- 5. 1596632

SOLUTION 1000 ppm Cl⁻ 85 ppm HClO₃ 20 ppm SO₄²⁻
10 ppm NO₃⁻ 2 ppm F⁻ SAME AS P 287

START PH 8.112

T = 95°C N₄ THERMO METER 32992

POTENTIOSTAT 273 41108 DD 10/6/95

REFERENCE FISHER SCE -13.60 13-620-SI SN 0165403

DATAFILE 825PP11.DWT

Ecorr -23mV

Ept +154mV

EAPPLIED 600mV

TEST STARTED 10/7/95

AT t = 8000 S POTENTIAL DECREASED TO -100mV

AT A RATE OF 5mV/s

TEST ABORTED CURRENT NOT RECORDED AFTER
POTENTIAL WAS DECREASED SPECIMEN REUSED
IN 825PP12 p 302

10/6/95

825 PP 12

OBJECTIVE Same as P 273

SPECIMEN ALLOY 825 ~~HH 888 DD~~ 10/10/95 HH 888ZF
COVERED IN NGAT SINK AREA = 0.041 cm²
INITIAL DEPTH = 1.8 mm

START WT

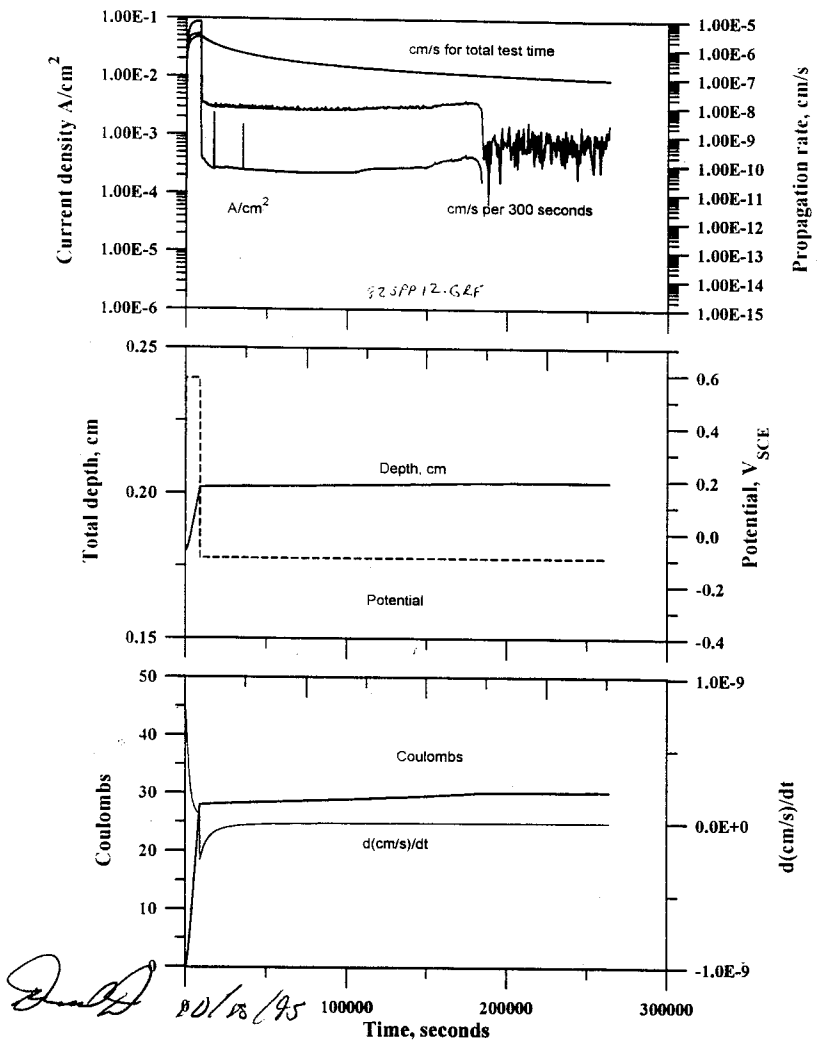
- 1 1542486
 - 2 1542496
 - 3 1542499
 - 4 1542506
 - 5 1542502
- AVERAGE
STANDARD DEV

SOLUTION 1000 ppm Cl⁻ 85 ppm HCO₃⁻ ~~20 ppm NO₃⁻~~ DD 10/10/95
20 ppm SO₄²⁻ 10 ppm NO₃⁻ 2 ppm F⁻ Same as p 287

START pH 8.112
T = 95°C Hg THERMOMETER 32992
POTENTIOSTAT MODEL 273 SN 41108
REFERENCE FISHER 13-620-S1 SN 0165403
DATA FILE 825 PP 12.DAT

E_{corr} -31 mV
E_{pc} +176 mV
E_{applied} 600 mV
TEST STARTED 10/10/95 2:31 pm
END pH 8.930

[Signature] 10/13/95



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.

N. Snickel

2/14/97

2 15 The project has been closed
scientific notebook is
turned in as Q.A. records
N. Snickel

ADDITIONAL INFORMATION FOR SCIENTIFIC NOTEBOOK #: 085

Document Date:	07/30/1993
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:	<input checked="" type="checkbox"/> "Non-Sensitive" <input type="checkbox"/> Sensitive <input type="checkbox"/> "Non-Sensitive - Copyright" <input type="checkbox"/> Sensitive - Copyright
Date Generated:	1997
Operating System: (including version number)	DOS
Application Used: (including version number)	Workbench, Version 2
Media Type: (CDs, 3 1/2, 5 1/4 disks, etc.)	1 8-mm tape
File Types: (.exe, .bat, .zip, etc.)	dat
Remarks: (computer runs, etc.)	Media contains: data files