

Scientific Notebook No. 602: Effect of Trace  
Elements Tests - Continuation of Scientific  
Notebook No. 465 (10/03/2003 through  
04/14/2004)

# CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES



CNWRA  
CONTROLLED  
COPY 602

Yi-Ming Pan  
ext. 6640

This is a continuation of CNWRA  
Scientific Notebook No. 465.

Yi-Ming Pan  
8/1/2003

Brian Derby B.D. BKD

Yiming Pan Y.P. Y.P.



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## Initial Scientific Notebook Entry for the Effect of Trace Elements Study

**Title:** Effect of trace elements tests

**Tests Performed by:** Yi-Ming Pan, Darrell Dunn, Brian Derby, Samuel Ireland.

**Objectives:** Determine the effect of trace elements on localized corrosion and stress corrosion cracking of waste package materials

**Equipments:** Polarization test cell, Solartron SI 1287 potentiostat, Keithley 617 electrometer, CorrWare V2.2 data acquisition software.

**Materials:** Alloy 22 Heat #2277-8-3175 and Alloy 825 Heat #HH4371Fe<sup>G</sup>  
ST  
TP (44)

**Measurement Parameters:** Current, potential, temperature.

**Required Level of Accuracy:** Current:  $\pm 100$  pA, potential:  $\pm 100$   $\mu$ V, temperature:  $\pm 2.0^\circ\text{C}$ .

**Uncertainty and Sources of Error:** The concentration of free lead ion and chloride complexes may not be experimentally determined. The solution chemistry will be calculated using OLI Systems Environmental Simulation Program, Version 6.2e.

*Yi-Ming Pan*  
5/24/01

Copied From Notebook # 465

B. E. J. 10/2/03

# Cyclic Polarization of C-22 Crevice Specimen in pH 10.7 $Pb(NO_3)_2$ Solution

Objective: See pg #5

Specimen: Alloy C-22 Crevice Specimen for Dimensions See  
NB # 465 pg #6 polished To A 600 Grit Finish - with 2 PTFE  
Crevice Washers Attached At 50 In-O<sub>2</sub> Using Q-Driver 2 SN# 1001200219  
cal 9/4/03 Due 4/4/04

Start wt = 41.15628g Santaricus Genius SN # 12809099 cal 11/14/03  
End wt = 41.48422g Due 5/14/04

Solution = \* New Solution 0.08 M  $Pb(NO_3)_2$   
53.01g  $Pb(NO_3)_2$  Lot # C08L02  
+ DI water To 2000mls

pH Start: 5.26 Adjusted To 12.50 with 31mls of 10 M NaOH Lot # 033922

pH End: 12.29

pH Meter: Orion EA920 SN# 5001A cal 1/9/03 Due 1/9/04

Potentiostat: Solartron 1480

Counter Electrode = Pt Flag

Reference: Fisher 13-620-52 SN# 099588

Temperature: 95°C Hg Thermometer SN# E98-191 cal 12/22/03 Due 6/22/04

Solution Deaerated with 99.999% N<sub>2</sub>

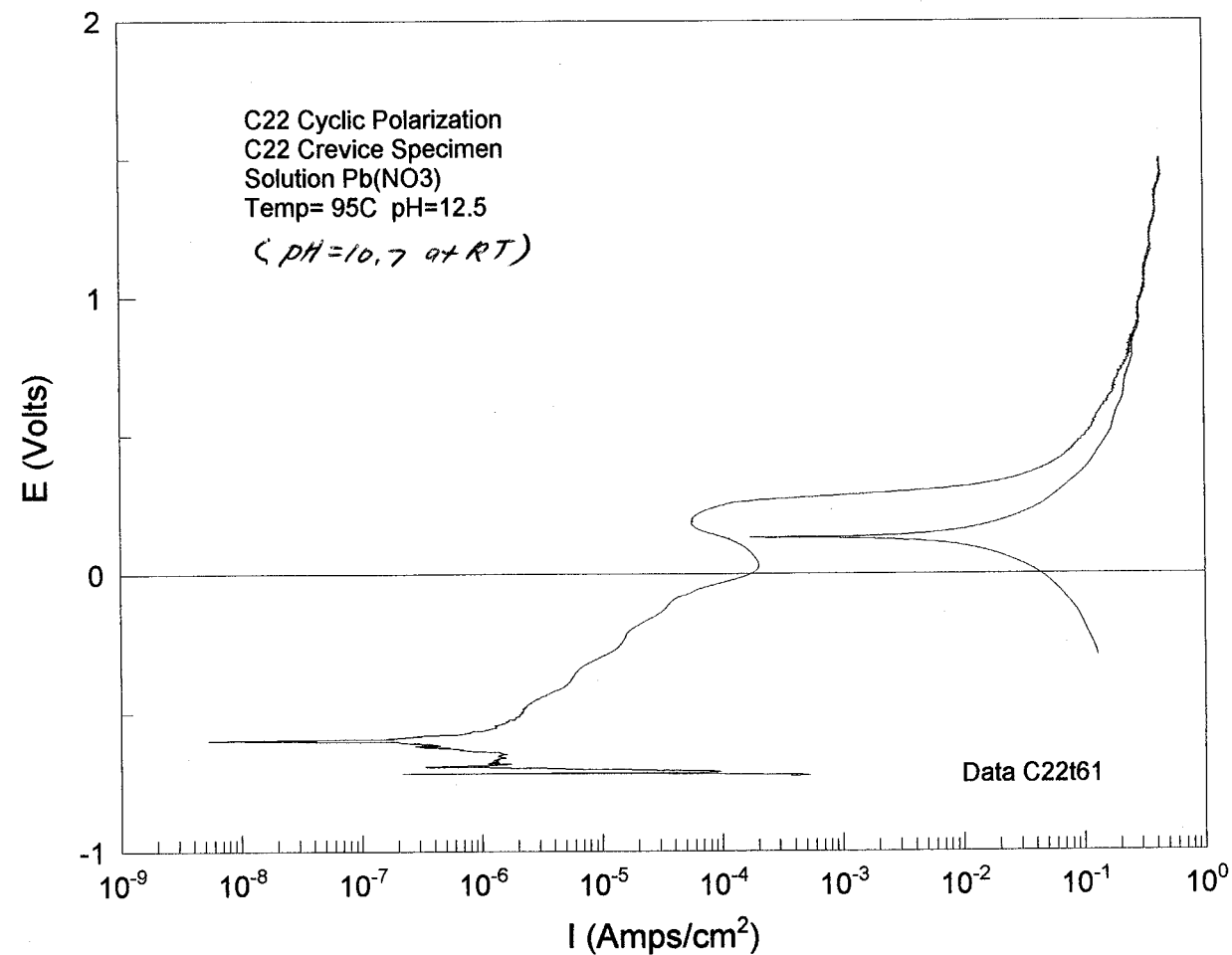
Ecorr = -532 Keithley 614 SN# 0704936 cal 12/22/03 Due 6/9/04  
6/9/03

E<sub>pt</sub> = -201

Specimen Examination: Build up of Solid Material on All Surfaces of Specimen

No Crevice Corrosion or Pitting - Black Haze Deposit on Surfaces  
Data C22t61

B. E. J.  
1/8/04



B. E. J.  
1/12/04

# Cyclic Polarization of C-22 - Crevice Specimen in pH 3.9 $Pb(NO_3)_2$ solution

Objective: see pg #5

Specimen: Alloy C-22 Crevice Specimen for Dimensions see NB #465 pg #6  
polished To A 600 grit Finish - with 2 PTFE crevice washers Attached At 50 In.-Oz  
Using Q Driven sn#1001200219 cal 9/4/03 Due 4/4/04

Start wt: 40.93728g Sartorius Genius sn#12809099 cal 11/14/03 Due 5/14/04  
End wt 40.94183g

Solution = \* New Solution 0.08M  $Pb(NO_3)_2$   
53.01g  $Pb(NO_3)_2$  Lot #C08602  
+ DI water To 2000mls

pH Start: 5.258 Orion EA940 Meter sn#5001A cal 1/9/03 Due 01/23/04  
pH End: 5.464 sn#2330 cal 7/15/03 Due 7/15/04

potentiostat: Solartron 1480

Counter Electrode: Pt Flag

Reference: Fisher 13-620-52 sn#099588

Temperature: 95°C Hg thermometer sn#E98-191 cal 12/22/03 Due 6/22/04

Solution Deaerates with 99.999%  $N_2$

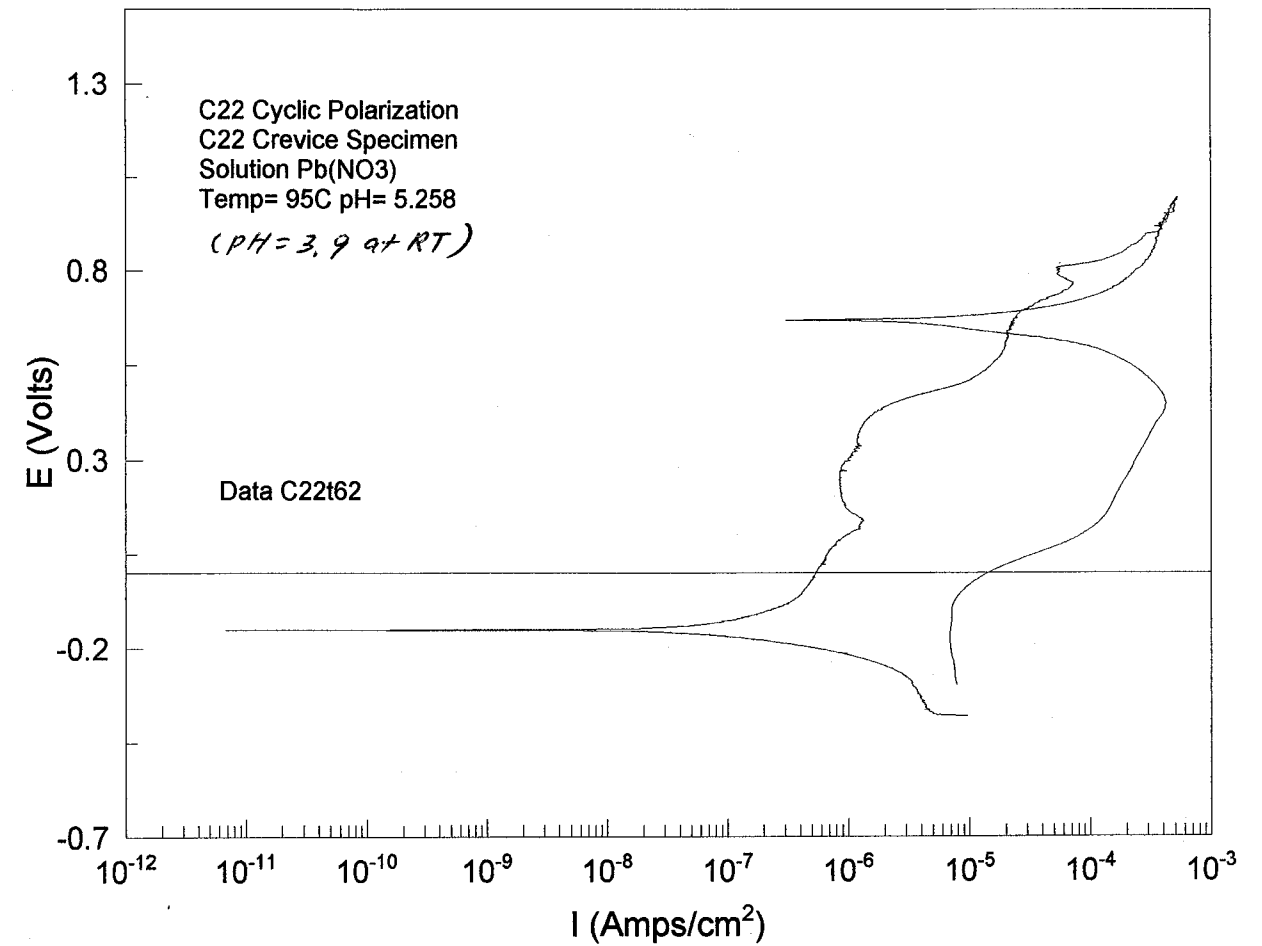
$E_{corr}$  = -175 mV Keithley 614 sn#0704936 cal 6/9/03 Due 6/9/04

$E_{pt}$  = +334 mV

Specimen Examination: No crevice corrosion 0/24 feet of crevice washer  
Dull Greenish/yellow tint staining on All surfaces of specimen

data C22+62

B. P. J.  
1/23/04



B. P. J.  
1/20/04

## POTENTIOSTATIC TEST ALLOY C22 U-BEND SPECIMENS

Objective: see page #5

*in pH 3.9 Pb(NO<sub>3</sub>)<sub>2</sub> solution at 140 mV*

Specimen: Alloy C22 ASTM G-30 for outer specimen; DOE Weld Alloy 059902LL2 Plate #D62x-Filler xx2048 BG Inner Specimen (NB#505 pg#2-25)

SPECIMEN a= DOE C22 Dimensions 5"(L)x 3.975"(M)x0.750"(W)x0.125"(T) SN# B1A

SPECIMEN b= C22 Dimensions 5"(L)x 4.370"(M)x0.750"(W)x0.125"(T) with 0.375" mounting hole SN# C2214

Initial Weight: SN# C22 #14

A= 63.76921g

SN# B1A

B= 63.31830g

Final Weight:

A= 63.77137g

B= 63.32641g

Model: Sartorius Genius

SN: 12809099

Cal: 11/14/03

Due: 5/14/04

SOLUTION:

0.08 m PbNO<sub>3</sub>52.95g PbNO<sub>3</sub> Lot# C08402

+ DI water To 2000mls

Reagents measured with

Model: OHAUS

SN: 2883

Cal: 2/4/04

DUE: 8/4/04

Initial pH: 5.242

MODEL: EA940

SN: 2330

Final pH: 5.352

Cal: 7/15/03

Due: 7/15/04

pH Probe: #13-620-296

SN: 2291257P6

TEST TEMPERATURE: 95°C

Measured with Hg Thermometer SN: E98-191

Cal: 12/22/03

Due: 6/22/04

Counter Electrode: Platinum Flag

Reference Electrode: Fisher SCE

13-620-52

SN: 00238265

0199568

Gas: 99.999% Nitrogen

Ecorr: -148 mV

Model: Keithley 614

SN: 467374

Ept: +363 mV

Cal: 6/09/03

Due: 6/09/04

Applied (vs SCE):

Potentiostat: Solartron 1480

SN# 00238265

Specimen Examination:

Test Enso 4/12/04

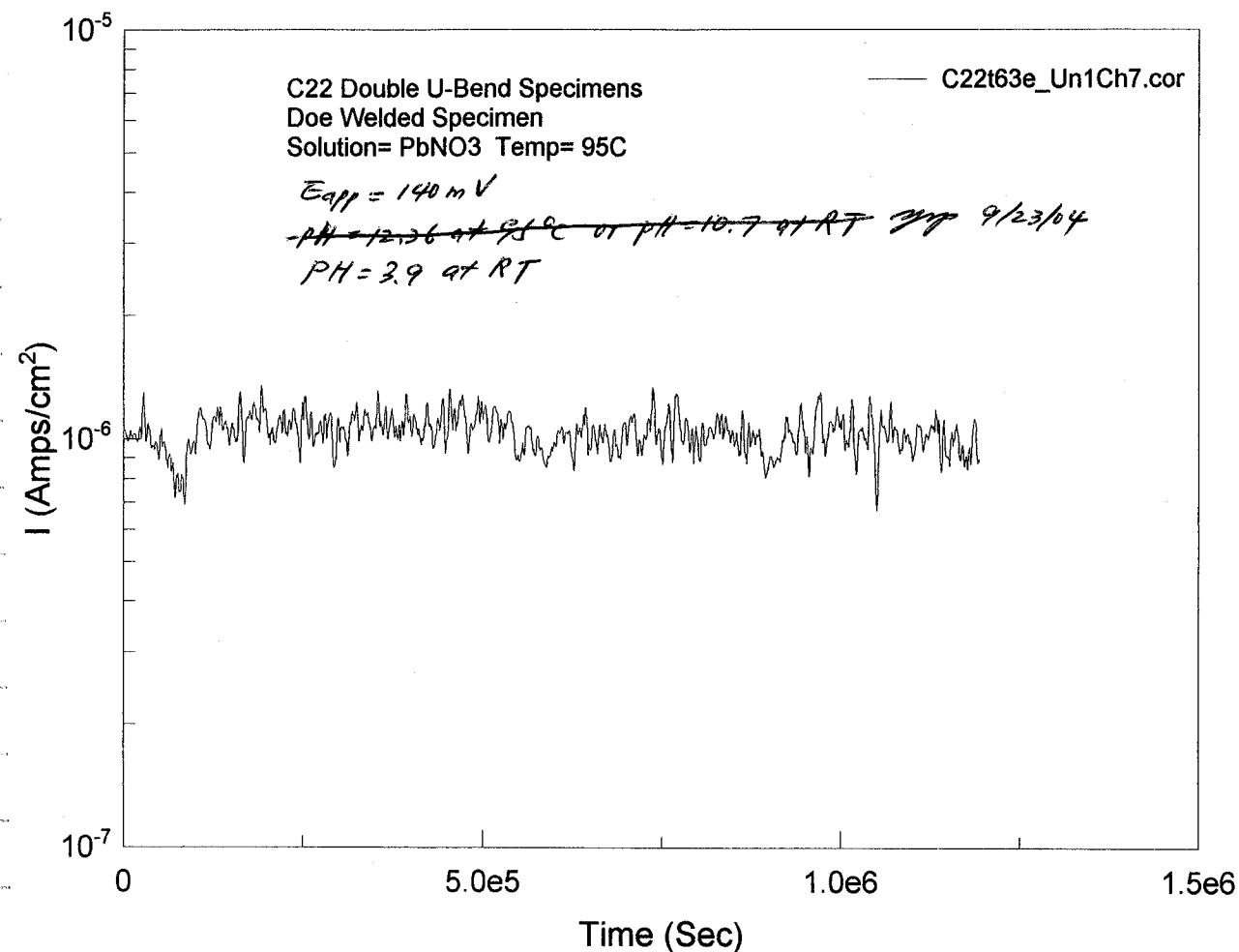
No Cracking on Either Specimens - Some build up of Material  
with Surface staining And Surface Etching

Data: C22+63

\* Note: Specimen A should be C22

Specimen B should be DOE

B. D. J. 2/23/04



B. D. J. 4/14/04



## POTENTIOSTATIC TEST ALLOY C22 U-BEND SPECIMENS

Objective: see page #5

*in pH 10.7 Pb(NO<sub>3</sub>)<sub>2</sub> solution at 50 mV*

Specimen: Alloy C22 ASTM G-30 for outer specimen; DOE Weld Alloy 059902LL2 Plate #D62x-Filler xx2048 BG Inner Specimen (NB#505 pg#2-25)

SPECIMEN a= DOE C22 Dimensions 5"(L)x 3.975"(M)x0.750"(W)x0.125"(T) #B1B

SPECIMEN b= C22 Dimensions 5"(L)x 4.370"(M)x0.750"(W)x0.125"(T) with 0.375" mounting holes #C22 #17

Initial Weight: C22 #17 A= 63.7469g #B1B B= 62.4615g

Final Weight: A= 63.7523g B= 62.4607g

## SOLUTION:

Model: Sartorius Genius SN: 12809099  
Cal: 11/14/03 Due: 5/14/040.08m PbNO<sub>3</sub>  
52.97g PbNO<sub>3</sub> lot #C08402  
+ DI water to 2000ml

## Reagents measured with

Model: OHAUS SN: 2883  
Cal: 2/4/04 DUE: 8/4/04

Initial pH: 5.253

MODEL: EA940 SN: 2330

Final pH: 11.464

Cal: 7/15/03 Due: 7/15/04

pH Probe: #13-620-296 SN: 2291257P6

\* PH Adjusted To 12.364 with 28mls 10m NaOH lot #

TEST TEMPERATURE: 95°C

Measured with Hg Thermometer SN: C96-816  
Cal: 12/22/04 Due: 6/22/04

Counter Electrode: Platinum Flag

Reference Electrode: Fisher SCE

13-620-52

SN: 8210504

Gas: 99.999% Nitrogen

Ecorr: -509mV

Model: Keithley 614

SN: 467374

Ept: -131mV

Cal: 6/09/03

Due: 6/09/04

Eapplied (vs SCE):

Potentiostat: Solartron 1480

SN# 00238265

Specimen Examination:

Test Ended 4/12/04

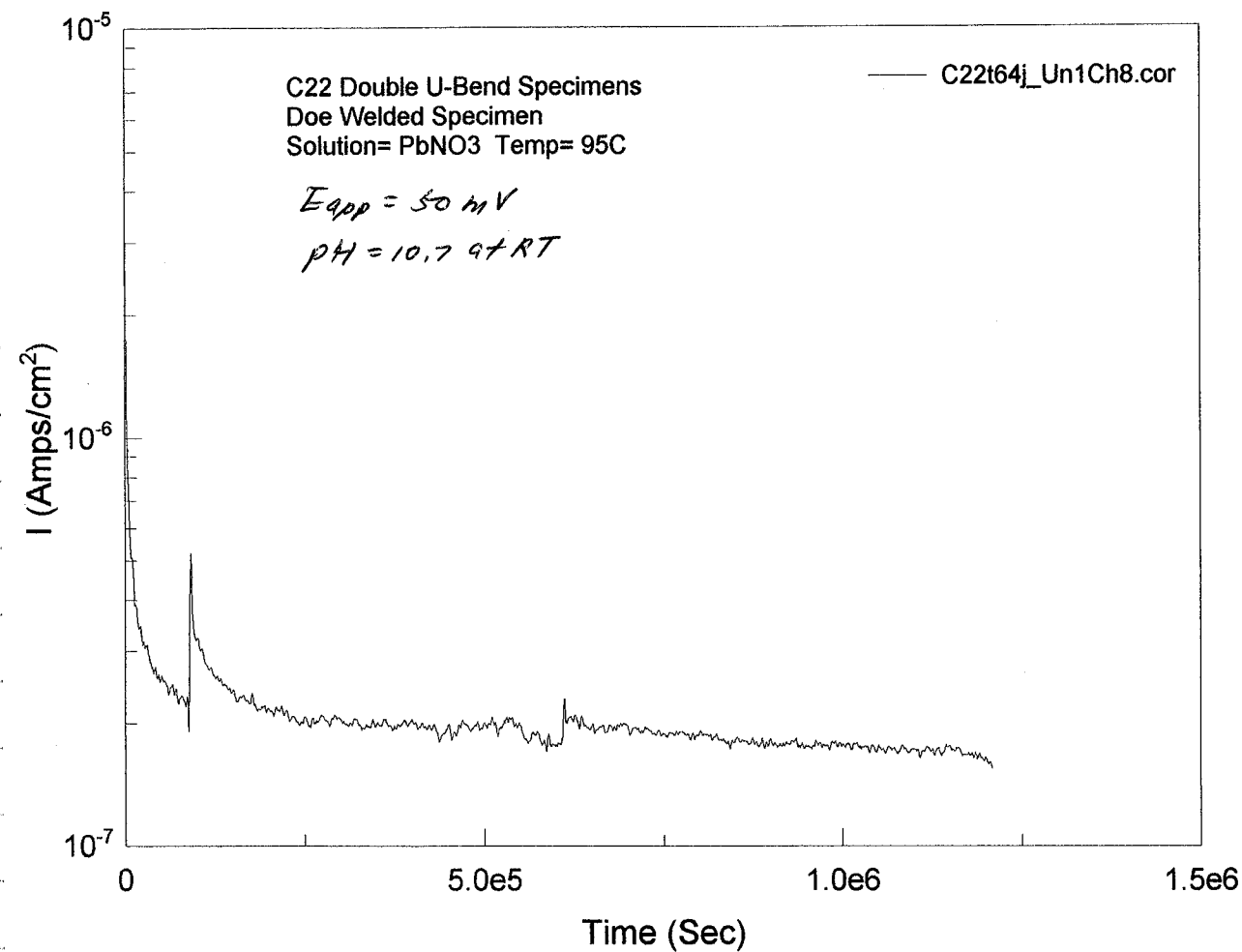
No Cracking on Either Specimen - Some build up of material  
with surface staining and surface etching

Data C22+64

\* Note: Specimen A should be C-22

Specimen B should be DOE

BIB 2/23/04



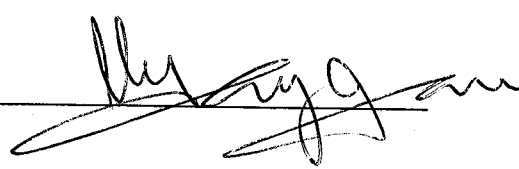
Copies sent to QA records.

JP  
9/28/04BIB  
4/14/04

SN#602

A.A. Csontos, Y.-M. Pan, D.S. Dunn, L. Yang, and G.A. Cragolino, The Effect of Environmental Chemistry on the Pb Assisted Stress Corrosion Cracking Susceptibility of Mill-Annealed Alloy 22 and GTAW Weldments, *Mat. Res. Soc. Symp. Proc.* Vol. 824, 39-44, 2004

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.

  
142/05

## ADDITIONAL INFORMATION FOR SCIENTIFIC NOTEBOOK NO. 602

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