

A516C-18

Specimen: A516 gr. 60, mill scale (bluish)Condition: dry; bluish sides facing each otherParameter: as on p. 79Stored as: A516C-18.Z on EJS data disk 1
4/18/97Walter J. Mackowski
3/8/97

A516C-19

Specimen: A516 gr. 60, mill scale (bluish)Condition: O-ring filled w/1000 ppm Cl^- solution
bluish sides facing each otherParameter: as on p. 79Solution: as on p. 82Stored as: A516C-19.Z on EJS data disk 1
4/18/97Walter J. Mackowski
5/8/97

A516C-20

Specimen: A516 gr. 60, 600 grit polished

Conditions: O-rings, with high pH 1000 ppm Cl^- solution
wait 10 mins before start after couple assembly

Parameter: FRA Sweep 20,000 \rightarrow 0.01 Hz

10 steps/decade

2 sec delay

2 sec integration time

P-Stat DC vs. open circuit

10 mV amplitude

Hi-F auto

Lo-F auto

auto min 10 μA

Trans F 1×10^{-5}

Attenuator: 0.2

Solution: 1000 ppm Cl^- 0.01M Na_2CO_3

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

3.29980 g NaCl lot 960780

2.10660 g Na_2CO_3 lot 960685

40 ml SO_4^{2-} 4/97 stock solution NB 157 p. 161

20 ml NO_3^- 4/97 " " " "

4 ml F^- 4/97 " " " "

+ DI water to 2000 ml pH 10.877

Stored as: A516-20.z on EIS data disk 1
4/28/97

Walter J Machowski
5/19/97

A516C-21

Specimen: A516 gr. 60, 600 grit polished

Condition: O-rings w/ Fe_3O_4 wetted w/ high pH (10.8)

1000 ppm Cl^- solution
10 min. hold before start after couple assembly

Parameter: same as p. 96

Solution: same as p. 96

Fe_3O_4 - Johnson-Matthey lot 593424AR

Stored as: A516C-21.z on EIS data disk 1 4/28/97

Walter J Machowski
5/19/97

A516C-22

Specimen: A516 gr. 60, 600 grit polishedCondition: O-ring w/ Fe_2O_3 wetted w/ high pH (10.8)
1000 ppm Cl^- solution
10 min. wait after couple assembly before startParameter: Same as p. 96Solution: Same as p. 96 Fe_2O_3 - Johnson-Matthey lot 597184Stored as: A516C-22.2 on EIS data disk 1
4/18/97Walter J. Mochariki
5/19/97

A516C-23

Specimen: A516 gr. 60, 600 grit polishedCondition: O-ring w/ FeO(OH) wetted w/ high pH (10.8)
1000 ppm Cl^- solution
10 min hold before start after couple assemblyParameter: same as p. 96Solution: same as p. 96 FeO(OH) Johnson-Matthey lot I06610

Stored as: A516C-23.2 on EIS data disk 1 4/18/97

Walter J. Mochariki
5/19/97

A516C-24

Specimen: A516 gr. 60, 600 grit polishedCondition: O-ring w/ corrosion product from A516 3
washed w/ high pH (10.8) 1000 ppm Cl^- solution
10 min. hold before start after couple assemblyParameter: same as p. 96Solution: same as p. 96

Stored as: A516C-24.2 on EIS data disk 1 4/18/97

Walter J. Mocharh
5/19/97

A516C-25

Specimen: A516 gr. 60, mill scale (reddish)Condition: O-ring w/ high pH (10.8) 1000 ppm Cl^- solution
hold 10 min. before start after couple assemblyParameter: same as p. 96Solution: same as p. 96

Stored as: A516C-25.2 on EIS data disk 1 4/18/97

Walter J. Mocharh
5/19/97

825C-26

Specimen: Alloy 825 (H#4371FG), 600 grit polishedCondition: O-ring, high pH (10.8) 1000 ppm Cl^- solution
wait 5 min after couple assemblyParameter: same as p. 96Solution: same as p. 96

Stored as: 825C-26.z on EIS data disk 1 4/18/97

Walter J Macdonald
5/19/97

A516C-27

Specimen: A516 gr. 60, 600 grit polishedCondition: O-ring, 100 ppm Cl^- solutionParameter: same as p. 96Solution: Took 100 ml. of solution on p. 82 and
diluted w/ DI water to one liter. pH 7.837

Stored as: A516C-27.z on EIS data disk 1 4/18/97

Walter J Macdonald
5/20/97

A516C-28

Specimen: A516 gr. 60, 600 grit polishedCondition: O-rings, Fe_3O_4 , wetted w/ 100 ppm Cl^- solutionParameter: Same as p. 96Solution: Same as p. 103 Fe_3O_4 - J-M lot 593424ARStored as: A516C-28. Z on EIS data disk 1 4/28/97
18'
WJMacomber
5/1/97Walter J. Macomber
5/20/97

A516C-29

Specimen: A516 gr. 60, 600 grit polishedCondition: O-rings, Fe_2O_3 , wetted w/ 100 ppm Cl^- solutionParameter: same as p. 96Solution: same as p. 103 Fe_2O_3 - J-M lot 597184

Stored as: A516C-29. Z on EIS data disk 1 4/18/97

Walter J. Macomber
5/20/97

A516C-30

Specimen: A516 gr. 60, 600 grit polishedCondition: O-ring, FeO(OH), wetted w/ 100 ppm Cl^- solutionParameter: Same as p. 96Solution: Same as p. 103

FeO(OH) - J-M lot I06G10

Stored as: A516C-30.2 on EIS data disk 1 4/18/97

Walter J. MacKorchi
5/30/97

A516C-31

Specimen: A516 gr 60, 600 grit polishedCondition: O-ring, corrosion product of SAW 3, wetted w/ 100 ppm Cl^- Parameter: same as p. 96Solution: Same as p. 103

Stored as: A516C-31.2 on EIS data disk 1 4/18/97

Walter J MacKorchi
5/30/97

A516C-32

Specimen: A516 gr. 60, mill scale (reddish)Condition: O-ring, 100 ppm Cl^{\ominus} solutionParameters: Same as p. 96Solution: Same as p. 103

Stored as: A516C-32.z on EIS data disk 1 4/18/97

Walter J. Macdonald
5/20/97

825C-33

Specimen: Alloy 825 (1H4371FC), 600 grit polishedCondition: O-ring, 100 ppm Cl^{\ominus} solutionParameters: Same as p. 96Solution: Same as p. 103

Stored as: 825C-33.z on EIS data disk 1 4/18/97

Walter J. Macdonald
5/20/97

A516C-34

Specimen: A516 gr. 60, 600 grit polished

Condition: O-ring, 10 ppm Cl^- solution

Parameter: same as p. 96

Solution: Took 10ml of solution on p. 82 and diluted w/ DI water to one liter.
pH 7.860

Stored as: A516C-34.^z on EIS data disk 1
5/20/97
WJ Macomber
4/18/97

Walter J. Macomber
5/25/97

A516C-35

Specimen: A516 gr. 60 600 grit polished

Condition: O-ring, Fe_3O_4 wetted w/ 10 ppm Cl^- solution

Parameter: same as p. 96

Solution: same as p. 110

Fe_3O_4 - J-M lot 593424 AR

Stored as: A516C-35.^z on EIS data disk 1 4/18/97

Walter J. Macomber
5/20/97

A516C-36

Specimen: A516 gr. 60, 600 grit polishedCondition: O-ring, Fe_3O_4 wetted w/10 ppm Cl^- solutionParameter: Same as p. 96Solution: Same as p. 110 Fe_3O_4 - J-M lot 597184Stored as: A516C-36.z on EIS data disk 1 4/18/97Walter J. MacLennan
5/20/97

A516C-37

Specimen: A516 gr. 60, 600 grit polishedCondition: O-ring, $\text{FeO}(\text{OH})$ wetted w/10 ppm Cl^- solutionParameter: Same as p. 96Solution: Same as p. 110 $\text{FeO}(\text{OH})$ J-M lot I06810Stored as: A516C-37.z on EIS data disk 1 4/18/97Walter J. MacLennan
5/20/97

A516C-38

Specimen: A516 gr.60, 600 grit polishedCondition: O-ring, corrosion product from CAV3 wetted
w/ 10 ppm Cl^- solutionParameters: Same as p. 96Solution: Same as p. 110Stored as: A516C-38.Z on ETS data disk 1
4/18/97Walter J. Macchowski
5/20/97

A516C-39

Specimen: A516 gr.60, mill scale (reddish)Condition: O-ring, 10 ppm Cl^- solutionParameters: Same as p. 96Solution: Same as p. 110Stored as: A516C-39.Z on ETS data disk 1
4/18/97Walter J. Macchowski
5/20/97

825C-40

Specimen: Alloy 825 (HH 4371FG), 600 grit polishedCondition: O-ring, 10 ppm Cl^- solutionParameter: Same as p. 96Solution: Same as p. 110Stored as: 825C-40.z on EIS data disk 1
4/18/97Walter J. MacKowski
5/20/97

825C-41

Specimen: Alloy 825 (HH 4371FG), 600 grit polishedCondition: O-ring, DI waterParameter: Same as p. 96Solution: ~~Same as p. 110~~ DI water ^{5/20/97}
^{WJ MacKowski}

Stored as: 825C-41.z on EIS data disk 1 4/18/97

Walter J. MacKowski
5/20/97

A516C-42

Specimen: A516 gr. 60, mill scale (radial)

Condition: O-ring, DI water

Parameter: same as p. 96

Solution: DI water

Stored as: A516C-42.z on EIS data disk 1
4/18/97

Walter J. MacKowski
5/30/97

A516C-43

Specimen: A516 gr. 60, 600 grit polished

Condition: O-ring, DI water

Parameter: same as p. 96

Solution: DI water

Stored as: A516C-43.z on EIS data disk 1 4/18/97

Walter J. MacKowski
5/30/97

A516C-44

Specimen: A516 gr. 60, 600 grit polished

Condition: O-ring, Fe₃O₄ wetted w/ DI water

Parameters: Same as p. 96

Solution: DI water

Fe₃O₄ - J-M lot 593424AR

Stored as: A516C-44.z on EIS data disk 1
4/18/97

Walter J. MacKinnon
5/20/97

A516C-45

Specimen: A516 gr. 60, 600 grit polished

Condition: O-ring, Fe₂O₃ wetted w/ DI water

Parameters: Same as p. 96

Solution: DI water

Fe₂O₃ - J-M lot 597184

Stored as: A516C-45.z on EIS data disk 1 4/18/97

Walter J. MacKinnon
5/20/97

A516C-46

Specimen: A516 gr. 60, 600 grit polishedCondition: O-ring, FeO(OH) wetted w/DI waterParameter: same as p. 92Solution: DI water

FeO(OH) J-M lot I06610

Stored as: A516-46.7 on EIS data disk 1
4/18/97Walter J. MacKowski
5/20/97

A516C-47

Specimen: A516 gr. 60, 600 grit polishedCondition: O-ring, core product GAV3 wetted w/DI waterParameter: same as p. 92Solution: DI Water

Stored as: A516C-47.7 on EIS data disk 1 4/18/97

Walter J. MacKowski
5/20/97

GALV 7, DAT

Specimen: A516 gr. 60
 start wt. 187.84310 g
 end wt. 183.15775 g
 Alloy 825
 start wt. 11.07494 g
 end wt. 11.07565 g
 immersed at 10:1 ratio

Solution: 1000 ppm Cl^- 85 ppm HCO_3^-
 20 ppm SO_4^{2-} 10 ppm NO_3^- 2 ppm F^-
 3.29854 g NaCl lot 960780
 0.23784 g $NaHCO_3$ lot 923337A
 40 ml SO_4^{2-} 6/97 stock solution NB 157 p.173
 20 ml NO_3^- 6/97 " " " " "
 4 ml F^- 6/97 " " " " "
 + DI water to 2000 mL

T = 95°C Hg thermometer #0323007
 start pH 8.487 aerated w/ year air
 end pH 9.455

Potentiostat: ESC 440 #2 channel 3

Reference Electrode: Fisher SCE 13-620-51 SN 5144349

E_{com} 825 -233 mV
 E_{com} 516 -665 mV

Test started 2PM 6/3/97
 Test stopped 1PM 6/17/97

825 - post test slight yellow film
 A516 - heavy black cor. product on immersed portion
 lighter - redder cor product on vapor phase
 A516 repolished & reused.

Walter J. MacKowski
 6/18/97

GALV 8, DAT

Specimen 1: A516 gr. 60
 start wt. 192.28120 g
 end wt. 190.94690 g
 Alloy 825
 start wt. 11.32162 g
 end wt. 11.32218 g
 immersed at 10:1

Solution: 1000 ppm Cl^- 0.01 M Na_2CO_3
 20 ppm SO_4^{2-} 10 ppm NO_3^- 2 ppm F^-
 3.30539 g NaCl lot 960780
 2.12380 g Na_2CO_3 lot 960685
 40 ml SO_4^{2-} 6/97 stock solution NB 157 p.173
 20 ml NO_3^- 6/97 " " " " "
 4 ml F^- 6/97 " " " " "
 + DI water to 2000 mL

T = 95°C Hg thermometer #0323007
 start pH 10.993 aerated w/ year air
 end pH 10.377

Potentiostat: ESC 440 #2 channel 4

Reference Electrode: Fisher SCE 13-620-51 SN 3106321

E_{com} 825 -312 mV
 E_{com} 516 -555 mV

Test started 2PM 6/3/97
 Test stopped 1PM 6/17/97

825 - silvery, no corrosion, red scale from solution on vapor phase.
 A516 - immersed area clean except for 3 small spots, vapor phase
 all red rust
 A516 repolished & reused.

Walter J. MacKowski
 6/18/97

GALV 9. DAT

Specimen: A516 gr. 60
start wt. 11.22910g
end wt. 11.14526g
Alloy 825
start wt. 11.39961g
end wt. 11.40043g
immersed at 1:1 ratio

Solution: 1000 ppm Cl⁻ 0.01M Na₂CO₃
20 ppm SO₄²⁻ 10 ppm NO₃⁻ 2 ppm F⁻
3.29715g NaCl lot 960780
2.12827g Na₂CO₃ lot 960685
40 ml SO₄²⁻ 6/97 stock solution NB 157 p.173
20 ml NO₃⁻ 6/97 " " " " "
4 ml F⁻ 6/97 " " " " "
+ DI water to 2000 mL

T = 25°C Hg thermometer # 0323007
start pH 11.008 aerated w/ new air
end pH 10.556

Potentiostat: ESC 440 #2 channel 5

Reference Electrode: Fisher SCE 13-620-51 SN 5089374

E_{com} 825 -208 mV

E_{com} 516 -493 mV

Test started 2PM 6/3/97
Test stopped 1PM 6/17/97
825 no corrosion repolished + reused
Some corrosion on A516, less than 30%.

Walter J Macdonald
6/18/97

GALV 10. DAT

Specimen: A516 gr. 60
start wt. 11.31261g
end wt. 11.22161g
Alloy 825 11.24115g
start wt. 11.24105g
end wt.
immersed at 1:1 ratio

Solution: 1000 ppm Cl⁻ 0.01M Na₂CO₃
20 ppm SO₄²⁻ 10 ppm NO₃⁻ 2 ppm F⁻
3.29479g NaCl lot 960780
2.12191g Na₂CO₃ lot 960685
40 ml SO₄²⁻ 6/97 stock solution NB 157 p.173
20 ml NO₃⁻ 6/97 " " " " "
4 ml F⁻ 6/97 " " " " "
+ DI water to 2000 mL

T = 60°C Hg thermometer # 0323007
start pH 11.002 aerated w/ new air
end pH 10.478

Reference electrode: Fisher SCE 13-620-51 SN 0165415

E_{com} 825 -213 mV

E_{com} 516 -454 mV

Test started 2PM 6/3/97
Test stopped 1PM 6/17/97

825 no corrosion repolished + reused
Some corrosion on A516 less than 30%
most of it in vapor phase

Walter J Macdonald
6/18/97

825C-48

Specimen: alloy 825 (HH 4371FG) 600 grit polishedCondition: heat treated (per page 75) at 100°C
for one weekrun dryParameter: same as p. 79Stored as 825C-48. Z on EIS data disc #1
4/18/976/12/97
Walter J. Macomber

825C-49

Specimen: Alloy 825 (HH 4371FG) 600 grit polishedCondition: heat treated (p. 75), dry w/ O-ringParameter: same as p. 79

Stored as 825C-49. Z on EIS data disc #1 4/18/97

6/12/97
Walter J. Macomber

A516C-50

Specimen: A516 gr. 60 600 grit polished

Condition: heat treated (p. 75) at 100°C
dry

Parameter: same as p. 79

Stored as A516C-50.2 on EIS data disk #1 4/18/97

Walter J. Macleod
6/12/97

⁵¹
A516C-50 w/2 markings
6/12/97

Specimen: A516 gr. 60 600 grit polished

Condition: same as p. 130 but w/ O-rings

Parameter: same as p. 79

Stored as A516C-51.2 on EIS data disk #1
4/18/97

Walter J. Macleod
6/12/97

825C-52

Specimen: Alloy 825 (HH4371FC) 600 grit polishedCondition: heat treated (p.75)O-ring with 1000 ppm Cl^- solutionParameters: same as p.79

Solution: 1000 ppm Cl^- 0.01M Na_2SO_4
 20 ppm SO_4^{2-} 10 ppm NO_3^- 2 ppm F^-
 3.29991 g NaCl lot 960780
 2.12105 g Na_2CO_3 lot 960685
 20 ml SO_4^{2-} 6/97 stock solution NB 159 p. 173
 10 ml NO_3^- "
 2 ml F^- "
 + DI water to 1000 mL

Stored as 825C-52.z on EIS data disk #1 4/18/97

Walter J. Macdonald
6/13/97

825C-53

Specimen: 825 (HH4371FC) 600 grit polishedCondition: heat treated (p.75)

O-ring w/ DI water

Parameters: same as p.79

Stored as 825C-53.z on EIS data disk #1 4/18/97

Walter J. Macdonald
6/13/97

A516C-54

Specimen: A516 gr. 60 600 grit polishedCondition: heat treated (p. 75)

O-ring w/ DI water

Parameter: same as p. 79

Stored as A516C-54.z on EIS data disk #1 4/8/97

Walter J. MacLennan
6/13/97

A516C-55

Specimen: A516 gr. 60 600 grit polishedCondition: heat treated (p. 75)O-ring, 1000 ppm Cl^- Solution: same as p. 132Parameter: same as p. 79

Stored as A516C-55.z on EIS data disk #1 4/8/97

Walter J. MacLennan
6/13/97

A516C-56

Specimen: A516 p.60 600 grit polishedCondition: heat treated (p.75)O-ring w/ 100 ppm Cl^- Parameters: same as p.79Solution: take 100 mL of solution on p.132
and dilute w/ DI water to 1000 mL

Stored as: A516C-56.z on EIS data disk #1 4/18/97

Walter J. Moehrk
6/13/97

825C-57

Specimen: 825 (HH4371FC) 600 grit polishedCondition: heat treated (p.75)O-ring w/ 100 ppm Cl^- Parameters: same as p.79Solution: same as p.136Stored as 825C-57.z on EIS data disk #1
4/18/97Walter J. Moehrk
6/13/97

825C-58

Specimen: 825 (HH4371FC) 600 grit polishedCondition: heat treated (p.75)O-rings 10 ppm Cl^- Parameters: same as p.79Solution: take 10 mL of solution on p. 132

and dilute w/ DI water to 1000 mL

Stored as 825C-58.z on EIS data disk #1
4/18/97Walter J. Mackowski
6/13/97

A516C-59

Specimen: A516 gr. 60 600 grit polishedCondition: heat treated (p.75)O-rings w/ 10 ppm Cl^- Parameters: Same as p.79Solution: Same as p.138Stored as A516C-59.z on EIS data disk #1
4/18/97Walter J. Mackowski
6/13/97

Thermal oxidation of specimen for EIS studies

Two specimens each of Alloy 825 (HH4371FG) and A516 g. 60 were put in the at 250°C for 7 days starting at 10 AM on 6/18/97

Specimens removed at 1 PM on 6/25/97.

Walter J. MacKowski
6/14/97

825C-60

Specimen: 825 (HH4371FG) 600 grit polished

Condition: heat treated (p. 140)
dry

Parameters: same as p. 29 ~~28~~ ²⁹ as MacKowski
6/25/97

Stored as: 825C-60.2 on EIS data disk #1 4/18/97

Walter J. MacKowski
6/18/97

825C-61

Specimen: 825 (H44371FG) 600 grit polishedCondition: Heat treated (p.140)

dry w/ O-ring

Parameter: same as p. 79Stored as: 825C-61.Z on EIS data disk #1
4/18/97Walter J. Moehrhof
6/18/97

825C-62

Specimen: 825 (H44371FG) 600 grit polishedCondition: Heat treated (p.140)O-ring w/ 1000 ppm Cl^- solutionParameter: same as p. 79Solution: same as p. 132Stored as: 825C-62.Z on EIS data disk #1
4/18/97Walter J. Moehrhof
6/18/97

A516C-63

Specimen: A516 gr. 60 600 grit polishedCondition: heat treated (p. 140)

dry

Parameters: same as p. 79Stored as: A516C-63.Z on EFS data disk #1
4/18/97Walter J MacKintosh
6/18/97

A516C-64

Specimen: A516 gr. 60 600 grit polishedCondition: heat treated (p. 140)

dry w/ O-rings

Parameters: same as p. 79Stored as: A516C-64.Z on EFS data disk #1
4/18/97Walter J MacKintosh
6/18/97

A516C-65

Specimen: A516 g.60 600 grit polished

Condition: Heat treated (p.140)

O-ring w/1000 ppm Cl⁻ solution

Parameter: same as p.79

Solution: same as p.132

Stored as: A516C-65.Z on EIS data disk #1
4/18/97

Walter J. Mochowski
6/18/97

A516C-66

Specimen: A516C g.60 600 grit polished

Condition: heat treated (p.140)

O-ring w/100 ppm Cl⁻ solution

Parameter: same as p.92

Solution: same as p.136

Stored as: A516C-66.Z on EIS data disk #1
4/18/97

Walter J. Mochowski
6/18/97

825C-67

Specimen: 825 (H#4371FG) 600 grit polishedCondition: heat treated (p.140)O-ring w/100 ppm Cl^- solutionParameter: same as p. 79Solution: same as p. 136Stored as: 825C-67.Z on EIS data disk #1
4/18/97Walter J Macdonald
6/18/97

825C-68

Specimen: 825 (H#4371FG) 600 grit polishedCondition: heat treated (p.140)O-ring w/10 ppm Cl^- solutionParameter: same as p. 79Solution: same as p. 138Stored as: 825C-68.Z on EIS data disk #1
4/18/97Walter J Macdonald
6/18/97

825C-69

Specimen: 825 (AH4371FG) 600 grit polishedCondition: Heat treated (p. 140)

O-ring w/ DI water

Parameter: same as p. 79Stored as: 825C-69.Z on EFS data disk #1
4/18/97Walter J. Macdonald
6/18/97

A516 C-70

Specimen: A516 gr. 60 600 grit polishedCondition: heat treated (p. 140)O-ring w/ 10 ppm Cl^- solutionParameter: same as p. 79Solution: same as p. 138Stored as: A516 C-70.Z on EFS data disk #1
4/18/97Walter J. Macdonald
6/18/97

A516C-71

Specimen: A516 gr. 60 600 grit polishedCondition: Heat treated (p. 140)

O-rings w/ DI water

Parameter: same as p. 79Stored as: A516C-71.2 on EIS data disk #1
4/18/97Walter J. Macfarlane
6/18/97

CALV11.DAT

Specimen: A516 gr. 60

start wt. 11.18426

end wt.

Alloy 825

start wt. 11.06770 g

end wt.

immersed at 1:1 ratio

Solution: 1000 ppm Cl^- 85 ppm HCO_3^- 20 ppm SO_4^{2-} 10 ppm NO_3^- 2 ppm F^-

3.29759 g NaCl lot # 960780

0.23687 g NaHCO_3 lot 923337A40 ml SO_4^{2-} 6/9720 ml NO_3^- 6/974 ml F^- 6/97

+ DI water to 2000 mL

start pH 8.193

end pH

T = 95°C thermometer # 0323002

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

de-aerated w/ 99.999% nitrogen

 E_{corr} 825 -325 mV E_{corr} 516 -754 mV

Start at 3:15 PM 7/3/97

Test aborted on 7/6/97 due to computer failure.

825 repolished and reused

Walter J. Macfarlane
7/7/97

GALV12.DAT

Specimen: A516 gr. 60
 start wt. 11.21717 g
 end wt.
 Alloy 825
 start wt. 11.23548 g
 end wt.
 immersed at 1:1 ratio

Solution: 1000 ppm Cl^- 0.01 M Na_2CO_3
 20 ppm SO_4^{2-} 10 ppm NO_3^- 2 ppm F^-
 3.29890 g NaCl lot 960780
 2.12727 g Na_2CO_3 lot 960685
 40 ml SO_4^{2-} 6/97 } stock solution NB157 p. 173
 20 ml NO_3^- 6/97 }
 4 ml F^- 6/97 }
 + DI water to 2000 mL
 start pH 10.897 end pH

de-aerated w/ 99.999% nitrogen

T = 95°C thermometer # 0323002

Reference electrode: Fisher SCE #13-620-51 S/N 5087405

$E_{\text{com}} 825$ -445 mV
 $E_{\text{com}} 516$ -532 mV

Start at 3:15 PM 7/3/97

Test aborted on 7/6/97 due to computer failure -
 825 repolished & reused

Walter J. Machowski
 7/7/97

GALV13.DAT

Specimen: A516 gr. 60
 start wt. 11.33785 g
 end wt.
 Alloy 825
 start wt. 11.31562 g
 end wt.
 immersed at 1:1 ratio

Solution: 1000 ppm Cl^- 85 ppm HCO_3^-
 20 ppm SO_4^{2-} 10 ppm NO_3^- 2 ppm F^-
 3.29968 g NaCl lot 960780
 0.23679 g NaHCO_3 lot 923337A
 40 ml SO_4^{2-} 6/97 } stock solution NB 157 p. 173
 20 ml NO_3^- 6/97 }
 4 ml F^- 6/97 }
 + DI water to 2000 mL
 start pH 8.261 end pH

aerated w/ geyser air

T = 95°C thermometer # 0323002

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

$E_{\text{com}} 825$ -535 mV
 $E_{\text{com}} 516$ -602 mV

Start at 3:15 PM 7/3/97

Test aborted on 7/6/97 - due to computer failure -
 825 repolished & reused

Walter J. Machowski
 7/7/97

CALV 14. DAT

Specimen: A516 gr. 60
 start wt. 11.34328 g
 end wt. 11.36400
 Alloy 825
 start wt. 11.39367 g
 end wt.
 immersed at 1:1 ratio

Solution: 1000 ppm Cl^- 0.01 M Na_2CO_3
 20 ppm SO_4^{2-} 10 ppm NO_3^- 2 ppm F^-
 3.29732 g NaCl lot 960780
 2.12244 g Na_2CO_3 lot 960685
 40 ml SO_4^{2-} 6/97
 20 ml NO_3^- 6/97 } stock solution NB 157 p. 173
 4 ml F^- 6/97
 + DI water to 2000 mL
 start pH 10.894 end pH 10.327

aerated w/ geo air

T = 95°C thermometer # 0323002

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

 $E_{\text{com}} 825$ -280 mV $E_{\text{com}} 516$ -417 mV

Start at 3:15 PM 7/3/97

Test aborted on 7/6/97 - due to computer failure.
 825 repolished + reused

Walter J. Macfarlane
 7/7/97

CALV 15. DAT

Specimen: A516 gr 60, 600 grit polished
 start wt. 11.35779 g
 end wt. 11.
 Alloy 825, 600 grit polished
 start wt. 11.05293 g
 end wt. 11.05675 g
 immersed at 1:1 ratio

Solution: 1000 ppm Cl^- 85 ppm HCO_3^-
 20 ppm SO_4^{2-} 10 ppm NO_3^- 2 ppm F^-
 3.31007 g NaCl lot # 960780
 0.23987 g NaHCO_3 lot # 923337A
 40 ml SO_4^{2-} 7/97
 20 ml NO_3^- 7/97 } stock solution NB 157 p. 174
 4 ml F^- 7/97
 + DI water to 2000 mL
 start pH 8.082 end pH 8.968

T = 95°C H₂ thermometer # 183305

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

de-aerated w/ 99.999% nitrogen

 $E_{\text{com}} 825$ -360 mV $E_{\text{com}} 516$ +566 mV

Test started 2:30 PM 7/22/97

Test off 9:30 PM 8/20/97
 825 repolished + reused

Walter J. Macfarlane
 8/19/97

CAV 16. DAT

Specimen: A516 gr. 60 600 grit polished
 start wt. 11.30333 g
 end wt. 11.31058 g
 Alloy 825, 600 grit polished
 start wt. 11.30167 g
 end wt. 11.30922 g
 immersed at 1:1 ratio

Solution: 1000 ppm Cl⁻ 0.01M Na₂CO₃
 20 ppm SO₄²⁻ 10 ppm NO₃⁻ 2 ppm F⁻
 3.30535 g NaCl lot # 960780
 2.12817 g Na₂CO₃ lot # 960685
 40 ml SO₄²⁻ 7/97 } stock solution NB 157 p. 174
 20 ml NO₃⁻ 7/97 }
 4 ml F⁻ 7/97 }
 + DI water to 2000 mL
 start pH 10.886 end pH

T = 95°C Hg thermometer # 183305

Reference electrode: Fisher SCE #13-620-51 S/N 5082405

de-aerated w/ 99.999% nitrogen

E_{com} 825 -491 mV

E_{com} 516 -583 mV

Test started 2:30 PM 7/22/97

Test off 9:30 PM 8/20/97
825 repolished + reused

Walter J. MacKinnon
9/19/97

CAV 17. DAT

Specimen: A516 gr. 60 600 grit polished
 start wt. 11.32230 g
 end wt. 10.13095 g
 Alloy 825 600 grit polished
 start wt. 11.22210 g
 end wt. 11.22274 g
 immersed at 1:1 ratio

Solution: 1000 ppm Cl⁻ 85 ppm HCO₃⁻
 20 ppm SO₄²⁻ 10 ppm NO₃⁻ 2 ppm F⁻
 3.30243 g NaCl lot # 960780
 0.23623 g NaHCO₃ lot # 923337A
 40 ml SO₄²⁻ 7/97 } stock solution NB 157 p. 174
 20 ml NO₃⁻ 7/97 }
 4 ml F⁻ 7/97 }
 + DI water to 2000 mL
 start pH 8.234 end pH 8.814

T = 95°C Hg thermometer # 183305

Reference electrode: Fisher SCE #13-620-51 S/N 5082374

aerated w/ gear air

E_{com} 825 -226 mV

E_{com} 516 -620 mV post test - heavy rust scale

Test started 2:30 PM 7/22/97

Mean current @ end of test w/ Keithly 485

4.12 μA ÷ 8 cm² = 0.515 μA/cm²

WB value 2.05 × 10⁻⁵ A/cm² @ 4305330 sec

Test stopped 10:15 AM 9/10/97

825 repolished + reused

Walter J. MacKinnon
9/19/97

GALV 18. DAT

Specimen: A516 gr. 60 600 grit polished
 start wt. 11.16729 g
 end wt. 11.07415 g
 Alloy 825 600 grit polished
 start wt. 11.38081 g
 end wt. 11.38091 g
 immersed at 1:1 ratio

Solution: 1000 ppm Cl^- 0.01 M Na_2CO_3
 20 ppm SO_4^{2-} 10 ppm NO_3^- 2 ppm F^-
 3.30264 g NaCl lot # 960780
 2.11427 g Na_2CO_3 lot # 960685
 40 ml SO_4 7/97 } Stock solution NB 157 p. 174
 20 ml NO_3 7/97 }
 4 ml F^- 7/97 }
 + DI water to 2000 mL
 start pH 10.901 end pH 10.035

T = 95°C Hg thermometer # 183305

Reference electrode: Fisher SCE # 13-620-51 S/N 5144349

aerated w/ zero air

E_{cm} 825 -321 mV

E_{cm} 516 -464 mV post test - rust on vapor phase part

Test started 2:30 PM 7/22/97
 Measure current @ end of test w/ Keithley 485
 $0.964 \mu A \div 8 = 0.12 \mu A/cm^2$
 WB value $6.23 \times 10^{-4} A/cm^2$ @ 4305320 sec

Test stopped @ 10:15 AM 9/10/97
 825 repolished & reused
 Walter J MacKowski
 9/19/97

GALV 19. DAT

Specimen: A516 gr. 60 600 grit polished
 start wt. 11.23940 g
 end wt. 10.87714 g
 Alloy 825 600 grit polished
 start wt. 11.03235 g
 end wt. 11.03276 g
 immersed at 1:1 ratio

Solution: 0.5 M NaCl 85 ppm HCO_3^-
 20 ppm SO_4^{2-} 10 ppm NO_3^- 2 ppm F^-
 58.49009 g NaCl lot # 960780
 0.23588 g $NaHCO_3$ lot # 923337A
 40 ml SO_4 8/97 } Stock solutions NB 157 p. 175
 20 ml NO_3 8/97 }
 4 ml F^- 8/97 }

+ DI water to 2000 mL
start pH 7.866 end pH 9.317

T = 95°C Hg thermometer # 183305

Reference electrode: Fisher SCE # 13-620-51 S/N 5087405
~~aerated w/ N_2 99.999%~~ 8/20/97 w/ mechanical

aerated w/ zero air

E_{cm} 825 -227 mV

E_{cm} 516 -685 mV post test very heavy scale deposit

Test started 1 PM 8/22/97
 Measure current @ end of test w/ Keithley 485
 $52.75 \mu A \div 8 cm^2 = 6.593 \mu A/cm^2$ @ 1632315 sec
 WB value $2.60 \times 10^{-4} A/cm^2$

Test stopped @ 10:15 AM 9/10/97
 825 repolished & reused
 Walter J MacKowski
 9/19/97

CALU 20. DAT

Specimen: A516 gr. 60 600 grit polished
 start wt. 11.29061 g
 end wt. 11.13310 g
 Alloy 825 600 grit polished
 start wt. 11.27366 g
 end wt. 11.27364 g
 immersed at 1:1 ratio

Solution: 0.5M NaCl 0.01M Na₂CO₃
 20 ppm SO₄²⁻ 10 ppm NO₃⁻ 2 ppm F⁻
 58.43390 g NaCl lot # 960780
 2.16144 g Na₂CO₃ lot # 960685
 40 ml SO₄²⁻ 8/97 }
 20 ml NO₃⁻ 8/97 } stock solutions NB 157 p. 175
 4 ml F⁻ 8/97 }

+ DI water to 2000 mL
 start pH 10.621 end pH 10.265

T = 95°C Hg thermometer # 183305

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

~~de-aerated w/ N₂ 99.999% 8/20/97 by Mochinski~~

aerated w/ yew air

E_{corr} 825 -226 mV

E_{corr} 516 -603 mV post test - rust on vapor phase part

Test started 1 PM 8/22/97

Measure current @ end of test w/ Keithly 485

19.2 μA ÷ 8 cm² = 2.4 mA/cm²

WB value = 9.6 × 10⁻⁵ A/cm² @ 1632240 secs

Test stopped 10:15 AM 9/10/97 Walter J Mochinski 9/19/97

825 repolished & reused

CALU 21. DAT

Specimen: A516 gr. 60 600 grit polished
 start wt. 11.29771 g
 end wt. 10.87487 g
 Alloy 825 600 grit polished
 start wt. 11.12725 g
 end wt. 11.12952 g
 immersed @ 1:1 ratio

Solution: 1000 ppm Cl⁻ 85 ppm HCO₃⁻
 20 ppm SO₄²⁻ 10 ppm NO₃⁻ 2 ppm F⁻
 3.29624 g NaCl lot # 960780
 0.24722 g NaHCO₃ lot # 923337A
 40 ml SO₄²⁻ }
 20 ml NO₃⁻ } 8/97 } stock solutions NB 157 p. 175
 4 ml F⁻ }

+ DI water to 2000 mL
 start pH 8.601 end pH 9.209

T = 95°C Hg thermometer 183301

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

aerated w/ yew air

E_{corr} 825 -283 mV

E_{corr} 516 -597 mV

On startup, current checked against Keithly 485 picoammeter
 S/N 509163. Cal Feb 20, 1997 next cal Feb 20, 1998

Test started 11:20 AM 9/18/97

Test stopped 4:30 PM 9/29/97

825 repolished & reused

Walter J Mochinski
 10/6/97

GALV 22. DAT

Specimen: A516 gr. 60 600 grit polished
 start wt. 11.18155 g
 end wt. 11.12073 g
 Alloy 825 600 grit polished
 start wt. 11.20471 g
 end wt. 11.21078 g
 immersed @ 1:1 ratio

Solution: 1000 ppm Cl^- 0.01 M Na_2CO_3
 20 ppm SO_4^{2-} 10 ppm NO_3^- 2 ppm F^-
 3.30082 g NaCl lot # 960780
 2.11065 g Na_2CO_3 lot # 960685
 40 ml SO_4^{2-}
 20 ml NO_3^- } 8/97 } stock solution NB157 p. 175
 4 ml F^- }
 + DI water to 2000 mL
 start pH 10.931 end pH 10.229

$T = 95^\circ\text{C}$ Hg thermometer 183301
Reference electrode: Fisher SCE #13-620-51 S/N 9214080
 aerated w/ zero air

$E_{\text{can 825}} = -280 \text{ mV}$

$E_{\text{can 516}} = -502 \text{ mV}$

On startup, current checked vs. Keithly 485 picoammeter
 S/N 509163 cal Feb 20, 1997 due Feb 20, 1998

Test started 11:20 AM 9/18/97
 Test stopped 4:30 PM 9/29/97

825 repolished & reused

Walter J Macdonald
 10/8/97

GALV 23. DAT

Specimen: A516 gr. 60 600 grit polished
 start wt. 10.97114 g
 end wt. 10.86297 g
 Alloy 825
 start wt. 11.01457 g
 end wt. 11.01572 g
 immersed @ 1:1 ratio

Solution: 0.5 M NaCl 85 ppm HCO_3^-
 20 ppm SO_4^{2-} 10 ppm NO_3^- 2 ppm F^- WJ Macdonald 9/10/97
 58.44669 g NaCl lot # 960780
 0.24237 g NaHCO_3 lot # 923337A
 40 ml SO_4^{2-}
 20 ml NO_3^- } 8/97 } stock solution NB157 p. 175
 4 ml F^- }
 + DI Water to 2000 mL
 start pH 8.115 end pH 8.923

$T = 95^\circ\text{C}$ Hg Thermometer 183301
Reference electrode: Fisher SCE #13-620-51 S/N 5144349
 aerated w/ zero air

$E_{\text{can 825}} = -253 \text{ mV}$

$E_{\text{can 516}} = -64 \text{ mV}$

On startup, current checked vs. Keithly 485 picoammeter
 S/N 509163 cal Feb 20, 1997 next cal Feb 20, 1998

Test started 11:20 AM 9/18/97
 Test stopped 4:30 PM 9/29/97

825 repolished & reused

Walter J Macdonald
 10/8/97

GALV 24. DAT

Specimen: A516 gr. 60 600 grit polished
 start wt. 11.30712 g
 end wt. 11.26194 g
 Alloy 825
 start wt. 11.25503 g
 end wt. 11.26455 g
 immersed @ 1:1 ratio

Solution: 0.5M NaCl 0.01M Na₂CO₃ w/NaOH 9/10/97
~~85 ppm HCO₃⁻~~
 20 ppm SO₄²⁻ 10 ppm NO₃⁻ 2 ppm F⁻
 58.44314 g NaCl lot # 960780
 2.13321 g Na₂CO₃ lot # 960685
 40 ml SO₄²⁻
 20 ml NO₃⁻ } 8/97 } stock solution NB157 p. 175
 4 ml F⁻

+ DI water to 2000 mL
 start pH 10.613 end pH 10.103

T = 95°C Hg thermometer 183301
Reference electrode: Fisher SCE #13-620-51 S/N 5087405

aerated w/zero air

E_{can} 825 -249 mV

E_{can} 516 -628 mV

On startup, current checked vs. Keithly 485 picoammeter
 S/N 509163 cal Feb 20, 1997 due cal Feb 20, 1998

Test started 11:20 am 9/18/97

Test stopped 4:30 PM 9/29/97

825 repolished + reused

Walter J. Mocharke
 10/8/97

GALV 25. DAT

Specimen: A516 gr. 60 600 grit polished
 start wt. 11.14562 g
 end wt. 10.89564 g
 Alloy 625 lot # NX9936 AC
 start wt. 12.25359 g
 end wt. 12.25349 g
 immersed @ 1:1 ratio

Solution: 0.5M NaCl
 20 ppm SO₄²⁻ 10 ppm NO₃⁻ 2 ppm F⁻
 58.46368 g NaCl lot # 960780
 40 ml SO₄²⁻
 20 ml NO₃⁻ } 9/97 } stock solution NB157 p. 181
 4 ml F⁻

+ DI water to 2000 mL
 start pH 7.495 end pH 4.596
 T = room temp

Reference electrode: Fisher SCE #13-620-51 S/N 3106345
 aerated w/zero air

E_{can} 625 -185 mV

E_{can} 516 -562 mV

Test started @ 12:25 PM 9/23/97

Test stopped @ 1:40 PM 10/1/97

825 repolished + reused

Walter J. Mocharke
 10/8/97

GALV 26.DAT

Specimen: A516 gr. 60 600 grit polished
 start wt. 11.09915 g 11.03285
 end wt. ~~11.11950 g~~ ^{10/1/97}
 Alloy 825 11.11950 g 600 grit polished
 start wt
 end wt. 11.11837g
 immersed at 1:1 ratio

Solution: 1000 ppm Cl⁻ 0.01 M Na₂CO₃
 20 ppm SO₄²⁻ 10 ppm NO₃⁻ 2 ppm F⁻
 3.29994g NaCl # 960780
 2.11707g Na₂CO₃ # 960685
 40 ml SO₄²⁻
 20 ml NO₃⁻ } 9/97 } stock solution NB157 p 181
 4 ml F⁻
 + DI water to 2000 mL
 start pH 10.911 end pH 10.436

T = room temp aerated w/ yew air
 Ref electrode: Fisher SCE 13-620-51 S/N 5087374

E_{com} 516 -503 mV

E_{com} 825 -211 mV

Test started @ 4:10 PM 10/1/97
 noted that Ch. #1 E_{GALV} was incorrect
 show 33 mV when actual was φ
 changed acquisition channels @ 10:40 AM 10/2
 + now read correct value of φ
 Test stopped 9:15 AM 10/9/97
 825 repolished + reused

Walter J Macdonald
 10/14/97

GALV 27.DAT

Specimen: A516 gr. 60
 start wt. 11.23302 g
 end wt. 11.01858 g
 Alloy 825 600 grit polished
 start wt. 11.65216 g
 end wt. 11.65172 g
 immersed at 1:1 ratio

Solution: 0.5 M NaCl
 20 ppm SO₄²⁻ 10 ppm NO₃⁻ 2 ppm F⁻
 58.47037g NaCl # 960780
 40 ml SO₄²⁻
 20 ml NO₃⁻ } 9/97 } stock sol'n NB157 p.181
 4 ml F⁻
 + DI water to 2000 mL

start pH 8.643 end pH 8.281

T = room temp
 Ref electrode: Fisher SCE 13-620-51 S/N 3106345

aerated w/ yew air

E_{com} 516 -592 mV

E_{com} 825 -158 mV ^{10/1/97} WJ Macdonald

Test started 4:10 PM 10/1/97
 Test stopped 9:15 AM 10/9/97

825 repolished + reused

Walter J Macdonald
 10/14/97

CALV 28. DAT

Specimen: A516 gr. 60 600 grit polished
 start wt. 11.02557 g
 10/10/97
 W. J. Macomber
 end wt. ~~11.00769 g~~ 10.99754 g
 Alloy 825 600 grit polished
 start wt. 11.24893 g
 end wt. 11.24971 g
 immersed at 1:1 ratio

Solution: 1000 ppm Cl^- 0.01M Na_2CO_3
 20 ppm SO_4^{2-} 10 ppm NO_3^- 2 ppm F^-
 3.29730 g NaCl # 960780
 2.11370 g Na_2CO_3 # 960685
 40 ml SO_4^{2-}
 20 ml NO_3^- } 9/97 } stock sol'n NB157 p.181
 4 ml F^-
 + DI water to 2000 mL
 start pH 10.918 end pH 10.081

T = 95°C H₂ thermometer 183301

de-aerated w/ N₂

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

E_{com} 516 -405 mV

E_{com} 825 -324 mV

Test started @ 4:10 PM 10/1/97

Test stopped 9:15 AM 10/9/97

825 repolished + reused

Walter J Macomber
 10/14/97

CALV 29. DAT

Specimen: A516 gr. 60 600 grit polished
 start wt. 10.98151 g
 end wt. 10.71960 g
 Alloy 825 600 grit polished
 start wt. 11.00708 g
 end wt. 11.00769 g
 immersed at 1:1 ratio

Solution: 1000 ppm Cl^- 85 ppm HCO_3^-
 20 ppm SO_4^{2-} 10 ppm NO_3^- 2 ppm F^-
 3.29938 g NaCl # 960780
 0.23715 g NaHCO_3 # 923337A
 40 ml SO_4^{2-}
 20 ml NO_3^- } 9/97 } stock sol'n NB157 p.181
 4 ml F^-
 + DI water to 2000 mL
 start pH 8.679 end pH 9.523

T = room temp

Ref electrode: Fisher SCE 13-620-51 S/N 9214080

aerated w/ fresh air

E_{com} 516 -528 mV

E_{com} 825 -154 mV

Test started @ 4:10 PM 10/1/97

Test stopped 9:15 AM 10/9/97

825 repolished + reused

Walter J Macomber
 10/14/97

G-ATV 30, DAT

Specimen: A516 gr. 60 600 grit polished
 start wt. 11.31541 g
 end wt. 10.40254 g
 Alloy 825 600 grit polished
 start wt. 182.59670 g
 end wt. 182.60135 g
 immersed at 1:10 ratio 516/825

Solution: 1000 ppm Cl^- 85 ppm HCO_3^-
 20 ppm SO_4^{2-} 10 ppm NO_3^- 2 ppm F^-
 3.29268 g NaCl # 960780
 0.23629 g $NaHCO_3$ # 923337A
 40 ml SO_4^{2-}
 20 ml NO_3^- } 9/97 } stock sol'n NB 157 p. 181
 4 ml F^- }
 + DI water to 2000 mL
 start pH 8.339 end pH 9.351

T = 95°C Hg thermometer 183301

aerated w/ new air
Ref electrode: Fisher SCE 13-620-51 S/N 5087405

$E_{com 516}$ -566 mV
 $E_{com 825}$ -187 mV

Test started 4:10 PM 10/1/97
 Test stopped 9:15 PM 10/9/97

825 repolished + reused

Walter J Macdonald
 10/14/97

G-ATV 31, DAT

Specimen: A516 gr. 60 600 grit polished
 start wt. 190.16100 g
 end wt. 188.12250 g
 Alloy 825 600 grit polished
 start wt. 11.19756 g
 end wt. 11.19801 g
 immersed at 10:1 ratio 516/825

Solution: 1000 ppm Cl^- 85 ppm HCO_3^-
 20 ppm SO_4^{2-} 10 ppm NO_3^- 2 ppm F^-
 3.29886 g NaCl # 960780
 0.23871 g $NaHCO_3$ # 923337A
 40 ml SO_4^{2-}
 20 ml NO_3^- } 9/97 } stock sol'n NB 157 p. 181
 4 ml F^- }
 + DI water to 2000 mL
 start pH 8.682 end pH 9.272

T = 95°C Hg thermometer 183301

aerated w/ new air
Ref electrode: Fisher SCE 13-620-51 S/N 5144349

$E_{com 516}$ -465 mV
 $E_{com 825}$ -195 mV

Test started 4:10 PM 10/1/97
 Test stopped 9:15 PM 10/9/97

A516 repolished + reused
 825 repolished + reused

Walter J Macdonald
 10/14/97

CALV 32.DAT

Specimen: A516 g. 60 600 grit polished
 start wt. 11.16892 g
 end wt. 10.77626 g
 Alloy 825 600 grit polished
 start wt. 12.23187 g
 end wt. 12.23242 g

immersed at 1:1 ratio

Solution: 1000 ppm Cl^- pH 5

10/10/97
WJ MacLachlan

3.28936 g NaCl # 960780
 1 drop conc HCl lot # 967077
 1 drop = 0.047 g
 start pH 5.056 end pH 8.728
 40 ml SO_4^{2-} }
 20 ml NO_3^- } #47 } NB 157 p.181
 4 ml F^- } 9/97

10/10/97 WJ MacLachlan

+ DI water to 2000 mL
T = 95°C Hg thermometer 183301

aerated w/ geo air
Reference electrode: Fisher 13-620-51 S/N 5744348

E_{can 516} - 516 mV
 E_{can 825} - 201 mV
 current checked vs. Keithly 485 picoammeter
 S/N 509163 cal Feb 20, 1997 due Feb 20, 1998

Test started 11:20 AM 10/10/97

| date | pH |
|-------|-------|
| 10/10 | 8.166 |
| 10/13 | 8.806 |
| 10/14 | 9.067 |
| 10/15 | 8.834 |

Test stopped 8:45 AM 10/20/97
 825 repolished & reused
 Walter J MacLachlan
 10/28/97

CALV 33.DAT

Specimen: A516 g. 60 600 grit polished
 start wt. 10.97906 g
 end wt. 10.61431 g
 Alloy 825 600 grit polished
 start wt. 11.18907 g
 end wt. 11.18997 g

immersed at 1:1 ratio

Solution: 1000 ppm Cl^- pH 3

20 ppm SO_4^{2-} 10 ppm NO_3^- 2 ppm F^-
 3.26804 g NaCl # 960780
 4 drops conc HCl lot # 967077
 40 ml SO_4^{2-} }
 20 ml NO_3^- } 9/97 } NB 157 p.181
 4 ml F^- }
 + DI water to 2000 mL

T = 95°C Hg thermometer 183301

aerated w/ geo air
Reference electrode: Fisher 13-620-51 S/N 5087405

E_{can 516} - 596 mV
 E_{can 825} - 53 mV
 current checked vs. Keithly 485 picoammeter
 S/N 509163 cal Feb 20, 1997 due Feb 20, 1998

Test started 11:20 AM 10/10/97

| date | pH |
|-------|-------|
| 10/10 | 7.042 |
| 10/13 | 4.458 |
| 10/14 | 4.754 |
| 10/15 | 4.726 |

Test stopped 8:45 AM 10/20/97
 825 repolished & reused
 Walter J MacLachlan
 10/28/97

CALV 34. DAT

Specimen: A516 g. 60 600 grit polished
 start wt. 11.27843g
 end wt. 11.06988g
 Alloy 825 600 grit polished
 start wt. 11.24644g
 end wt. 11.24620g

immersed at 1:1 ratio

Solution: 1000 ppm Cl^- pH 3
 20 ppm SO_4^{2-} 10 ppm NO_3^- 2 ppm F^-
 3.25532g NaCl #960780
 3 drops conc HCl #967077
 40ml SO_4^{2-}
 20ml NO_3^- } 9/97 } NB 157 p.181
 4ml F^- }
 + DI water to 2000 mL
 start pH 3.250 end pH 5.333

T = room temp

aerated w/ geo air

Ref electrode: Fisher 13-620-51 S/N 9214080

$E_{can 516} = -528 mV$
 $E_{can 825} = -38 mV - 130 mV$
 $= -94 mV = -226 mV$

10/10/97 w2 malumbi

current checked vs. Keithly 485 picoammeter
 S/N 509165 cal Feb 20, 1997 due Feb 20, 1998

Test started 11:20 AM 10/10/97

date pH

10/10 4.288 Test stopped 8:45 AM 10/20/97

10/13 5.203

10/14 5.642

10/15 5.484 825 repolished & reused 10/28/97

Walter J Macdonald

CALV 35. DAT

Specimen: A516 g. 60 600 grit polished
 start wt 10.86350g
 end wt. 10.40883g
 Alloy 825 600 grit polished
 start wt 11.00480g
 end wt 11.00455g

immersed at 1:1 ratio

Solution: 1000 ppm Cl^- pH 5
 20 ppm SO_4^{2-} 10 ppm NO_3^- 2 ppm F^-
 3.29092g NaCl #960780
 1 drop 1110 HCl #967077
 40ml SO_4^{2-}
 20ml NO_3^- } 9/97 } NB 157 p.181
 4ml F^- }
 + DI water to 2000 mL
 start pH 5.002 end pH 6.299

T = room temp

aerated w/ geo air

Ref electrode: Fisher 13-620-51 S/N 3106339

$E_{can 516} = -498 mV$
 $E_{can 825} = -23 mV$

current checked vs. Keithly 485 picoammeter
 S/N 509163 cal Feb 20, 1997 due Feb 20, 1998

Test started 11:20 AM 10/10/97

date pH

10/10 5.636

10/13 5.804

10/14 6.090

10/15 6.130

Test stopped 8:45 AM 10/20/97
 825 repolished & reused

Walter J Macdonald 10/28/97

GALV 36.DAT

Specimen: A516 gr. 60 600 grit polished
 Start wt. 11.16407g
 end wt. 11.15315g
 Alloy 825 600 grit polished
 Start wt. 11.64679g
 end wt. 11.64632g

immersed at 1:1 ratio

Solution: 1000 ppm Cl^- pH 5
 20 ppm SO_4^{2-} 10 ppm NO_3^- 2 ppm F^-
 3.29594g NaCl #960780
 1 drop 1:10 HCl #967077
 40ml SO_4^{2-}
 20ml NO_3^- } 9/87 } NB 157 p181
 4ml F^- }
 + D.F. water to 2000 mL

Start pH 5.035 end pH 7.293
 T = 95°C H₂ thermometer 183301
 de-aerated w/ 99.999% N₂

Ref. electrode: Fisher 13-620-51 S/N 5087374

E_{com} 516 -702mV
 E₈₂₅ -280mV

current checked vs. Keithly 485 picoammeter
 S/N 509163 cal Feb 20, 1997 due Feb 20, 1998

Test started 11:20 AM 10/10/97

| date | pH |
|-------|-------|
| 10/10 | 6.381 |
| 10/13 | 7.294 |
| 10/14 | 7.056 |
| 10/15 | 7.328 |

Test stopped 8:45 AM 10/20/97
 825 repolished & reused

Walter J Machowski
 10/28/97

GALV 37.DAT

Specimen: A516 gr. 60 600 grit polished
 Start wt. 11.1530
 end wt. 9.70813g
 Alloy 825 600 grit polished
 Start wt. 182.50255g
 end wt. 182.50330g

immersed at 10:1 ratio 825/516

Solution: 1000 ppm Cl^- pH 5
 20 ppm SO_4^{2-} 10 ppm NO_3^- 2 ppm F^-
 3.28485g NaCl #960780
 1 drop 1:10 HCl #967077
 40ml SO_4^{2-}
 20ml NO_3^- } 9/87 } NB 157 p181
 4ml F^- }
 + D.F. water to 2000 mL

Start pH 4.937 end pH 8.707

T = 95°C H₂ thermometer 183301

aerated w/ geo air

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

E_{com} 516 -572mV
 E_{com} 825 -25mV

current checked vs. Keithly 485 picoammeter
 S/N 509163 cal Feb 20, 1997 due Feb 20, 1998

Test started 11:20 AM 10/10/97

| date | pH |
|-------|-------|
| 10/10 | 6.397 |
| 10/13 | 7.755 |
| 10/14 | 7.629 |
| 10/15 | 6.076 |

Test stopped 8:45 AM 10/20/97
 825 repolished & reused

Walter J Machowski
 10/28/97

QVCP1.DAT

Specimen: A516 gr. 60 600 grit polished
10/15/97 start wt. ~~10.90548 g~~ 10.88650 g
wg mechanical end wt.

Solution: 1000 ppm Cl⁻ pH 5
20 ppm SO₄²⁻ 10 ppm NO₃⁻ 2 ppm F⁻
1.64749 g NaCl lot # 960780
1 drop HCl 1:10 lot # 962077
20 ml SO₄²⁻ }
10 ml NO₃⁻ } 9/97 } NB 157 p.181
2 ml F⁻ }
+ DI water to 1000 mL
start pH 4.962 end pH 7.868

T = 95°C Hg thermometer
de-aerated w/ 99.999% N₂

Ref. electrode: Fisher SCE 13-620-51 S/N 7079122
Counter electrode: Pt flag

David D 11/8/97

QVCP2.DAT

Specimen: A516 gr. 60 600 grit polished
start wt. 11.11986 g
end wt.

Solution: 1000 ppm Cl⁻ pH 3
20 ppm SO₄²⁻ 10 ppm NO₃⁻ 2 ppm F⁻
1.64996 g NaCl lot # 960780
3 drops conc HCl } lot # 962077
6 drops HCl 1:20 }
20 ml SO₄²⁻ }
10 ml NO₃⁻ } 9/97 } NB 157 p.181
2 ml F⁻ }
+ DI water to 1000 mL
start pH 3.085 end pH 3.588

T = 95°C Hg thermometer
de-aerated w/ 99.999% N₂

Ref. electrode: Fisher SCE 13-620-51 S/N 7079122
Counter electrode: Pt flag

David D 11/8/97

GALV 38. DAT

Specimen: A516 gr. 60 600 grit polished
 start wt. 11.06832 g
 end wt. 10.94403 g
 Alloy 825 600 grit polished
 start wt. 193.48255 g
^{11/4/97}_{w2 macbush} end wt. 193.48341 g
 immersed @ 10:1 ratio (825:516)

Solution: 1000 ppm Cl⁻ 0.01M Na₂CO₃
 20 ppm SO₄²⁻ 10 ppm NO₃⁻ 2 ppm F⁻
 3.29723 g NaCl lot # 960780
 2.11371 g Na₂CO₃ lot # 960685
 40 ml SO₄²⁻
 20 ml NO₃⁻ } 9/97 } NB 157 p. 181
 4 ml F⁻ }
 + DI water to 2000 mL

start pH 10.833 end pH 10.029

T = 95°C Hg thermometer 183301
aerated w/ zero air

Ref. electrode: Fisher SCE #13-620-51 S/N 7079122
 E_{com} 825 -274 mV
 E_{com} 516 -494 mV

Test started @ 3:15 PM 10/22/97

| pH | secs | date |
|--------|--------|----------|
| 10.203 | 84170 | 10/23/97 |
| 10.035 | 167160 | 10/24/97 |
| 9.880 | 163420 | 10/27/97 |
| 9.928 | 249500 | 10/28/97 |
| 9.947 | 427120 | 10/30/97 |
| 9.960 | 515580 | 10/31/97 |

Test stopped 11/3/97 8:15 AM
 825 no corrosion; repolished
 + used in other tests

Walter J Macbush
11/7/97

GALV 39. DAT

Specimen: A516 gr. 60 600 grit polished
 start wt. 188.08555 g
 end wt. 186.49905 g
 Alloy 825 600 grit polished
 start wt. 12.22810 g
 end wt. 12.22822 g
 immersed @ 1:10 ratio (825:516)

Solution: 1000 ppm Cl⁻ 0.01M Na₂CO₃
 20 ppm SO₄²⁻ 10 ppm NO₃⁻ 2 ppm F⁻
 3.29645 g NaCl lot # 960780
 2.11472 g Na₂CO₃ lot # 960685
 40 ml SO₄²⁻
 20 ml NO₃⁻ } 9/97 } NB 157 p. 181
 4 ml F⁻ }
 + DI water to 2000 mL

start pH 10.807 end pH 10.393

T = 95°C Hg thermometer 183301

aerated w/ zero air
 Ref. electrode: Fisher SCE #13-620-51 S/N 5144349
 E_{com} 825 -417 mV -238 mV 10/21/97 w2 macbush
 E_{com} 516 -822 mV -470 mV 10/21/97 w2 macbush

Test started @ 3:15 PM 10/22/97

| pH | secs | date |
|--------|--------|----------|
| 11.135 | 84340 | 10/23/97 |
| 11.167 | 167280 | 10/24/97 |
| 10.897 | 163520 | 10/27/97 |
| 10.827 | 249580 | 10/28/97 |
| 10.598 | 427190 | 10/30/97 |
| 10.540 | 515670 | 10/31/97 |

Test stopped 11/3/97 8:15 AM
 825 no corrosion; repolished +
 used in other tests

Walter J Macbush
11/7/97

CALV 40.DAT

Specimen: A516 gr. 60 600 grit polished
 start wt. 11.21660g
 end wt. 11.20011g
 Alloy 825 600 grit polished
 start wt. 11.18430g
 end wt. 11.18442g
 immersed @ 1:1 ratio

Solution: 1000 ppm Cl⁻ 85 ppm HCO₃⁻
 20 ppm SO₄²⁻ 10 ppm NO₃⁻ 2 ppm F⁻
 3.29811g NaCl lot # 960780
 0.23832g NaHCO₃ lot # 960685
 40ml SO₄²⁻
 20ml NO₃⁻ } 9/97 } NB 157 p. 181
 4ml F⁻ }
 + DI water to 2000 mL
 start pH 8.050 end pH 9.233

T = 95°C Hg thermometer 183301
 de-aerated w/ 99.999% N₂

Ref. electrode: Fisher SCE #13-620-51 S/N 9214080
 E_{com} 825 -445mV

E_{com} 516 -734mV

Test started 3:15 PM 10/22/97

| pH | secs | date | |
|-------|--------|----------|---|
| 9.580 | 84660 | 10/23/97 | Test stopped 11/3/97 8:15 AM 825 no corrosion, repolished & used in other tests |
| 9.684 | 167590 | 10/24/97 | |
| 9.420 | 163650 | 10/27/97 | |
| 9.379 | 249650 | 10/28/97 | |
| 9.293 | 427290 | 10/30/97 | |
| 9.310 | 515750 | 10/31/97 | |

Walter J Machowski
 11/2/97

CALV 41.DAT

Specimen: A516 gr. 60 600 grit polished
 start wt. 11.24975g
 end wt. 10.21307g
 Alloy 825 600 grit polished
 start wt. 182.45525g
 end wt. 182.45612g
 immersed @ 10:1 ratio (825:516)

Solution: 1000 ppm Cl⁻ pH 3
 20 ppm SO₄²⁻ 10 ppm NO₃⁻ 2 ppm F⁻
 3.29558g NaCl lot # 960780
 1 drop conc HCl lot # 967077
 40ml SO₄²⁻
 20ml NO₃⁻ } 9/97 } NB 157 p. 181
 4ml F⁻ }
 + DI water to 2000 mL
 start pH 3.156 end pH 5.316

T = 95°C Hg thermometer 183301
 aerated w/ geo air

Ref. electrode: Fisher SCE #13-620-51 S/N 5087405
 E_{com} 825 +8mV

E_{com} 516 -665mV

Test started @ 3:15 AM 10/22/97

| pH | secs | date | |
|-------|--------|----------|---|
| 5.945 | 84815 | 10/23/97 | Test stopped 11/3/97 8:15 AM 825 no corrosion, repolished & used in other tests |
| 5.263 | 167820 | 10/24/97 | |
| 5.930 | 165720 | 10/27/97 | |
| 6.216 | 250120 | 10/28/97 | |
| 5.902 | 427820 | 10/30/97 | |
| 6.132 | 515850 | 10/31/97 | |

Walter J Machowski
 11/2/97

PALV42.DAT

Specimen: A516 gr. 60 600 grit polished
 start wt. 11.07940 g
 end wt. 10.41264 g
 Alloy 825 600 grit polished
 start wt. 11.00132 g
 end wt. 11.00112 g
 immersed @ 1:1 ratio

Solution: 1000 ppm Cl⁻ pH 3
 20 ppm SO₄²⁻ 10 ppm NO₃⁻ 2 ppm F⁻
 3.25788 g NaCl #960780
 7 drops conc HCl #967077
 40ml SO₄²⁻
 20ml NO₃⁻ } 9/97 } NB157 p.181
 4ml F⁻ }
 + DI water to 2000 mL
 start pH 3.188 end pH 5.466

T = 95°C Hg thermometer 183301
 de-aerated w/99.999% N₂

Ref. electrode: Fisher SCE #13-620-51 S/N 3106339
 E_{com} 825 -25 mV
 E_{com} 516 -697 mV

Test started @ 3:15 PM 10/22/97

| pH | secs | date | |
|-------|--------|----------|---|
| 5.942 | 84880 | 10/23/97 | Test stopped 11/3/97 8:15 AM 825 no corrosion; repolished + used in other tests |
| 5.810 | 167860 | 10/24/97 | |
| 5.929 | 163790 | 10/27/97 | |
| 6.081 | 250200 | 10/28/97 | |
| 5.851 | 427520 | 10/30/97 | |
| 6.210 | 515950 | 10/31/97 | |

Walter J MacKowski
11/7/97

PALV43.DAT

Specimen: A516 gr. 60 600 grit polished
 start wt. 11.08890 g
 end wt. 10.96599 g
 Alloy 825 600 grit polished
 start wt. 11.24164 g
 end wt. 11.24168 g
 immersed @ 1:1 ratio

Solution: 0.5M NaCl pH 3
 20 ppm SO₄²⁻ 10 ppm NO₃⁻ 2 ppm F⁻
 58.44278 g NaCl lot #960780
 6 drops conc HCl lot #967077
 40ml SO₄²⁻
 20ml NO₃⁻ } 9/97 } NB157 p.181
 4ml F⁻ }
 + DI water to 2000 mL
 start pH 3.128 end pH 4.887

T = 95°C Hg thermometer 183301
 aerated w/gew air

Ref. electrode: Fisher SCE #13-620-51 S/N 5087374
 E_{com} 825 ±69 mV +207 mV 10/21/97 WJ MacKowski
 E_{com} 516 -697 mV

Test started @ 3:15 PM 10/22/97

| pH | secs | date | |
|-------|--------|----------|---|
| 5.998 | 84920 | 10/23/97 | Test stopped 11/3/97 8:15 AM 825 no corrosion; repolished + used in other tests |
| 4.302 | 167920 | 10/24/97 | |
| 5.882 | 163890 | 10/27/97 | |
| 4.971 | 250250 | 10/28/97 | |
| 4.580 | 427520 | 10/30/97 | |
| 4.645 | 516040 | 10/31/97 | |

Walter J MacKowski
11/7/97

IMPEDANCE TESTS

OBJECTIVE SAME AS P 76

P-STAT 6686 MODEL 273 SN 41108

FRA SOLARTRON 1260 SN

SOFTWARE ~~EPLOT~~ ~~DD~~ 10/22/97 ~~EPLOT/EDIT~~
EPLOT AND EVIEW FOR WINDOWS

TEST SETUP PLACE SPECIMENS TOGETHER
AS DESCRIBED FOR EACH TEST
MEASURE IMPEDANCE USING 20000 TO 0.1 Hz
RANGE USING 10mV SIGNAL

PERFORM TESTS BOTH WITH AND WITHOUT
AREA CORRECTION

FRA SETUP 6 SECOND INTEGRATION TIME
2 SECOND DELAY

AFTER TESTS COMPLETE MEASURE RESISTANCE
WITH KEITHLEY 614 SN 555368

[Signature] 11/14/97

AS16T1.Z AS16T2.Z AS16T3.Z

SPECIMEN AS16 GRAB 60
BLUG MILL FINISHED SURFACES TOUCHING (DRY)
AREA = 7.83 cm²

AS16T1.Z EIS w/ 100 nA MIN CURRENT RANGE
SETTING AREA = 1

~~AS16T2.Z~~ ~~DD~~ 10/22/97

AS16T2.Z EIS w/ 100 μA MIN CURRENT RANGE
AREA = 1

AS16T3.Z EIS w/ 100 μA MIN CURRENT RANGE
AREA = 7.83 cm²

DC RESISTANCE (KEITHLEY 614) = 2.53 kΩ

AS16T11.Z EIS w/ 100 μA range
O-ring w/ 10 ppm Cl⁻
area = 1 cm²

AS16T12.Z EIS w/ 100 μA range
O-ring w/ 10 ppm Cl⁻
area = 2.32 cm²

Resistance = 8.05 kΩ

AS16T13.Z EIS w/ 100 μA range
O-ring w/ 1000 ppm Cl⁻
area = 1 cm²

AS16T14.Z EIS w/ 100 μA range
O-ring w/ 1000 ppm Cl⁻
area = 2.32 cm²

Resistance = 2.25 kΩ

[Signature] 11/14/97

A516T4.2

SPECIMEN A516 GRADE 60
 MILL SCALE RED-BROWN
 AREA = 7.83 cm²

A516T4.2 EIS w/ 100 μA CURRENT RANGE
 AREA = 1 cm²

A516T5.2 EIS w/ 100 μA CURRENT RANGE
 AREA = 7.83 cm²

RESISTANCE = 17.2 KΩ

A516T6.2 EIS w/ 100 μA RESISTOR
 AREA = 7.83 cm²

A516T7.2 EIS w/ 100 μA RANGE
 O-ring w/ 10 ppm Cl⁻
 area = 1 cm²

A516T8.2 EIS w/ 100 μA range
 O-ring w/ 10 ppm Cl⁻
 area = 2.32 cm²

Resistance = 16.32 KΩ

A516T9.2 EIS w/ 100 μA range
 O-ring w/ 1000 ppm Cl⁻
 area = 1 cm²

A516T10.2 EIS w/ 100 μA range
 O-ring w/ 1000 ppm Cl⁻
 area = 2.32 cm²

Resistance = 0.75 KΩ

Walter J. Macdonald
 11/14/97

SPECIMEN A516 gr. 60

oxidized @ 100°C for one week (p.75)
 area = 8.05 cm²

A516T15.2 EIS w/ 100 μA range
 bare dry surfaces touching
 area = 1 cm²

A516T16.2 EIS w/ 100 μA range
 bare dry surface touching
 area = 8.05 cm²

Resistance = ∅

A516T17.2 EIS w/ 100 μA range
 O-ring w/ 10 ppm Cl⁻
 area = 1 cm²

A516T18.2 EIS w/ 100 μA range
 O-ring w/ 10 ppm Cl⁻
 area = 2.32 cm²

Resistance = 7.35 KΩ

A516T19.2 EIS w/ 100 μA range
 O-ring w/ 1000 ppm Cl⁻
 area = 1 cm²

A516T20.2 EIS w/ 100 μA range
 O-ring w/ 1000 ppm Cl⁻
 area = 2.32 cm²

Resistance = 4.48 KΩ

Walter J. Macdonald
 11/14/97

SPECIMEN: A516 g1.60
oxidized @ 250°C for one week (p. 140)
area = 7.97 cm²

A516T21.Z EIS w/100 μA range
bare dry surfaces touching
area = 1 cm²

A516T22.Z EIS w/100 μA range
bare dry surfaces touching
area = 7.97 cm²

Resistance = 0.11 KΩ

A516T23.Z EIS w/100 μA range
O-ring w/10 ppm Cl⁻
area = 1 cm²

A516T24.Z EIS w/100 μA range
O-ring w/10 ppm Cl⁻
area = 2.32 cm²

Resistance = 9.18 KΩ ^{10/23/95} w J MacKorsh

A516T25.Z EIS w/100 μA range
O-ring w/1000 ppm Cl⁻
area = 1 cm²

A516T26.Z EIS w/100 μA range
O-ring w/1000 ppm Cl⁻
area = 2.32 cm²

Resistance = 6.55 KΩ

Walter J MacKorsh
11/14/97

SPECIMEN Alloy 825
oxidized @ 100°C for one week (p. 75)
area = 7.89 cm²

^{10/23/97}
w J MacKorsh 825T27, 825T1.Z EIS w/100 μA range
bare dry surfaces touching
area = 1 cm²

825T2.Z EIS w/100 μA range
bare dry surfaces touching
area = 7.89 cm²

Resistance = ∞

825T3.Z EIS w/100 μA range
O-ring w/10 ppm Cl⁻
area = 1 cm²

825T4.Z EIS w/100 μA range
O-ring w/10 ppm Cl⁻
area = 2.32 cm²

^{10/23/97}
Resistance = 17, 145.7 KΩ
w J MacKorsh

825T5.Z EIS w/100 μA range
O-ring w/1000 ppm Cl⁻
area = 1 cm²

825T6.Z EIS w/100 μA range
O-ring w/1000 ppm Cl⁻
area = 2.32 cm²

Resistance = 11.6 KΩ

Walter J MacKorsh
11/14/97

Specimen Alloy 825
oxidized @ 250°C for one week (p.140)
area = 7.89 cm²

825T 7.2 EIS w/100 μA range
dry bare surface together
area = 1 cm²

825T 8.2 EIS w/100 μA range
dry bare surface together
area = 7.89 cm²

Resistance = ∅

825T 9.2 EIS w/100 μA range
O-ring w/10 ppm Cl⁻
area = 1 cm²

825T 10.2 EIS w/100 μA range
O-ring w/10 ppm Cl⁻
area = 2.32 cm²

Resistance = 164.0 KΩ

825T 11.2 EIS w/100 μA range
O-ring w/1000 ppm Cl⁻
area = 1 cm²

825T 12.2 EIS w/100 μA range
O-ring w/1000 ppm Cl⁻
area = 2.32 cm²

Resistance = 156.7 KΩ

Walter J. Macomber
11/14/97

Specimen Alloy 825
polished specimen
area = 7.89 cm²

825T 13.2 EIS w/100 μA range
dry bare surface together
area = 1 cm²

825T 14.2 EIS w/100 μA range
dry bare surface together
area = 7.89 cm²

Resistance = ∅

825T 15.2 EIS w/100 μA range
O-ring w/10 ppm Cl⁻
area = 1 cm²

825T 16.2 EIS w/100 μA range
O-ring w/10 ppm Cl⁻
area = 2.32 cm²

Resistance = 140.0 KΩ

825T 17.2 EIS w/100 μA range
O-ring w/1000 ppm Cl⁻
area = 1 cm²

825T 18.2 EIS w/100 μA range
O-ring w/1000 ppm Cl⁻
area = 2.32 cm²

Resistance = 133.8 KΩ

Walter J. Macomber
11/14/97

Specimen A516 gr. 60
polished specimen
area = 7.91 cm²

A516T 27. Z EIS w/100 μA range
bare dry surface touching
area = 1 cm²

A516T 28. Z EIS w/100 μA range
bare dry surface touching
area = 7.91 cm²

Resistance = ∅

A516T 29. Z EIS w/100 μA range
O-ring w/10 ppm Cl⁻
area = 1 cm²

A516T 30. Z EIS w/100 μA range
O-ring w/10 ppm Cl⁻
area = 2.32 cm²

Resistance = 6.18 KΩ

A516T 31. Z EIS w/100 μA range
O-ring w/1000 ppm Cl⁻
area = 1 cm²

A516T 32. Z EIS w/100 μA range
O-ring w/1000 ppm Cl⁻
area = 2.32 cm²

Resistance = 5.03 KΩ

Walter J. Moehrhof
11/14/97

Specimen A516 gr. 60 polished
area = 7.91 cm²

γ-FeO(OH) J-M lot # I06810
10/14/97 w/ Moehrhof

A516T 33. Z EIS w/100 μA range
O-ring w/ γ-FeO(OH) dry
area = 1 cm²

A516T 34. Z EIS w/10 μA range
O-ring w/ γ-FeO(OH) dry
area = 2.32 cm²

Resistance = 16.36 MΩ

A516T 35. Z EIS w/100 μA range
O-ring w/ γ-FeO(OH) wetted w/10 ppm Cl⁻
area = 1 cm²

A516T 36. Z EIS w/100 μA range
O-ring w/ γ-FeO(OH) wetted w/10 ppm Cl⁻
area = 2.32 cm²

Resistance = 0.33 KΩ

A516T 37. Z EIS w/100 μA range
O-ring w/ γ-FeO(OH) wetted w/1000 ppm Cl⁻
area = 1 cm²

A516T 38. Z EIS w/100 μA range
O-ring w/ γ-FeO(OH) wetted w/1000 ppm Cl⁻
area = 2.32 cm²

Resistance = 0.58 KΩ

Walter J. Moehrhof
11/14/97

Specimen A516 gr. 60 polished
area = 7.91 cm²

Fe₃O₄ J-M lot # S93424AR

A516T39.Z EIS w/100 μA range
O-ring w/ Fe₃O₄, dry
area = 1 cm²

A516T40.Z EIS w/100 μA range
O-ring w/ Fe₃O₄, dry
area = 2.32 cm²

Resistance = 8.01 MΩ

A516T41.Z EIS w/100 μA range
O-ring w/ Fe₃O₄, wetted w/10 ppm Cl⁻
area = 1 cm²

A516T42.Z EIS w/100 μA range
O-ring w/ Fe₃O₄, wetted w/10 ppm Cl⁻
area = 2.32 cm²

Resistance = 0.52 KΩ

A516T43.Z EIS w/100 μA range
O-ring w/ Fe₃O₄, wetted w/1000 ppm Cl⁻
area = 1 cm²

A516T44.Z EIS w/100 μA range
O-ring w/ Fe₃O₄, wetted w/1000 ppm Cl⁻
area = 2.32 cm²

Resistance = 0.90 KΩ

Walter J MacLaurin
11/14/97

Specimen A516 gr. 60 polished
area = 7.91 cm²

Corrosion products from A516 specimen: CALV32 - CALV37

A516T45.Z EIS w/100 μA range
O-ring, dry corrosion products
area = 1 cm²

A516T46.Z EIS w/100 μA range
O-ring, dry corrosion products
area = 2.32 cm²

Resistance = 88.7 KΩ

A516T47.Z EIS w/100 μA range
O-ring, cor products wetted w/10 ppm Cl⁻
area = 1 cm²

A516T48.Z EIS w/100 μA range
O-ring, cor products wetted w/10 ppm Cl⁻
area = 2.32 cm²

Resistance = 0.54 KΩ

A516T49.Z EIS w/100 μA range
O-ring, cor products wetted w/1000 ppm Cl⁻
area = 1 cm²

A516T50.Z EIS w/100 μA range
O-ring, cor products wetted w/1000 ppm Cl⁻
area = 2.32 cm²

Resistance = 1.38 KΩ

Walter J MacLaurin
11/14/97

Specimen: A516 gr. 60 polished
area = 7.91 cm²

FeCl₂ · 4H₂O Fisher lot # 944192

A516T51.2 EIS w/100 μA range
O-ring, dry FeCl₂ · 4H₂O
area = 1 cm²

A516T52.2 EIS w/100 μA range
O-ring, dry FeCl₂ · 4H₂O
area = 2.32 cm²

Resistance = 2.41 KΩ

A516T53.2 EIS w/100 μA range
O-ring, FeCl₂ · 4H₂O wetted w/10 ppm Cl⁻
area = 1 cm²

A516T54.2 EIS w/100 μA range
O-ring, FeCl₂ · 4H₂O, wetted w/10 ppm Cl⁻
area = 2.32 cm²

Resistance = 0.09 KΩ

A516T55.2 EIS w/100 μA range
O-ring, FeCl₂ · 4H₂O wetted w/1000 ppm Cl⁻
area = 1 cm²

A516T56.2 EIS w/100 μA range
O-ring, FeCl₂ · 4H₂O wetted w/1000 ppm Cl⁻
area = 2.32 cm²

Resistance = 0.07 KΩ

Walter J Macfowen
11/14/97

Specimen: A516 gr. 60 polished
area = 7.91 cm²

1000 ppm Cl pH 10.92

A516T57.2 EIS w/100 μA range
O-ring, 1000 ppm Cl @ pH 10
area = 1 cm²

A516T58.2 EIS w/100 μA range
O-ring, 1000 ppm Cl @ pH 10
area = 2.32 cm²

Resistance = 6.41 KΩ

1000 ppm Cl pH 7.96

A516T59.2 EIS w/100 μA range
O-ring, 1000 ppm Cl @ pH 8
area = 1 cm²

A516T60.2 EIS w/100 μA range
O-ring, 1000 ppm Cl @ pH 8
area = 2.32 cm²

Resistance = 3.21 KΩ

1000 ppm Cl pH 2.93

A516T61.2 EIS w/100 μA range
O-ring, 1000 ppm Cl @ pH 3
area = 1 cm²

A516T62.2 EIS w/100 μA range
O-ring, 1000 ppm Cl @ pH 3
area = 2.32 cm²

Resistance = 3.52 KΩ

Walter J Macfowen
11/14/97

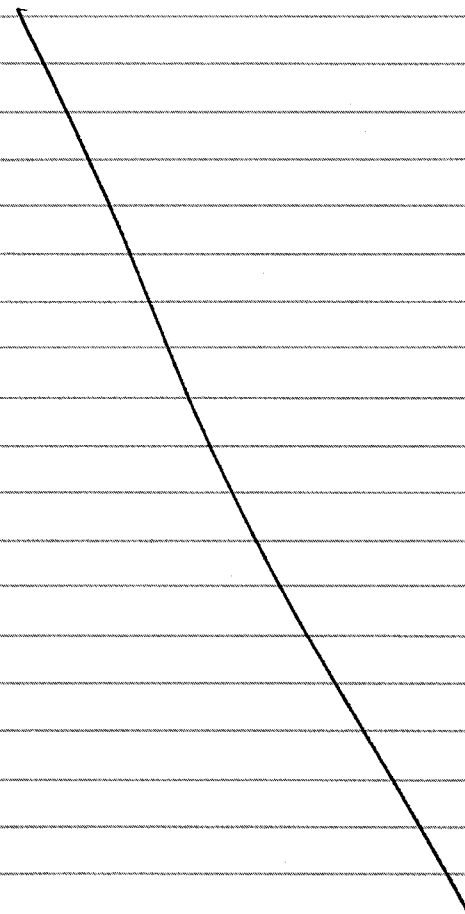
Oxidation of A516 Specimens

A516 in Fisher Isotemp Oven Model 838F
@ 100°C @ 9AM 10/30/97

A516 in Lindberg Oven Model
@ 250°C @ 9am 10/30/97

A516 in Lindberg furnace Model 51333
@ 350°C @ 9AM 10/30/97

all specimen removed @ 10AM 11/4/97



Walter J. Machowski
11/4/97

CAV 44. DAT (ch #1)

Specimen: A516 gr. 60 oxidized @ 100°C (p. 202)

start wt. 11.00951 g.

end wt. 10.58129 g

Alloy 825 600 grit polished

start wt. 11.18060 g

end wt. 11.18160 g

immersed @ 1:1 ratio

Solution: 1000 ppm Cl⁻ pH 3

20 ppm SO₄²⁻ 10 ppm NO₃⁻ 2 ppm F⁻

3.29600 g NaCl lot # 960780

6 drops conc HCl lot # 967077

40 ml SO₄²⁻

20 ml NO₃⁻

4 ml F⁻

+ DI water to 2000 ml

start pH 3.114

end pH 5.743

T = 95°C

Hg thermometer 183301

aerated w/ geo air

Ref. electrode: Fisher SCE #13-520-51 S/N 3106339

E_{corr} 825 +55 mV

E_{corr} 516 -653 mV

Test started 1:10PM 11/4/97

pH see date

4.169 87480 11/5/97

4.214 171570 11/6/97

5.486 518150 11/10/97 note: salt bridge solⁿ before electrode

Test stopped 9AM 11/12/97

825 no corrosion - repolished & used in later tests

Walter J. Machowski
11/20/97

CAV 45. DAT (ch #2)

Specimen: A516 gr. 60 oxidized @ 250°C (p. 202)
 start wt. 10.93818 g
 end wt. 10.48439 g
 Alloy 825 600 grit polished
 start wt. 10.99693 g
 end wt. 10.99673 g
 immersed @ 1:1 ratio

Solution: 1000 ppm Cl⁻ pH 3
 20 ppm SO₄²⁻ 10 ppm NO₃⁻ 2 ppm F⁻
 3.29571 g NaCl lot # 960780
 7 drops conc HCl lot # 967077
 40 ml SO₄²⁻
 20 ml NO₃⁻ } 10/97 } NB 157 p. 182
 4 ml F⁻ }
 + DI water to 2000 mL
 start pH 3.090 end pH 3.969

T = 95°C Hg thermometer 183301

aerated w/ yew air

Ref. electrode: Fisher #13-620-51 S/N 9214080

E_{cm} 825 -323 mV

E_{cm} 516 -660 mV

Test started 1:10 PM 11/4/97

| pH | sec | date |
|-------|--------|----------|
| 4.168 | 87530 | 11/5/97 |
| 4.237 | 171750 | 11/6/97 |
| 4.232 | 518280 | 11/10/97 |

Test stopped 9 AM 11/12/97

825 no corrosion; repolished & used in other tests

Walter J. Macintosh
 11/20/97

CAV 46. DAT (ch #3)

Specimen: A516 gr. 60 oxidized @ 350°C (p. 202)
 start wt. 10.90146 g
 end wt. 10.42413 g
 Alloy 825 600 grit polished
 start wt. 11.23813 g
 end wt. 11.23776 g
 immersed @ 1:1 ratio

Solution: 1000 ppm Cl⁻ pH 3
 20 ppm SO₄²⁻ 10 ppm NO₃⁻ 2 ppm F⁻
 3.29538 g NaCl lot # 960780
 6 drops conc HCl lot # 967077
 40 ml SO₄²⁻
 20 ml NO₃⁻ } 10/97 } NB 157 p. 182
 4 ml F⁻ }
 + DI water to 2000 mL
 start pH 3.075 end pH 3.864

T = 95°C Hg thermometer 183301

aerated w/ yew air

Ref. electrode: Fisher #13-620-51 S/N 5087374

E_{cm} 825 +21 mV

E_{cm} 516 -684 mV

Test started 1:10 PM 11/4/97

| pH | sec | date |
|-------|--------|----------|
| 4.098 | 87850 | 11/5/97 |
| 4.059 | 171880 | 11/6/97 |
| 3.838 | 518420 | 11/10/97 |

Test stopped 9 AM 11/12/97

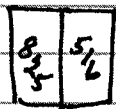
825 no corrosion; repolished & used in other tests

Walter J. Macintosh
 11/20/97

RAV 47, DAT (ch #1)

Specimen: A516 gr. 60 red-oxide face, mill scale
 start wt. 69.81642 g
 end wt. 69.75124 g
 Alloy 825 sl. 600 grit polished + passivated
 start wt. 73.36312 g
 end wt. 73.36561 g

Specimen Configuration: tight face to face



Solution: 1000 ppm Cl⁻ 0.01 M Na₂CO₃
 20 ppm SO₄²⁻ 10 ppm NO₃⁻ 2 ppm F⁻
 3.29587 g NaCl lot # 960780
 2.11752 g Na₂CO₃ lot # 960685
 40 ml SO₄²⁻
 20 ml NO₃⁻
 4 ml F⁻ } 10/97 } stock sol'n NB 159 p. 182
 + DI water to 2000 mL

start pH 10.929 end pH 10.094

T = 95°C Hg thermometer 183301 aerated w/ gear air

Ref electrode: Fisher SCE #13-620-51 S/N 5087374

Test started 2 PM 11/14/97

E_{cm} 516 -569 mV

E_{cm} 825 -549 mV

Test stopped 9:30 AM 11/24/97

825 repolished + reused

Walter J. Macbrink
11/26/97

RAV 48, DAT (ch #2)

Specimen: A516 gr. 60 600 grit polished
 start wt. forget to weigh
 end wt. 68.53506 g
 Alloy 825 600 grit polished + passivated
 start wt. 72.17718 g
 end wt. 72.17860 g

Specimen Configuration: tight face to face



Solution: 1000 ppm Cl⁻ 0.01 M Na₂CO₃
 20 ppm SO₄²⁻ 10 ppm NO₃⁻ 2 ppm F⁻
 3.29927 g NaCl lot # 960780
 2.12433 g Na₂CO₃ lot # 960685
 40 ml SO₄²⁻
 20 ml NO₃⁻
 4 ml F⁻ } 10/97 } stock sol'n NB 159 p. 182
 + DI water to 2000 mL

start pH 10.929 end pH 9.991

T = 95°C Hg Thermometer 183301 aerated w/ gear air

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

Test started 2 PM 11/14/97

E_{cm} 516 -583 mV

E_{cm} 825 -583 mV

Test stopped 9:30 AM 11/24/97


825 repolished + reused

Walter J. Macbrink
11/26/97

PAU 49, DAT (ch #3)

mill scale, red oxide
↑ 11/14/97 WJ Macburch

Specimen: A516 g. 60 ~~to 250°C oxidized~~
start wt. 69.04504 g
end wt. 68.92238 g
Alloy 825 600 grit polished; 250°C oxidized*
start wt. 73.76136 g
end wt. 73.76734 g

Specimen Configuration:  tight face to face

Solution: 1000 ppm Cl⁻ 0.01M Na₂CO₃
20 ppm SO₄²⁻ 10 ppm NO₃⁻ 2 ppm F⁻
3.29706 g NaCl lot # 960780
2.12083 g Na₂CO₃ lot # 960685
40 ml SO₄²⁻
20 ml NO₃⁻
4 ml F⁻
+ DI water to 2000 mL
} 10/97 } stock sol'n no NB 157 p. 182

start pH 10.939 end pH 9.925

T = 95°C H₂ thermometer 183301
aerated w/ zero air

Ref electrode: Fisher SCE #13-620-51 S/N 5087405

Test started 2PM 11/14/97

E_{cm} 516 -599 mV

E_{cm} 825 -574 mV

* in @ 2PM 11/4/97 @ 250°C out @ 10AM 11/10/97


Test stopped 9:30AM 11/24/97

825 repolished & reused

Walter J Macburch
11/26/97

PAU 50, DAT (ch #4)

Specimen: A516 g. 60 mill scale, red-oxide
start wt. 69.62204 g
end wt. 68.88040 g
Alloy 825 600 grit polished + passivated
start wt. 74.91334 g
end wt. 74.88093 g

Specimen Configuration:  tight face to face

Solution: 1000 ppm Cl⁻ pH 3
20 ppm SO₄²⁻ 10 ppm NO₃⁻ 2 ppm F⁻
3.26084 g NaCl lot # 960780
4 drops conc HCl lot #
40 ml SO₄²⁻
20 ml NO₃⁻
4 ml F⁻
+ DI water to 2000 mL
} 10/97 } stock sol'n no NB 157 p. 182

start pH 2.954 end pH 3.844

T = 95°C H₂ thermometer 183301
aerated w/ zero air

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

Test started 2PM 11/14/97

E_{cm} 516 -670 mV

E_{cm} 825 -470 mV


Test stopped 9:30AM 11/24/97

825 repolished & reused

Walter J Macburch
11/26/97

GALV 51. DAT (ch #5)

Specimen: A516 gr. 60 600 grit polished
 start wt. 68.44710 g
 end wt. 68.36102 g
 Alloy 825 600 grit polished + passivated
 start wt. 74.74860 g
 end wt. 74.73804 g

Specimen configuration:  O-rings w/ corrosion products wet w/ 1000 ppm Cl sol'n

Solution: 1000 ppm Cl⁻ 10/12/97 w/ Macbush
 20 ppm SO₄²⁻ 10 ppm NO₃⁻ 2 ppm F⁻ pH 3 0.01 M Na₂CO₃
 3.29567 g NaCl lot # 960780
 2.11214 g Na₂CO₃ lot # 960685
 40 ml SO₄²⁻
 20 ml NO₃⁻ } 10/97 } stock sol'n NB 157 p. 182
 4 ml F⁻
 + DJF water to 2000 mL
 start pH 10.990 end pH 10.012

T = 95°C H₂ thermometer 183301
 aerated w/ gear air

Ref. electrode: Fisher SCE #13-620-51 S/N 9214080

Test started 2PM 11/14/97

E_{cor} 516 -583 mV


E_{cor} 825 -555 mV

small amount of "bridging" > 5% of O-rings area
 Test stopped 9:30 AM 11/24/97
 825 repolished + reused

Walter J Macbush
 11/26/97

GALV 52. DAT (ch #6)

Specimen: A516 gr. 60 mill scale, redoxide
 start wt. 69.53232 g
 end wt. 69.40812 g
 Alloy 825 600 grit polished + passivated
 start wt. 74.94666 g
 end wt. 74.94216 g

Spec. configuration:  O-rings w/ corrosion products wet w/ 1000 ppm Cl solution

Solution: 1000 ppm Cl⁻ 0.01 M Na₂CO₃
 20 ppm SO₄²⁻ 10 ppm NO₃⁻ 2 ppm F⁻
 3.29238 g NaCl lot # 960780
 2.11430 g Na₂CO₃ lot # 960685
 40 ml SO₄²⁻
 20 ml NO₃⁻ } 10/97 } stock sol'n NB 157 p. 182
 4 ml F⁻
 + DJF water to 2000 mL
 start pH 10.939 end pH 10.082

T = 95°C H₂ thermometer 183301
 aerated w/ gear air

Ref. electrode: Fisher SCE #13-620-51 S/N 7079122

Test started 2PM 11/14/97

E_{cor} 516 -578 mV

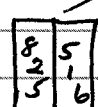
E_{cor} 825 -430 mV

small amount of "bridging" at bottom
 Test stopped 9:30 AM 11/24/97
 825 repolished + reused

Walter J Macbush
 11/26/97

CALV 53. DAT (ch #1)

Specimen: A516 gr. 60 mill scale
 start wt. 69.79066 g
 end wt. 69.56084 g
 Alloy 825 250°C oxidized
 start wt. 24.50140 g
 end wt. 24.50146 g

Spec. Configuration:  tight face to face

Solution: 1000 ppm Cl⁻ pH 3
 20 ppm SO₄²⁻ 10 ppm NO₃⁻ 2 ppm F⁻
 3.29652 g NaCl lot # 960780
 8 drops conc HCl lot # 967077
 40 ml SO₄²⁻
 20 ml NO₃⁻
 4 ml F⁻ } 12/97 } stock sol'n NB 086 p. 218
 + DI water to 2000 mL
 start pH 3.159 end pH 5.413

T = 95°C Hg thermometer 183301
 aerated w/ gear air

Ref. electrode: Fisher SCE #13620-51 S/N 7029122

E_{com 516} -617 mV

E_{com 825} -427 mV


Test started @ 11:30 AM 12/4/97
 Test stopped @ 9 AM 12/12/97

825 repolished & reused

Walter J. Marchewski
 12/19/97

CALV 54. DAT (ch #2)

Specimen: A516 gr. 60 mill scale
 start wt. 69.68508 g
 end wt. 69.34552 g
 Alloy 825 600 grit polished; 250°C oxidized
 start wt. 24.72558 g
 end wt. 24.72494 g

Spec. Configuration:  O-ring w/ conc products
 wetted w/ 1000 ppm Cl⁻

Solution: 1000 ppm Cl⁻ pH 3
 20 ppm SO₄²⁻ 10 ppm NO₃⁻ 2 ppm F⁻
 3.29357 g NaCl lot # 960780
 9 drops conc HCl lot # 967077
 40 ml SO₄²⁻
 20 ml NO₃⁻
 4 ml F⁻ } 12/97 } stock sol'n NB 086 p. 218
 + DI water to 2000 mL
 start pH 3.152 end pH 5.223

T = 95°C Hg thermometer 183301
 aerated w/ gear air

Ref. electrode: Fisher SCE #13620-51 S/N 5144349

E_{com 516} -618 mV

E_{com 825} -461 mV

Test started @ 11:30 AM 12/4/97
 Test stopped @ 9 AM 12/12/97

825 repolished & reused

Walter J. Marchewski
 12/19/97

PALV55.DAT (ch#3)

Specimen: A516 gr. 60 mill scale
 start wt. 69.46838 g
 end wt. 69.16762 g
 Alloy 825 600 grit polished; 250°C oxidized
 start wt. 72.04098 g
 end wt. 72.04384 g

Spec. Configuration:  O-ring w/ Fe_3O_4
 wetted w/ 1000 ppm Cl^-

Solution: 1000 ppm Cl^- pH 3
 20 ppm SO_4^{2-} 10 ppm NO_3^- 2 ppm F^-
 3.29590 g NaCl lot # 960780
 9 drops conc HCl lot # 967077
 40 ml SO_4^{2-}
 20 ml NO_3^-
 4 ml F^- } 12/97 } stock sol'n NB086 p. 218
 + DI water to 2000 mL
 start pH 3.176 end pH 4.993

$T = 95^\circ\text{C}$ Hg thermometer 183301
 aerated w/ gear air

Ref. electrode: Fisher SCE #13-620-51 S/N 9214080

$E_{\text{cm 516}} = -612 \text{ mV}$

$E_{\text{cm 825}} = -424 \text{ mV}$

Test started @ 11:30 AM 12/4/97
 Test stopped @ 9 AM 12/12/97
 825 repolished + reused

Walter J. MacKowski
 12/19/97

PALV56.DAT (ch#4)

Specimen: A516 gr. 60 mill scale
 start wt. 69.39050 g
 end wt. 62.76332 g
 Alloy 825 600 grit polished; 250°C oxidized
 start wt. 73.21204 g
 end wt. 74.71728 g

Spec. Configuration:  O-ring w/ $\alpha\text{-Fe}_2\text{O}_3$
 wetted w/ 1000 ppm Cl^-

Solution: 1000 ppm Cl^- pH 3
 20 ppm SO_4^{2-} 10 ppm NO_3^- 2 ppm F^-
 3.29804 g NaCl lot # 960780
 9 drops conc HCl lot # 967077
 40 ml SO_4^{2-}
 20 ml NO_3^-
 4 ml F^- } 12/97 } stock sol'n NB086 p. 218
 + DI water to 2000 mL
 start pH 3.158 end pH 5.197

$T = 95^\circ\text{C}$ Hg thermometer 183301
 aerated w/ gear air

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

$E_{\text{cm 516}} = -617 \text{ mV}$

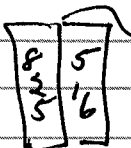
$E_{\text{cm 825}} = -454 \text{ mV}$

Test started @ 11:30 AM 12/4/97
 Test stopped @ 9 AM 12/12/97
 825 repolished + reused

Walter J. MacKowski
 12/19/97

GALV 57. DAT (ch #5)

specimen: A516 gr. 60 600 grit polished
 start wt. 67.97308 g
 end wt. 69.23554 g
 Alloy 825 600 grit polished + passivated
 start wt. 74.74240 g
 end wt. ^{73.21241} 74.74240 g 12/4/97 WJ Machowski

Spec. Configuration:  tight face to face

Solution: 1000 ppm Cl^- pH 3
 20 ppm SO_4^{2-} 10 ppm NO_3^- 2 ppm F^-
 3.29603g NaCl lot # 960780
 10 drops conc HCl lot # 967077
 40 ml SO_4^{2-}
 20 ml NO_3^-
 4 ml F^-
 } 12/97 } stock sol'n NB086 p. 218
 + DI water to 2000 mL
 start pH 3.118 end pH 4.857

T = 95°C Hg thermometer 183301
 aerated w/ zero air

Ref. electrode: Fisher SCE #13-620-51 S/N 5087374

E_{an} 516 -597 mV

E_{an} 825 -595 mV

Test started @ 11:30 AM 12/4/97
 Test stopped @ 9 AM 12/12/97
 825 repolished and reused

Walter J Machowski
 12/19/97

GALV 58. DAT (ch #6)

specimen: A516 gr. 60 600 grit polished
 start wt. 68.27612 g
 end wt. 67.89220 g
 Alloy 825 600 grit polished + passivated
 start wt. 73.51748 g
 end wt. 73.51554 g

Spec. Configuration:  tight face to face

Solution: 1000 ppm Cl^- 85 ppm HCO_3^-
 20 ppm SO_4^{2-} 10 ppm NO_3^- 2 ppm F^-
 3.29262g NaCl lot # 960780
 0.23419g $NaHCO_3$ lot # 897789
 + DI
 40 ml SO_4^{2-}
 20 ml NO_3^-
 4 ml F^-
 } 12/97 } stock sol'n NB086 p. 218
 + DI water to 2000 mL
 start pH 8.433 end pH 9.149

T = 95°C Hg thermometer 183301
 aerated w/ zero air

Ref. electrode: Fisher SCE #13-620-51 S/N 5087405

E_{an} 516 -625 mV

E_{an} 825 -625 mV

Test started @ 11:30 AM 12/4/97
 Test stopped @ 9 AM 12/12/97
 516 had lots of black "crust" on it
 825 repolished and reused

Walter J Machowski
 12/19/97

GAM

Stock Solutions

SO_4^{2-} 12/97
1000 ppm SO_4^{2-} as Na_2SO_4

1.47496 g Na_2SO_4 # 901213
+ DI water to 1000 mL
prep 12/2/97 exp 1/2/98

NO_3^- 12/97
1000 ppm NO_3^- as Na_2NO_3

1.37206 g Na_2NO_3 # 961222A
+ DI water to 1000 mL
prep 12/2/97 exp 1/2/98

F^- 12/97
1000 ppm F^- as NaF
2.22006 g NaF # 896405
+ DI water to 1000 mL
prep 12/2/97 exp 1/2/98

Walter J Macchiarri
12/2/97

Oxidation of Alloy 825

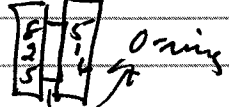
Four specimens were placed in oven
at 250°C on 11/25/97 and removed at 3:30 PM
@ 9:10 AM

on 12/2/97. Oven was the Lindberg
Model 57823.

Walter J Macchiarri
12/3/97

CALV 59.DAT

Specimen: A516 gr. 60 mill scale
 start wt. 69.66170
 end wt. 69.38984
 Alloy 825 600 grit polished
 start wt. 74.21856
 end wt. 74.24180

Spec. config:  O-rings of corrosion products

Solution: 1000 ppm Cl⁻ pH 3
 20 ppm SO₄⁻ 10 ppm NO₃⁻ 2 ppm F⁻
 3.29964 g NaCl lot # 960780
 7 drops HCl (conc) lot # 967077
 40 ml SO₄⁻
 20 ml NO₃⁻ } 12/97 } Stock solution NB 086 p. 218
 4 ml F⁻ }
 + DI water to 2000 mL

start pH 3.046 end pH 4.080
 T = 95°C Hg thermometer #183304

aerated w/ger air

Ref. electrode: Fisher #13650-51 SCE S/N 7079122

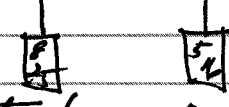
DC resistance

| | | | |
|------------|---------|---------|--------------------------|
| 0 sec | 0.308 Ω | 923,780 | 7.8 KΩ |
| 60,530 sec | 7.5 KΩ | 1184470 | 37.3 KΩ |
| 89,360 " | 6.2 KΩ | 1212440 | 7.5 KΩ |
| 146,250 " | 10.2 KΩ | 1271370 | 6.1 KΩ |
| 174,870 " | 10.1 KΩ | | |
| 233,000 | 10.8 KΩ | | 825 respolished & reused |
| 262,400 | 10.1 KΩ | | |
| 320,100 | 60.0 KΩ | 9.5 KΩ | → different meters |
| 578,890 | 9.9 KΩ | | |
| 607,700 | 10.0 KΩ | | |
| 664,650 | 9.8 KΩ | | |
| 694,100 | 9.8 KΩ | | |

Test stopped 9am 1/20/98
 Walter J. Macdonald
 1/20/98

CALV 60.DAT

Specimen: A516 gr. 60 mill scale
 start wt. 69.73016 g
 end wt. 69.42756
 Alloy 825 600 grit polished
 start wt. 74.51068
 end wt. 74.52164

Spec config:  separated ~ 2 inches

Solution: 1000 ppm Cl⁻ pH 3
 20 ppm SO₄⁻ 10 ppm NO₃⁻ 2 ppm F⁻
 3.30212 g NaCl lot # 960780
 6 drops HCl (conc) lot # 967077
 40 ml SO₄⁻
 20 ml NO₃⁻ } 12/97 } Stock sol'n NB 086 p. 218
 4 ml F⁻ }
 + DI water to 2000 mL

start pH 3.042 end pH 4.188
 T = 95°C Hg thermometer #183304

aerated w/ger air

Ref. electrode: SCE Fisher #13650-51 S/N 5087405

DC resistance

| | | | |
|------------|---------|---------|--------------------------------|
| 0 sec | 0.4 Ω | 693,400 | 7.9 KΩ |
| 61,370 sec | 7.4 KΩ | 923,250 | 8.3 KΩ |
| 89,790 " | 7.8 KΩ | 1184060 | 7.9 KΩ |
| 146,850 " | 7.6 KΩ | 1211820 | 7.8 KΩ |
| 175,300 | 7.7 KΩ | 1270180 | 7.9 KΩ |
| 233,600 | 0.62 Ω | | |
| 262,760 | 0.66 Ω | 7.9 KΩ | Walter J. Macdonald 1/20/98 |
| 320,680 | 69.7 KΩ | 7.9 KΩ | → different meters |
| 578,270 | 8.1 KΩ | | |
| 606,970 | 8.1 KΩ | | |
| 664,020 | 8.1 KΩ | | |

* note discharge CALV 60 → used among reference E

test stopped 9am 1/20/98
 Walter J. Macdonald
 1/20/98

Stock Solutions

SO₄²⁻ 1/98
 1000 ppm SO₄²⁻ as Na₂SO₄
 1.47909 g Na₂SO₄ lot # 901213
 + DI water to 1000 mL
 prep 1/19/98 exp 2/19/98

NO₃⁻ 1/98
 1000 ppm NO₃⁻ as NaNO₃
 1.38002 g NaNO₃ lot # 961722A
 + DI water to 1000 mL
 prep 1/19/98 exp 2/19/98

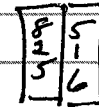
F⁻ 1/98
 1000 ppm F⁻ as NaF
 2.22171 g NaF lot # 896405
 + DI water to 1000 mL
 prep 1/19/98 exp 2/19/98

Walter J. Machrowski
 1/19/98

CAUV 61. DAT

Specimens: A516 g. 60 mill scale
 start wt. 69.71872 g
 end wt. 68.23838 g
 Alloy 825 600 grit polished + passivated
 start wt. 73.27726 g
 end wt. 73.27726 g

Spec. config

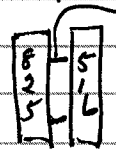


Solution: 1000 ppm Cl⁻ pH 3
 20 ppm SO₄²⁻ 10 ppm NO₃⁻ 2 ppm F⁻
 3.29758 g NaCl lot # 960780
 4 drops conc HCl lot # 967077
 40 ml SO₄²⁻
 20 ml NO₃⁻ } 1/98 } Stock sol's NB 086 g. 222
 4 ml F⁻ }
 + DI water to 2000 mL
 start pH 3.039 end pH 4.389
 T = 95°C Hg thermomete #183304
 aerated w/ gen air
 ref. electrode: Fisher SCE #13-630-51 S/N 7079122

| res | Ω | 1036900 | 2/11/98 w/2 machrowski |
|---------|---------|--------------------|---------------------------|
| 560 | 1.22 KΩ | 705,690 | 0.03 KΩ |
| 12150 | 1.25 KΩ | 1428700 | 0.03 KΩ |
| 25420 | .35 KΩ | 1516900 | 0.03 KΩ |
| 85,670 | .12 KΩ | 1639620 | 0.03 KΩ |
| 113,570 | .12 KΩ | 1729100 | 0.03 KΩ |
| 171,460 | .11 KΩ | | |
| 432,180 | .08 KΩ | | 825 repolished + reused |
| 459,050 | .07 KΩ | | |
| 518,900 | .08 KΩ | | |
| 603,750 | .08 KΩ | | |
| 690,080 | .07 KΩ | | |
| 777,192 | .07 KΩ | | |

Test stopped 9 AM 2/10/98
 Walter J. Machrowski 2/10/98

GALV 62. DAT

Specimen: #516 gr. 60 mill scale
 start wt. 69.1326g
 end wt. 68.43914g
 Alloy 825 600 grit polished + passivated
 start wt. 73.02024
 end wt. 73.01962
 spec. config.  milled w/ Fe_3O_4
 milled w/ 1000 ppm Cl^-

Solution: 1000 ppm Cl^- pH 3
 20 ppm SO_4^{2-} 10 ppm NO_3^- 2 ppm F^-
 3.29151 g NaCl lot # 960780
 4 drops conc HCl lot # 967077
 40 ml SO_4^{2-}
 20 ml NO_3^-
 4 ml F^- } 4/98 } stock sol'n NB086 p. 222
 + DI water to 2000 mL
 start pH 3.029 end pH 4.608
 T = 95°C Hg thermometer # 183304
 aerated w/ new air

ref. electrode: Fisher SCE #13-620-51 S/N 5087405

| | | | |
|---------|----------------|--------------------------------|----------------|
| 820 | 8.8 K Ω | 1121520 | 9.2 K Ω |
| 12020 | 9.7 K Ω | 1429200 | 9.0 K Ω |
| 25200 | 9.8 K Ω | 1516900 | 9.1 K Ω |
| 85,470 | 9.3 K Ω | 1638330 | 8.9 K Ω |
| 113,280 | 9.6 K Ω | 1728150 | 9.0 K Ω |
| 171,160 | 9.8 K Ω | | |
| 431,120 | 9.5 K Ω | 825 spec. repolished and dried | |
| 458,475 | 9.4 K Ω | | |
| 578,525 | 9.4 K Ω | | |
| 603,350 | 9.3 K Ω | Test Stopped 9 AM 2/10/98 | |
| 689,600 | 9.3 K Ω | | |
| 776,780 | 9.4 K Ω | | |
| 1036570 | 9.3 K Ω | Walter J. MacKowski 2/10/98 | |

Stock Solutions

SO_4^{2-} 4/98
 1000 ppm SO_4^{2-} as Na_2SO_4
 1.47943 g Na_2SO_4 lot # 901213
 + DI water to 1000 mL
 prep 4/7/98 exp 5/7/98

NO_3^- 4/98
 1000 ppm NO_3^- as $NaNO_3$
 1.37797 g $NaNO_3$ # 961772A
 + DI water to 1000 mL
 prep 4/7/98 exp 5/7/98

F^- 4/98
 1000 ppm F^- as NaF
 2.20933 g NaF # 896405
 + DI water to 1000 mL
 prep 4/7/98 exp 5/7/98

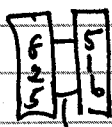
Walter J. MacKowski
4/7/98

CAKU 63.DAT

Specimen: A516 gr. 60 mill scale
 start wt. 69.20652 g
 end wt. 67.16320 g
 Alloy 825 600 grit polished + passivated
 start wt. ~~74.350~~ 74.36228 g
 end wt. 74.32933 g

as received
4/2/98

spec. config



0-rins

w/FeCl₃ wetted w/
test solution

Solution: 1000 ppm Cl⁻ pH 3
 20 ppm SO₄²⁻ 10 ppm NO₃⁻ 2 ppm F⁻
 3.30071 g NaCl lot # 972274
 6 drops conc HCl lot # 967077
 40 ml SO₄²⁻ }
 20 ml NO₃⁻ } 5/98 } stock sol'n NB 086
 4 ml F⁻ } p. 225

+ DI water to 2000 mL

start pH 3.038 end pH 3.582

T = 95°C

H₂ thermometer #

aerated w/zero air

ref. electrode: Fisher SCE # 13-620-51 S/N 5087405

Test Stopped 1:52 PM 4/29/98

825 specimen repolished and reused

Walter J Machowski
4/30/98

CAKU 64.DAT

Specimen: A516 gr. 60 mill scale
 start wt. 69.47910 g
 end wt. 68.20528 g
 Alloy 825 600 grit polished + passivated
 start wt. 73.99784 g
 end wt. 73.94078 g

spec. config



Solution: 1000 ppm Cl⁻ pH 3
 20 ppm SO₄²⁻ 10 ppm NO₃⁻ 2 ppm F⁻
 6 drops HCl lot # 967077
 3.29590 g NaCl lot # 972274
 40 ml SO₄²⁻ }
 20 ml NO₃⁻ } 5/98 } stock sol'n NB 086 p. 225
 4 ml F⁻ }

+ DI water to 2000 mL

start pH 3.060 end pH 4.305

T = 95°C

aerated w/zero air

ref. electrode Fisher SCE # 13-620-51 S/N 5087405

Start 3 PM 4/30/98

Stopped 9 AM 5/18/98

825 repolished and reused

Walter J Machowski
5/20/98

Stock Solutions

SO₄⁻ 6/98
 1000 ppm SO₄⁻ as Na₂SO₄
 1.47989 g Na₂SO₄ lot # 901213
 + DI water to 1L
 prep 5/18/98 exp 6/18/98

NO₃⁻ 6/98
 1000 ppm NO₃⁻ as NaNO₃
 1.37308 g NaNO₃ lot # 961772A
 + DI water to 1L
 prep 5/18/98 exp 6/18/98

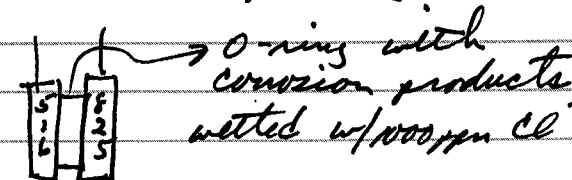
F⁻ 6/98
 1000 ppm F⁻ as NaF
 2.20605 g NaF lot # 896405
 + DI water to 1L
 prep 5/18/98 exp 6/18/98

Walter J Machowski
 5/20/98

CAV65. DAT

Specimen: A516 gr. 60 mill scale
 start wt 69.39170 g
 end wt.
 Alloy 825 600 grit polished + passivated
 start wt. 71.90102 g
 end wt. 71.90006 g

Spec. config:



Solution: 1000 ppm Cl⁻ pH 3
 20 ppm SO₄⁻ 10 ppm NO₃⁻ 2 ppm F⁻
 3.29262 g NaCl lot # 972274
 5 drops conc HCl lot # 967077
 40 ml SO₄⁻
 20 ml NO₃⁻
 4 ml F⁻ } 6/98 } stock sol'n NB086 p 228

+ DI water to 2000 mL
 start pH 3.068 end pH 4.085
 T = 95°C aerated w/ gear air
 reflec: Fuhr SCE 13-620-51 S/N 3106339

Start 10AM 5/19/98 Stop 6/3/98

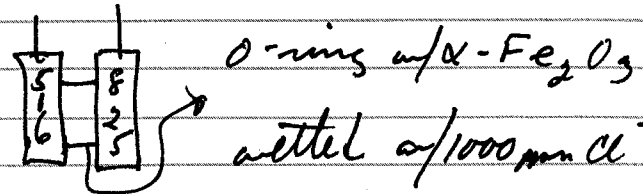
825 repolished and reused

Walter J Machowski
 6/3/98

GALV 66.DAT

Specimen: A516 gr. 60 mill scale
 start wt. 68.88420 g
 end wt.
 Alloy 825 600 grit polished + passivated
 start wt. 72.60230 g
 end wt. 72.58158 g

Spec config



Solution: 1000 ppm Cl⁻ pH 3
 20 ppm SO₄²⁻ 10 ppm NO₃⁻ 2 ppm F⁻
 3.29804 g NaCl lot # 972274
 6 drops conc HCl lot # 967077
 40 ml SO₄²⁻
 20 ml NO₃⁻
 4 ml F⁻

+ DI water to 2000 mL
 start pH 3.002 end pH 5.332
 T = 95°C aerated w/ gen air
 ref. elec. Fisher SCE 13-620-51 S/N 5087405

Start 10 AM 5/19/98 Stop 6/3/98

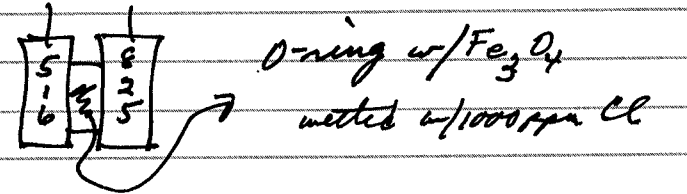
825 repolished + reused

Walter J Machowski
6/3/98

GALV 67.DAT

Specimen: A516 gr. 60 mill scale
 start wt. 69.35094
 end wt.
 Alloy 825 600 grit polished + passivated
 start wt. 72.32764 g
 end wt.

Spec. config



Solution: 1000 ppm Cl⁻ pH 3
 20 ppm SO₄²⁻ 10 ppm NO₃⁻ 2 ppm F⁻
 3.29918 g NaCl # 972274
 5 drops conc HCl # 967077
 40 ml SO₄²⁻
 20 ml NO₃⁻
 4 ml F⁻

+ DI water to 2000 mL
 start pH 3.078 end pH 3.915
 T = 95°C aerated w/ gen air

ref. elec. Fisher SCE 13-620-51 S/N 5087405

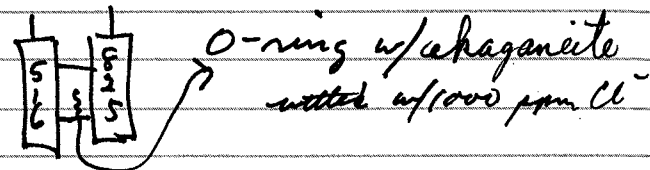
Start 6/4/98 Stop 6/19/98

David D 6/24/98

CALV 68. DAT

Specimen: A516 g. 60 mill scale
 start wt. 69.03090 g
 end wt.
 Alloy 825 600 grit polished + passivated
 start wt. 71.65658 g
 end wt.

Spec config:



Solution: 1000 ppm Cl^- pH 3
 20 ppm SO_4^{2-} 10 ppm NO_3^- 2 ppm F^-
 3.30234 g NaCl # 972274
 6 drops conc HCl # 967077
 40 ml SO_4^{2-}
 20 ml NO_3^- } 6/98 } stock sol'n NB086 p. 228
 4 ml F^-
 + DI water to 2000 mL
 start pH 3.056 end pH 4.582

$T = 95^\circ\text{C}$ aerated w/yeast air

ref. elec. Fisher SCE 13-620-51 S/N 3106339

start 6/4/98 Stop 6/19/98

David D. 6/24/98

C-22 Passive Current Density

Objective: Measure passive current density.

Specimen: C-22 Heat 2277-8-3715
 start wt. 12.3405 ^{12.34252} 12.34035 g 3/10/99 wjm
 end wt. 12.34025

Solution: 1000 ppm Cl^- pH 2.2
 3.59857 g NaCl Lot # 972274
 + DI water to 2000 mL
 adjust pH w/HCl Lot # 971828

start pH 0.738

(this is the same sol'n as NB157 p. 303)

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

Potentiostat: Versastat S/N 20104

Counter electrode: Pt flag

Reference: Fisher SCE 13-620-51 S/N 7030126

$E_{\text{can}} = -105 \text{ mV}$ Keithly 6517 S/N 599913

$E_{\text{Pt}} = +134 \text{ mV}$ " " "

$E_{\text{applied}} = +400 \text{ mV}$

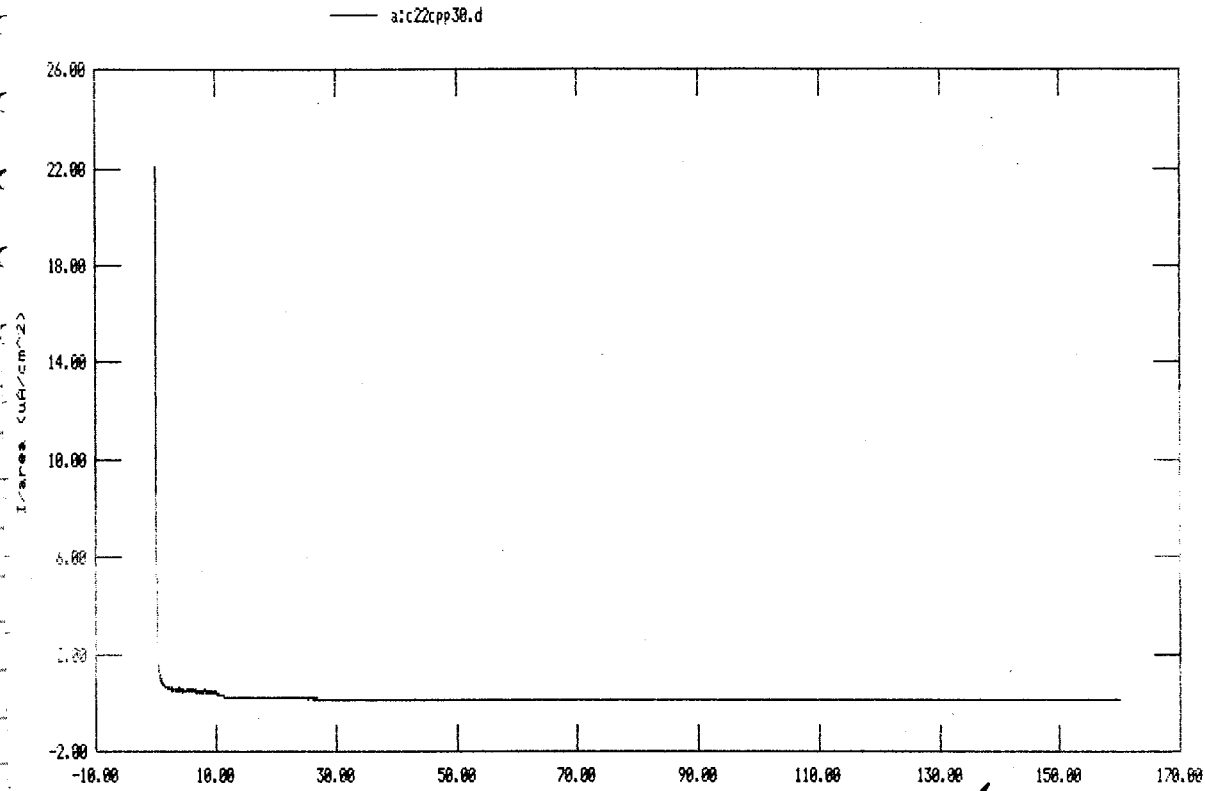
still has metallic sheen, no pits

data saved as C22CPP30.DAT

passive current density 105 \rightarrow 135 $\mu\text{A}/\text{cm}^2$

Walter J. Macdonald
 2/10/99

Model 352/252 Corrosion Analysis Software, v. 2.30
 PS POTENTIOSTATIC File Status: NORMAL Date Run: 01-05-99 Time Run: 11:52:27
 CP PASS vs. R CT PASS IP 0.400 vs. R ID 5 S TP 5.333E+01 T1 1.600E+05
 CR AUTO NP 3000 SO Pass IR NONE FL 1 5.3Hz RT HIGH STABILITY
 REF 0.24150 SCE WPK SOLID AR 8.900E+00 LS NO EN 0.000E+00 DEN 8.900E+00 AU NO
 OC -0.106
 Comment: C-22: 1000ppm Cl @ pH 0.738 @ 95°C +400mV SCE



(s) Walter J Machowski 2/10/99

Model 352/252 Corrosion Analysis Software, v. 2.30
 Filename: a:c22cpp30.dat
 Pstat: VStat[] Ver 2
 PS POTENTIOSTATIC File Status: NORMAL
 Date Run: 01-05-99 Time Run: 11:52:27

| | | | | | | | |
|---------------|----|-------|---|--------------|----|----------|---|
| Cond. Time | CT | pass | s | Initial Pot. | IP | 400.0E-3 | V |
| Cond. Pot. | CP | pass | V | Time Step 1 | T1 | 160.0E3 | s |
| Initial Delay | ID | 5 | s | Stop On | SO | Pass | |
| Time/Pt. | TP | 53.33 | s | Curr. Range | CR | Auto | |
| No. of Points | NP | 3000 | | | | | |

Line Sync. LS no IR Mode IR none
 Rise Time RT high stability Filter FL 1 5.3Hz
 Working Elec. WE Solid Ref. Elec. RE SCE 241.5E-3V
 Sample Area AR 8.900 cm² Equiv. Wt. EW 0.0000 g
 Density DE 8.900 g/ml AUX A/D AU no
 Open Circuit OC -106.0E-3 V

Comment: C-22: 1000ppm Cl @ pH 0.738 @ 95°C +400mV SCE

Walter J Machowski 2/10/99

Walter J Machowski
2/10/99

C-22 Repassivation Potential

Objective: To measure repassivation potential

Specimen: C-22 Heat 2277-8-3175

Start wt: 47.05769 g

End wt: 46.83155 g

use PTFE crevice blocks @ 100 ox-in torque

Solution: 1M LiCl 85 ppm HCO₃⁻

20 ppm SO₄²⁻ 10 ppm NO₃⁻ 2 ppm F⁻

84.88987 g LiCl Lot # 954236

0.24116 g NaHCO₃ Lot # 892789

40 ml SO₄²⁻

20 ml NO₃⁻ } 2/99 } Stock sol'n NB157 p. 302

4 ml F⁻

+ DI water to 2000 mL

Start pH 7.353

Data saved as C22RP10.DAT

Temp = 95°C

Hg thermometer # 183305

de-aerated w/99.999% N₂

Potentiostat: EG&G 273 S/N 41108

Counter Electrode: Pt flag

Reference: Fisher SCE 13-620-51 S/N 9214024

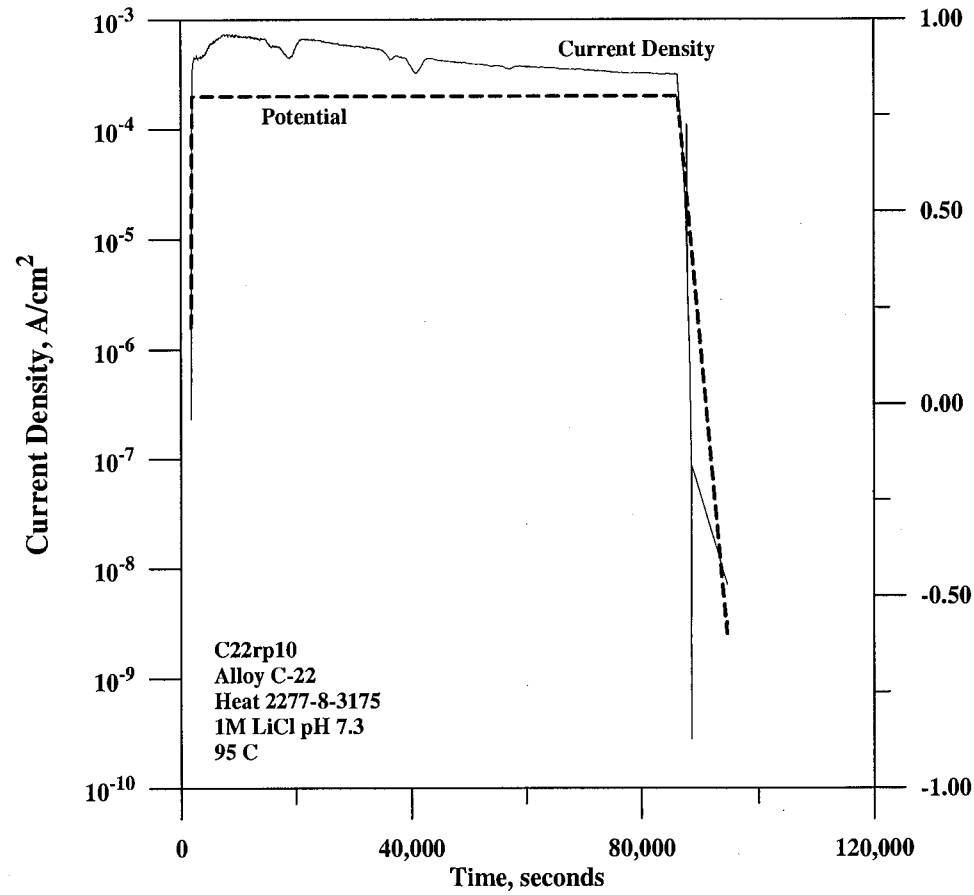
E_{on} -539 mV

Keithley 614 S/N 553368

E_{pr} -268 mV

specimen had brown film on it, which easily flaked off after drying, no crevice attack

Walter J Machowski
2/10/99



$i < 10^{-5} \text{ A/cm}^2$ NT 527 mV_{SCE}
 $i < 10^{-6} \text{ A/cm}^2$ NT 470 mV_{SCE}
 $i < 0$ NT 407 mV_{SCE}

C-22 Passive Current Density

Objective: To measure passive current density

Specimens: C-22 same as p. 233
 Start wt. 12.34035 g
 End wt. 12.34032 g

Solution: 1000 ppm Cl^- pH < 7
 Same solution as p. 233

Same conditions as p. 233

Same potential as p. 233
 Same electrodes as p. 233

$E_{com} +55 \text{ mV}$ Keithly 6517 S/N 558913
 $E_{pt} +209 \text{ mV}$

Applied +400 (forgot to change parameter - should have been +600)

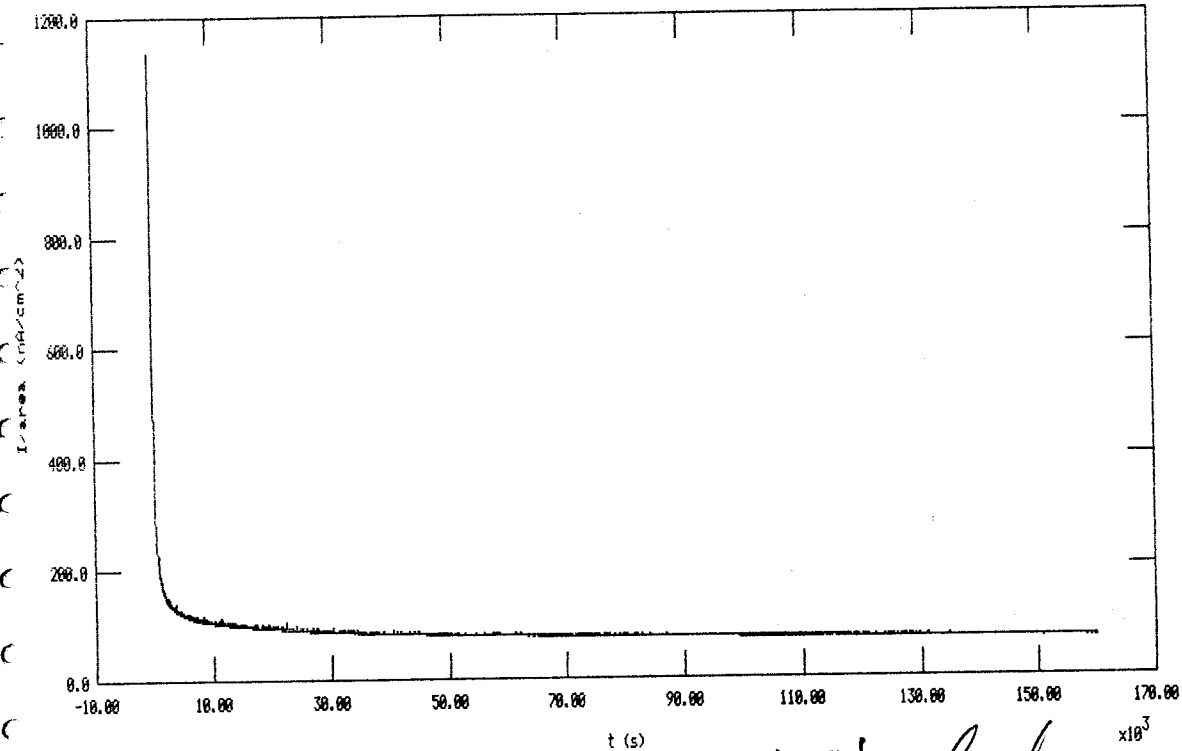
Current ~ 70-75 $\mu\text{A/cm}^2$
 saved as C22CPP31.DAT

no pits, still has metallic sheen

Walter J. Mocharli
 2/15/99

Model 352/252 Corrosion Analysis Software, v. 2.30
 PS POTENTIOSTATIC File Status: NORMAL Date Run: 01-07-99 Time Run: 13:14:52
 CP PASS vs. R CT PASS IP 0.400 vs. R ID 5 S TP 5.333E+01 T1 1.600E+05
 CR AUTO NP 3000 SO Pass IR NONE FL 15.3Hz RT HIGH STABILITY
 REF 0.24150 SCE WRK SOLID AR 8.900E+00 LS NO EW 0.000E+00 DEN 8.900E+00 AU NO
 OC 0.046
 Comment: C-22: 1000ppm Cl @ pH 0.738 @ 95°C +600mV SCE

a:c22cpp31.d



Walter J Macchiarri 2/15/99

Model 352/252 Corrosion Analysis Software, v. 2.30
 Filename: a:c22cpp31.d
 Pstat: VStat[] Ver 2
 PS POTENTIOSTATIC File Status: NORMAL
 Date Run: 01-07-99 Time Run: 13:14:52

| | | | | | | | |
|---------------|----|----------------|------|--------------|----|---------------|---|
| Cond. Time | CT | pass | s | Initial Pot. | IP | 400.0E-3 | V |
| Cond. Pot. | CP | pass | V | Time Step 1 | T1 | 160.0E3 | s |
| Initial Delay | ID | 5 | s | Stop On | SO | Pass | |
| Time/Pt. | TP | 53.33 | s | Curr. Range | CR | Auto | |
| No. of Points | NP | 3000 | | | | | |
| Line Sync. | LS | no | | IR Mode | IR | none | |
| Rise Time | RT | high stability | | Filter | FL | 15.3Hz | |
| Working Elec. | WE | Solid | | Ref. Elec. | RE | SCE 241.5E-3V | |
| Sample Area | AR | 8.900 | cm² | Equiv. Wt. | EW | 0.0000 | g |
| Density | DE | 8.900 | g/ml | AUX A/D | AU | no | |
| Open Circuit | OC | 46.00E-3 | V | | | | |

Comment: C-22: 1000ppm Cl @ pH 0.738 @ 95°C +600mV SCE

Walter J Macchiarri 2/15/99

Walter J Macchiarri 2/15/99

C-22 Repassivation Potential

Objective: To measure repassivation potential.

Specimen: C-22 Heat 2277-8-3175

Start wt. 46.99005 g

End wt. 46.89539 g

use PTFE crevice blocks @ 100 in-oz torque

Solution: 4M LiCl 85 ppm HCO₃⁻
 20 ppm SO₄²⁻ 10 ppm NO₃⁻ 2 ppm F⁻
 339.12 g LiCl Lot # 954336
 0.24618 g NaHCO₃ Lot # 897789
 40ml SO₄²⁻
 20 ml NO₃⁻ } 2/99 } stock sol'n #B157 p.302
 4 ml F⁻

+ DI water to 2000 mL

de-aerate w/ 99.999% N₂

Start pH 7.082

End pH 7.208

Temp = 95°C Hg thermometer #183305

E_{com} = -635 mV

Keithley 614 S/N 555368

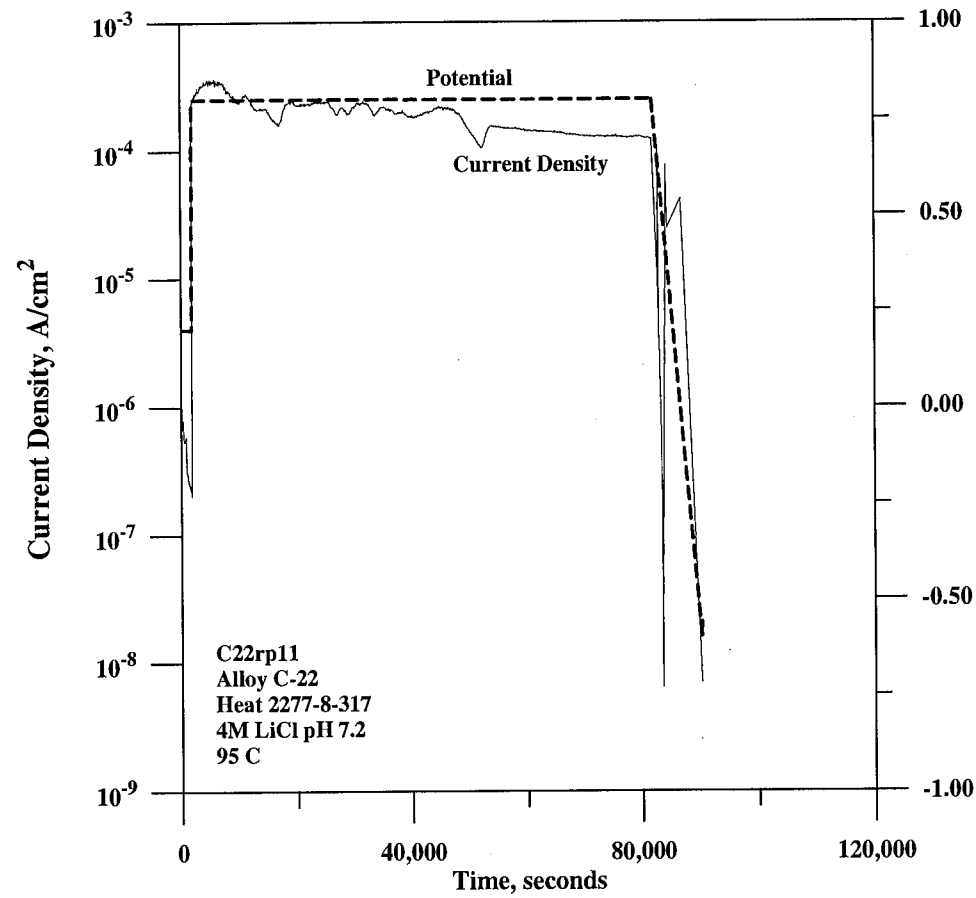
E_{pt} = -146 mV

run on EGA 273 S/N 41108

no crevice corrosion or pits - maybe some transpassive dissolution
some grain boundaries visible

data saved as C22RP11.DAT

Walter J Macchiarri 2/16/99



$i < 10^{-5}$ A/cm² AT 624 mV_{SCE}
 $i < 10^{-6}$ A/cm² AT 562 mV_{SCE}
 $i < 0$ AT 516 mV_{SCE}

C-22 Passive Current Density

Objective: To measure passive current density.

Specimen: C-22 same as p.233
 Start wt: 12.34032 g
 End wt: 12.33921 g

Solution: 1000 ppm Cl⁻ pH < 2
 same solution as p.233

Same conditions as p.233

Same potential as p.233
 Same electrodes as p.233

E_{com} -126 mV Keithly 6517 S/N 599913
 " " " "

E_{pt} +252 mV

$E_{applied}$ +600 mV

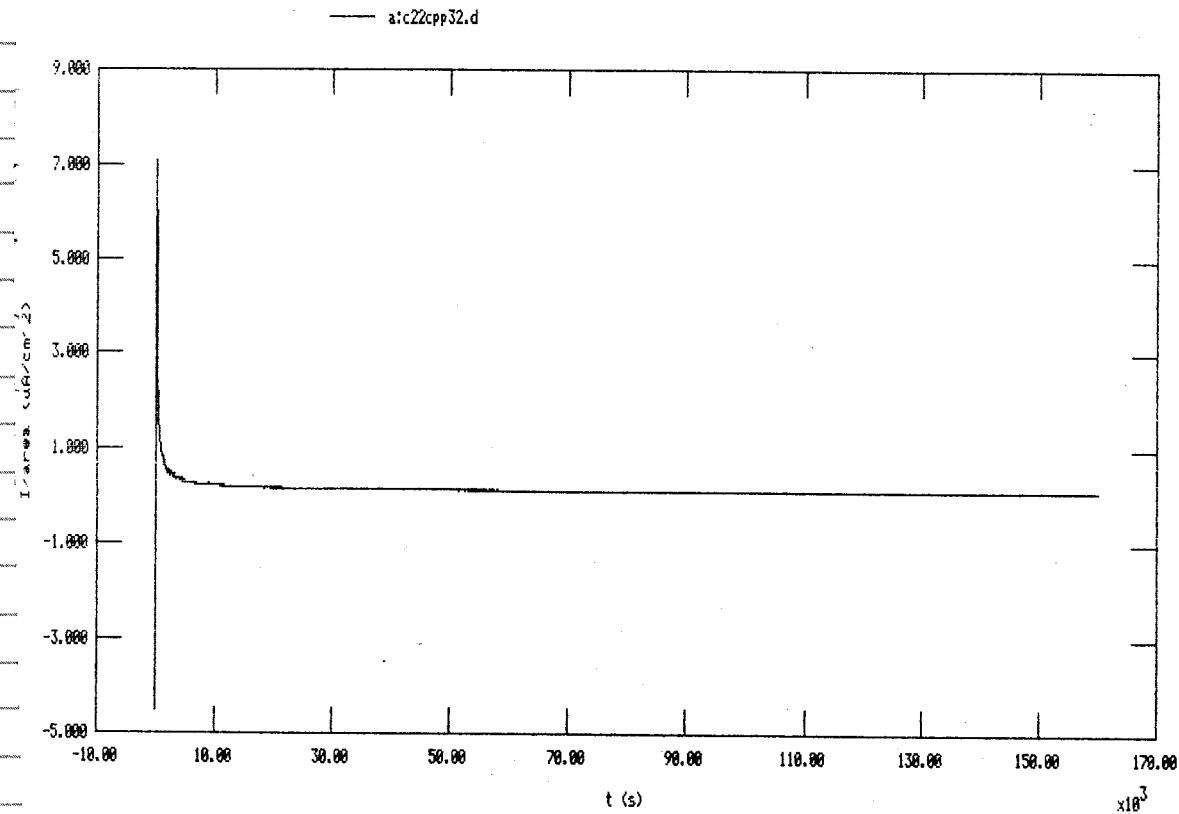
no pits, still has metallic sheen

DATA SAVED AS
 C22CPP32.DAT

0.09 - 0.13 μ A/cm²

Walter J. Meehan
 2/17/99

Model 352/252 Corrosion Analysis Software, v. 2.38
 PS POTENTIOSTATIC File Status: NORMAL Date Run: 01-09-99 Time Run: 12:05:51
 CP PASS vs. R CT PASS IP 0.600 vs. R ID 5 S TP 5.333E+01 T1 1.600E+05
 CR AUTO HP 3000 SQ Pass IR NONE FL 1 5.3Hz RT HIGH STABILITY
 REF 0.24150 SCE WPK SOLID AR 8.900E+00 LS NO EN 0.000E+00 DEN 8.900E+00 AU NO
 OC -0.131
 Comment: C-22: 1000ppm Cl @ pH 0.738 @ 95°C +600mV SCE



Walter J. Macdonald 2/17/99

Model 352/252 Corrosion Analysis Software, v. 2.38
 Filename: a:c22cpp32.dat
 Pstat: VStat[] Ver 2
 PS POTENTIOSTATIC File Status: NORMAL
 Date Run: 01-09-99 Time Run: 12:05:51

| | | | | | | | |
|---------------|----|-------|---|--------------|----|----------|---|
| Cond. Time | CT | pass | s | Initial Pot. | IP | 600.0E-3 | V |
| Cond. Pot. | CP | pass | V | Time Step 1 | T1 | 160.0E3 | s |
| Initial Delay | ID | 5 | s | Stop On | SO | Pass | |
| Time/Pt. | TP | 53.33 | s | Curr. Range | CR | Auto | |
| No. of Points | HP | 3000 | | | | | |

Line Sync. LS no IR Mode IR none
 Rise Time RT high stability Filter FL 1 5.3Hz
 Working Elec. ME Solid Ref. Elec. RE SCE 241.5E-3V
 Sample Area AR 8.900 cm² Equiv. Wt. EW 0.0000 g
 Density DE 8.900 g/ml AUX A/D AU no
 Open Circuit OC -131.0E-3 V

Comment: C-22: 1000ppm Cl @ pH 0.738 @ 95°C +600mV SCE

Walter J. Macdonald 2/17/99

Walter J. Macdonald
2/17/99

C-22 Passive Current Density

Objective: To measure passive current density

Specimen: C-22 same as p.233
 Start WT. 12.33921 g
 End WT. 12.32118 g

Solution: 1000 ppm Cl⁻ pH ~ 1
 same solution as p.233

Same conditions as p.233

Same potential as p.233
 Same electrodes as p.233

E_{com} +201 mV Keithly 6517 S/N 599913

E_{PX} +276 mV

E_{applied} +800 mV

Current density 65 → 72 μA

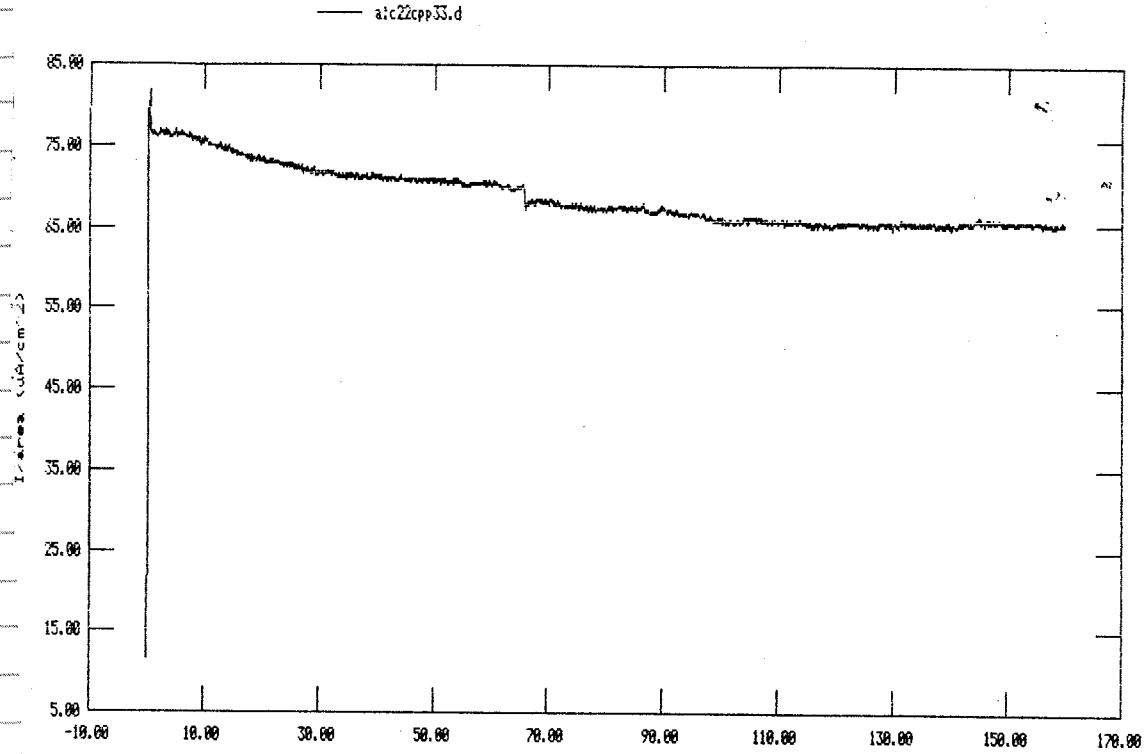
no pits, still had metallic sheen
 some grain boundaries visible under microscope

data saved as c22cpp33.dat

64-66 μA/cm²

Walter J. Macdonald
2/25/99

Model 352/252 Corrosion Analysis Software, v. 2.38
 PS POTENTIOSTATIC File Status: NORMAL Date Run: 01-11-99 Time Run: 13:17:07
 CP PASS vs. R CT PASS IP 0.800 vs. R ID 5 S TP 5.333E+01 T1 1.600E+05
 CR AUTO NP 3000 SO Pass IR NONE FL 1 5.3Hz RT HIGH STABILITY
 REF 0.24150 SCE WRK SOLID AR 8.900E+00 LS NO EM 0.000E+00 DEN 8.900E+00 AU NO
 OC 0.197
 Comment: C-22: 1000ppm Cl @ pH 0.738 @ 95°C +800mV SCE



Walter J Macdonald 2/22/99

Model 352/252 Corrosion Analysis Software, v. 2.38
 Filename: a/c22cpp33.dat Pstat: UStat[] Ver 2
 PS POTENTIOSTATIC Date Run: 01-11-99 Time Run: 13:17:07
 File Status: NORMAL
 Cond. Time CT pass s Initial Pot. IP 800.0E-3 V
 Cond. Pot. CP pass V Time Step 1 T1 160.0E3 s
 Initial delay ID 0 s stop on 50 Pass
 Time/Pt. TP 53.33 s Curr. Range CR Auto
 No. of Points NP 3000
 Line Sync. LS no IR Mode IR none
 Rise Time RT high stability Filter FL 1 5.3Hz
 Working Elec. WE Solid Ref. Elec. RE SCE 241.5E-3V
 Sample Area AR 8.900 cm² Equiv. Wt. EW 8.0000 g
 Density DE 8.900 g/ml AUX A/D AU no
 Open Circuit OC 197.0E-3 V

Comment: C-22: 1000ppm Cl @ pH 0.738 @ 95°C +800mV SCE

Walter J Macdonald 2/22/99

Walter J Macdonald 2/22/99

C-22 Passive Current Density

Objective: Measure passive current density.

Specimen: C-22 Heat 2277-8-3715
 Start WT. 12.33243 g
 End WT. 12.33322 g

Solution: 4M Cl⁻ 85 ppm HCO₃⁻
 20 ppm SO₄²⁻ 10 ppm NO₃⁻ 2 ppm F⁻
 467.52 g NaCl Lot # 985302
 0.23681 g NaHCO₃ Lot # 89789
 40 ml SO₄²⁻
 20 ml NO₃⁻
 4 ml F⁻ } 2/99

Start pH 6.964 End pH 7.922

Temp = 95°C Hg thermometer 183303
 de-aerated w/ 99.999% N₂

Potentiostat: Versostat S/N 20104
 Counter electrode: Pt flag
 Reference: Fisher SCE 13-620-51 S/N 9214074

E_{com} -200 mV Keithly 6517 S/N 599913
 E_{py} +534 V

Applied -200 mV SCE

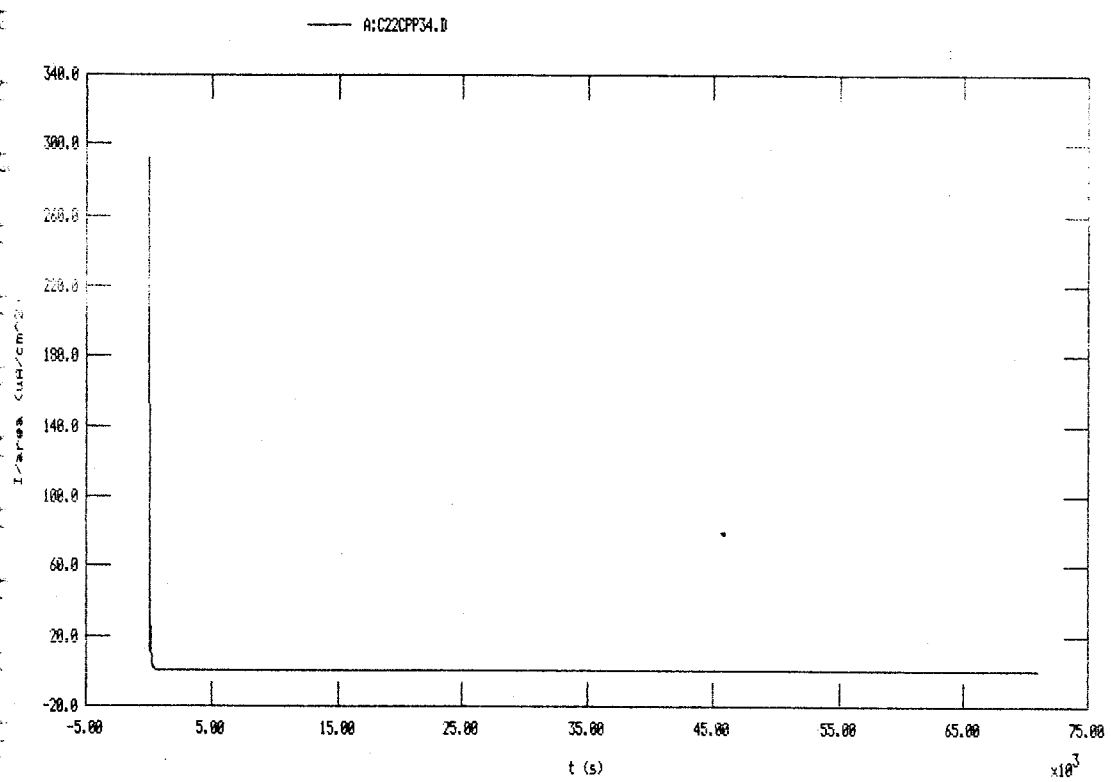
Potentiostat failed - experiment aborted
 data saved as C22CPP34.DAT

0.01 - 0.014 μA/cm²

Walter J Macdonald

2/24/99

Model 352/252 Corrosion Analysis Software, v. 2.30
 PS POTENTIOSTATIC File Status: NORMAL Date Run: 01-13-99 Time Run: 11:05:51
 CP PASS vs. R CT PASS IP -0.200 vs. R ID 5 S TP 5.333E+01 T1 1.600E+05
 CR AUTO HP 1329 SD Pass IR NONE FL 1 5.3Hz RT HIGH STABILITY
 REF 0.24150 SCE MRK SOLID AR 8.980E+00 LS NO EM 0.000E+00 DEN 8.980E+00 AU NO
 OC 0.257
 Comment: C-22: 4M Cl pH 8 @ 95°C -200mV SCE



David D 5/11/99

Model 352/252 Corrosion Analysis Software, v. 2.30
 Filename: A:\C22CPP34.DAT
 Pstat: VStat11 Ver 2
 PS POTENTIOSTATIC File Status: NORMAL
 Date Run: 01-13-99 Time Run: 11:05:51

| | | | | | | | |
|---------------|----|-------|---|--------------|----|-----------|---|
| Cond. Time | CT | pass | s | Initial Pot. | IP | -200.0E-3 | V |
| Cond. Pot. | CP | pass | V | Time Step 1 | T1 | 160.0E3 | s |
| Initial Delay | ID | 5 | s | Stop On | SO | Pass | |
| Time/Pt. | TP | 53.33 | s | Durr. Range | CR | Auto | |
| No. of Points | HP | 1329 | | | | | |

Line Sync. LS no IR Mode IR none
 Rise Time RT high stability Filter FL 1 5.3Hz
 Working Elec. WE Solid Ref. Elec. RE SCE 241.5E-3V
 Sample Area AR 8.980 cm² Equiv. Wt. EW 8.0000 g
 Density DE 8.980 g/ml AUX A/D AU no
 Open Circuit OC 257.0E-3 V

Comment: C-22: 4M Cl pH 8 @ 95°C -200mV SCE

David D 5/11/99

Summary of Passive Current Results

| CONC | TEMP | APPLIED POTENTIAL | pH | PASSIVE CURRENT |
|-------------|------|-------------------|----|--------------------------|
| 1000 ppm Cl | 95°C | +200 mV | 8 | 25 → 35 nA |
| 1000 ppm Cl | 95°C | +400 | " | 70 → 350 nA |
| " | " | +600 | " | 140 → 850 nA |
| " | " | +800 | " | 450 → 600 μA |
| 0.5M Cl | 20°C | +200 mV | 8 | 5-16 nA (spike 49 nA) |
| " | " | +400 | " | 30 → 300 nA |
| " | " | +600 | " | 40 → 140 nA |
| " | " | +800 | " | 48 → 114 μA |
| 0.5M Cl | 95°C | +200 mV | 8 | 9.5 → 29 nA |
| " | " | +400 | " | 13 → 35 nA |
| " | " | +600 | " | 39 → 50 μA |
| 4M Cl | 95°C | +400 mV | 8 | 32 → 54 nA |
| " | " | +200 | " | 12 → 40 nA |
| " | " | +600 | " | 68 → 103 nA |
| " | " | +800 | " | 0.73 → 1.26 μA |
| 0.5M Cl | 95°C | 0 mV | 8 | 14 → 20 nA (0.65 K5) |
| " | " | +600 | " | 203 → 390 nA |
| 4M Cl | 95°C | +200 mV | 2 | 5-7 nA (one large spike) |
| " | " | +400 | " | 25 → 30 nA |
| " | " | +600 | " | 27 → 33 μA |
| " | " | +800 | " | 0.5 → 0.65 mA |
| 4M Cl | R.T. | +200 mV | 8 | 11-20 nA (one spike) |
| " | " | +800 | " | 50 → 90 μA |

*Walter J. Mochowski
2/23/99*

Summary of Passive Current Results

| CONC | TEMP | APPLIED POTENTIAL | pH | ^{20m 2/22/99} pH | PASSIVE CURRENT |
|-------------|------|-------------------|------|---------------------------|--------------------------|
| 1M Cl | 95°C | +200mV | 8 | | 9 → 24 nA |
| " " | " | +800mV | " | | 0.80 → 1.15 mA |
| 1000 ppm Cl | 95°C | +200mV | <1.0 | | 65 → 220 nA |
| " | " | +400 | " | | 105 → 135 nA |
| " | " | +600 | " | | |
| " | " | +800 | " | | 65 → 72 μA |
| 1000 ppm Cl | 20°C | +200mV | 8 | | 1.5-2 nA/cm ² |

Paul D 5/31/2000

C-22 Repassivation Potential

Objective: To measure repassivation potential.

Specimen: C-22 Heat 2277-8-3175

Start WT. 46.44052 g

End WT. 46.23892 g

use PTFE crevice blocks @ 100 in-oz torque

Solution: 11.5M LiCl

474.97 g LiCl Lot # 97223 g

+ DI water to 2000 mL

Start pH 3.193

End pH 5.295

Temp = 95°C

By thermometer #183305

de-aerate w/ 99.999% N₂

Potentiostat EGC 273 S/N 41108

Counter elec. Pt flag

Reference: Fisher SCE 13-630-51

S/N 7030126

E_{com} -360mV

Keithly 6517 S/N 599913

E_{ref} +152mV

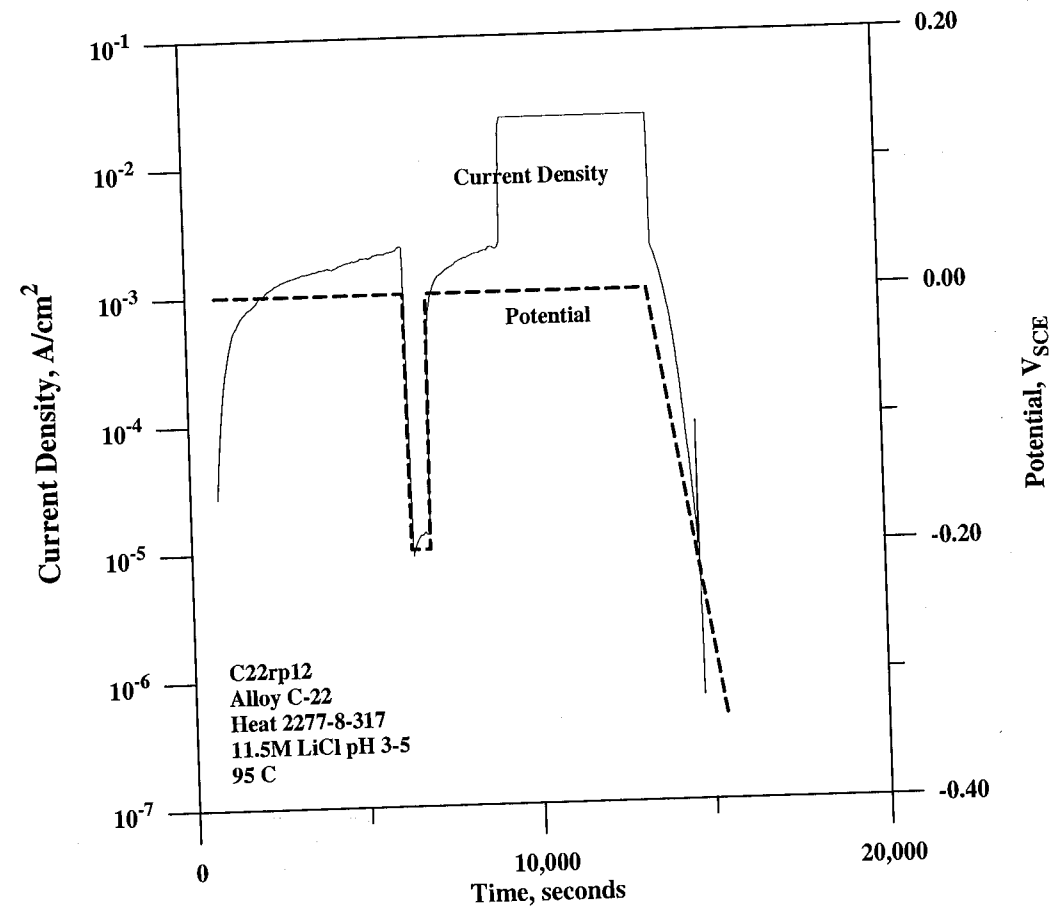
" " "

Currents resulting from the programmed potentials were too high + caused overload. Program was changed to accommodate this

data saved as C22RP12.DAT

Paul D 5/31/2000

C-22 REPASSIVATION POTENTIAL PLOT



$i < 10^{-5}$ A/cm² AT -220 mV_{SCE}
 $i < 10^{-6}$ A/cm² AT -226 mV_{SCE}
 $i < 0$ AT -230 mV_{SCE}

David De 5/31/2000

C-22 Repassivation Potential

Objective: To measure repassivation potential

Specimen: C-22 Heat 2277-8-3175

Start wt: 46.559838

End wt:

use PTFE cradle blocks @ 100 in sq target

Solution: 4M LiCl

339.13g LiCl Lot # 954236

+ DI water to 2L

Start pH 4.172

END pH 5.621

Temp = 95°C

Hg thermometer # 183305

de-aerate w/ 99.999% N₂

Potentiostat EG&G 273 S/N 41108

Counter electrode: Pt flag

Reference: Fisher SCE 13-620-51 S/N 7030126

E_{corr} -425 mV Keithley 6517 S/N 599913

E_{pp} -249 mV " " "

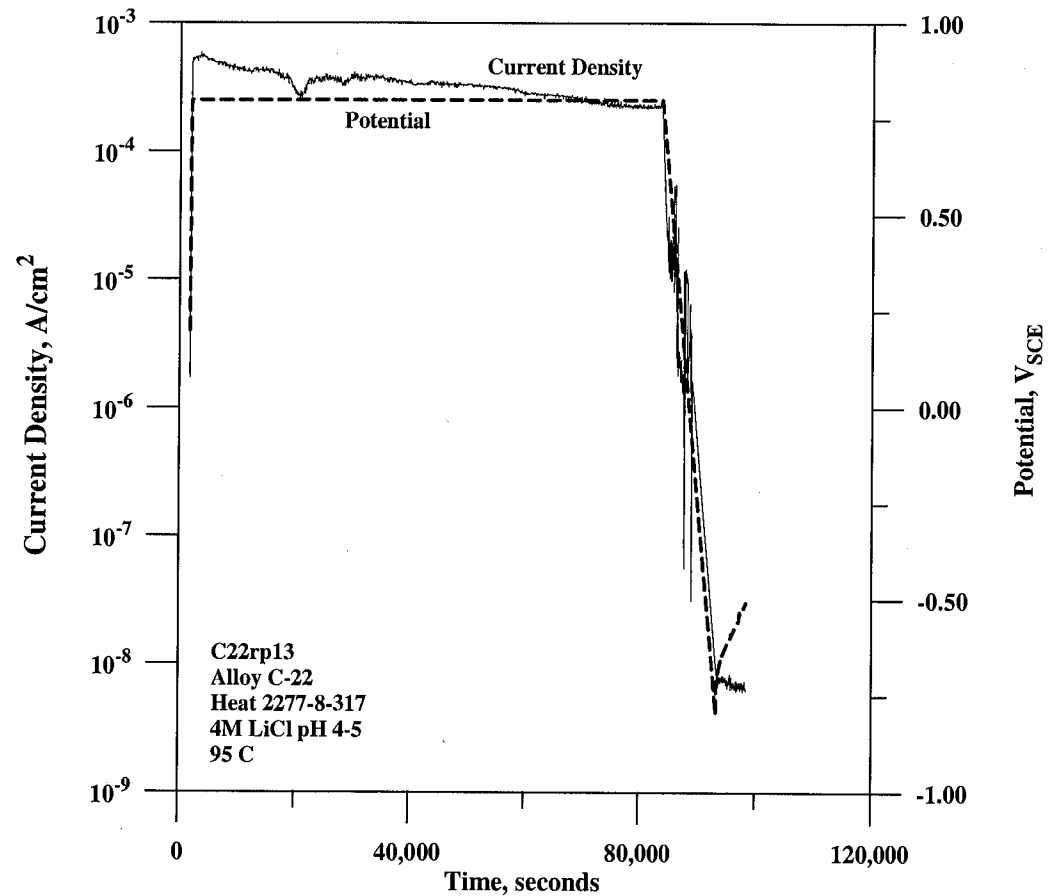
current @ +200 mV start ≈ 1.03 → 1.09 mA

current @ +800 mV ≈ 15 mA at start of period

Saved as C22RP13.DAT

David De 5/31/2000

C-22 REPASSIVATION POTENTIAL PLOT



$i' < 10^{-5}$ A/cm² AT 372 mV_{SCE}
 $i' < 10^{-6}$ A/cm² AT 172 mV_{SCE}
 $i' < 0$ 55 mV_{SCE}

[Signature] 5/31/2000

C-22 PASSIVE CURRENT DENSITY.

OBJECTIVE MEASURE PASSIVE CURRENT DENSITY.

SPECIMEN ALLOY C-22 HEAT 2277-8-3175
 600 GRET FINISH 1.915" x 0.250"
 START WT 12.11913 g
 END WT 12.11917 g

SOLUTION 4m Cl⁻ 85ppm HCO₃⁻ 20ppm SO₄²⁻ 10ppm NO₃⁻
 2ppm F⁻ 2L PREPARED AS FOLLOWS
 467g NaCl LOT 985302
 6.24011g NaHCO₃ LOT 897789
 40 mL SO₄ - 3/99 STOCK SOLUTION 1000 ppm SO₄²⁻
 20 mL NO₃ - 3/99 STOCK SOLUTION 1000 ppm NO₃⁻
 4 mL F⁻ - 3/99 STOCK SOLUTION 1000 ppm F⁻
 + DI WATER TO 2000 mL

START pH 7.499
 END pH NOT RECORDED
 TEMP = 95°C H₂ THERMOMETER 183303
 SOLUTION PREPARED w/ 99.999% N₂

POTENTIOSTAT SOLARTRON 1287 SERIAL # 00148500
 COUNTER ELECTRODE Pt FLUG
 REFERENCE ELECTRODE FISHER 13-620-SI SN 7030726

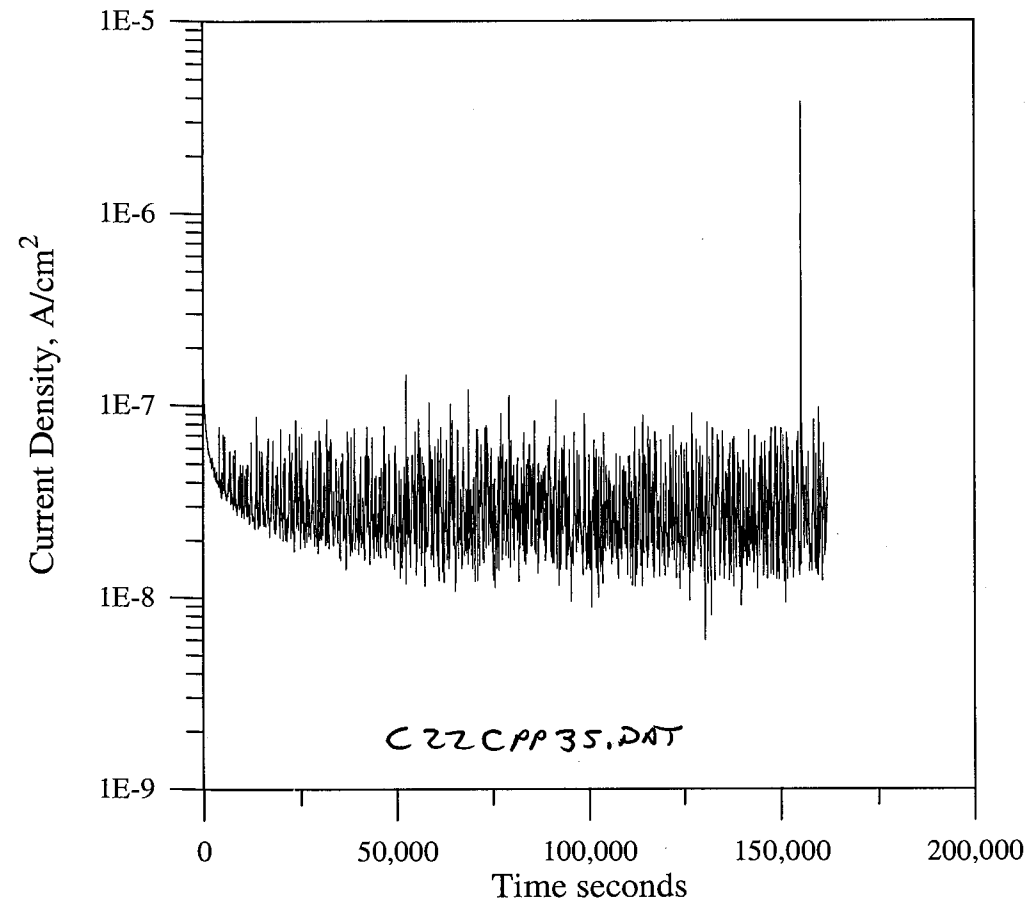
E_{corr} -410 mV KEITHLEY 614 SN 704936
 E_{pt} -403 mV "
 E_{APPLIED} -200 mV_{SCE}
 TEST STARTED 3/11/99

E_{corr} AT END OF TEST -341 mV_{SCE}
 DATA SAVED AS C22CPP35.DAT

[Signature] 5/11/99

NO PITS OR VISIBLE FICM.
 PLOT P254.

[Signature] 3/13/99 6-60 nA/cm²
 SPIKES TO 120 nA/cm²



James D
5/11/99

James D 5/31/2000

C-22 PASSIVE CURRENT DENSITY
C-22 2277-8-3175

OBJECTIVE MEASURE PASSIVE CURRENT DENSITY OF C-22

SPECIMEN ALLOY C22 2277-8-3175
SAMP AS P253
START WT 12.11917
END WT 12.11914

SOLUTION SAMP AS P253
4M Cl⁻ AS NaCl
85 PPM NCO₃ AS NaHCO₃
20 PPM SO₄ AS Na₂SO₄
10 PPM NO₃ AS NaNO₃
2 PPM F⁻ AS NaF
T = 95°C N₂ THERMOMETER 183303
SOLUTION DE AERATION w/ 99.999 % N₂

POTENTIOSTAT SOLARTRON 1287 SN 00148500
COUNTER ELECTRODE Pt FLMC
REFERENCE FISHER SC6 13-620-51 SN 7030126

E_{corr} -392 mV_{scs} KEITHLEY 614 SN 704936
E_{pt} -223 mV_{scs} KEITHLEY 614 SN 704936
E_{APPLIED} 0.0 mV_{scs} KEITHLEY 614 SN 704936

TEST STARTED 3/14/99 8:17 PM.
Test Stopped 3/16/99 after 45 hrs.
E_{com} @ end -407 mV_{scs} final pH 8.564

DATA SAVED as C22CPP36.DAT
no pits or visible film

LIMITING CURRENT DENSITY

OBJECTIVE MEASURE LIMITING CURRENT DENSITY
FOR O₂ REDUCTION

ELECTRODES 2 Pt 51.6 cm²
REFERENCE FISHER SC6 13-620-S1 SN 9214074

SOLUTION 1000 PPM Cl⁻ AS NaCl
3.278 g NaCl LOT 985302
+ DE WATER TO 2000 mL
SOLUTION AERATED W/ 2620 AIR 21% O₂ / 79% N₂

E_{pt} (FIRST ELECTRODE) +275 mV_{SCC} KEITHLEY 614 SN 704936
E_{pt} (SECOND ELECTRODE) +303 mV_{SCC} "

POTENTIOSTAT SOLARTRON 1287 SN 00148500
TEST STARTED 3/18/99
DATA SAVED AS LIMAPT1.COR

TEST RE RUN USING -2.5 V_{SCC} AS LOWER
VALUE
DATA SAVED AS LIMAPT2.COR

Switched de-aerated w/ 99.999% N₂ @ 9:15 AM 3/19/99
E_{pt} (left E) +781 mV_{SCC} Keithley 614 SN 704936
E_{pt} (right E) +756 mV_{SCC} " " "
Start test 11:25 AM 3/19/99 LIMAPT3.COR

SOLUTION DEAERATED FROM 5:00 PM 3/19/99 TO 10:00 AM
3/20/99 w/ TEST CELL CABLES FIXED
E_{pt} +729 mV_{SCC} KEITHLEY 614 SN 704936
E_{pt} +727 mV_{SCC} "
TEST STARTED 10:20 AM 3/20/99 LIMAPT4.COR

SOLUTION DEGENERATED AT A SLOW RATE
E_{pt} +718 mV KEITHLEY 614 SN 704936
E_{pt} +749 mV
TEST STARTED 2:48 AM 3/21/99 LIMAPT 5.COR

T INCREASED TO 95°C N₂ DEGENERATED
E_{pt} +688 mV KEITHLEY 614 SN 704936
E_{pt} +757 mV
TEST STARTED 4:28 PM 3/21/99 LIMAPT 6.COR

RERUN 95°C N₂ DEGENERATED
E_{pt} 752 mV KEITHLEY 614 SN 704936
E_{pt} 788 mV
TEST STARTED 3/22/99 7:12 AM LIMAPT 7.COR.
TEST STOPPED 3/22/99 2:1 PM

Start aeration w/ new air @ 1:20 PM 3/22/99

95°C AERATED
E_{pt} +736 mV KEITHLEY 614 SN 704936
E_{pt} +790 mV
TEST STARTED 3/22/99 4:00 PM LIMAPT 8.COR

95°C AERATED
E_{pt} 728 mV KEITHLEY 614 SN 704936
E_{pt} 768 mV
TEST STARTED 3/23/99 7:45 AM LIMAPT 9.COR

David D 3/29/99

PASSIVE CURRENT DENSITY C-22

Specimen: C22 Heat 2277-8-3715
Start wt. 12.30401 g
End wt. not taken

Solution: 1000 ppm Cl⁻ 85 ppm HCO₃⁻
20 ppm SO₄²⁻ 10 ppm NO₃⁻ 2 ppm F⁻
3.29254 g NaCl # 985302
0.23829 NaHCO₃ # 897789
40 ml SO₄²⁻
20 ml NO₃⁻ } 3/99
4 ml F⁻
+ DI water to 2000 mL

Start pH 8.415 End pH 9.137

T = Room Temp aerated w/ new air

Potentiostat: Versastat #20104
Counter electrode: Pt flag
Reference: Fisher SCE 13-620-51 s/w 9214074

E_{scan} -256 mV Keithley 614 SN 704936
E_{pt} +338 mV
E_{applied} +200 mV

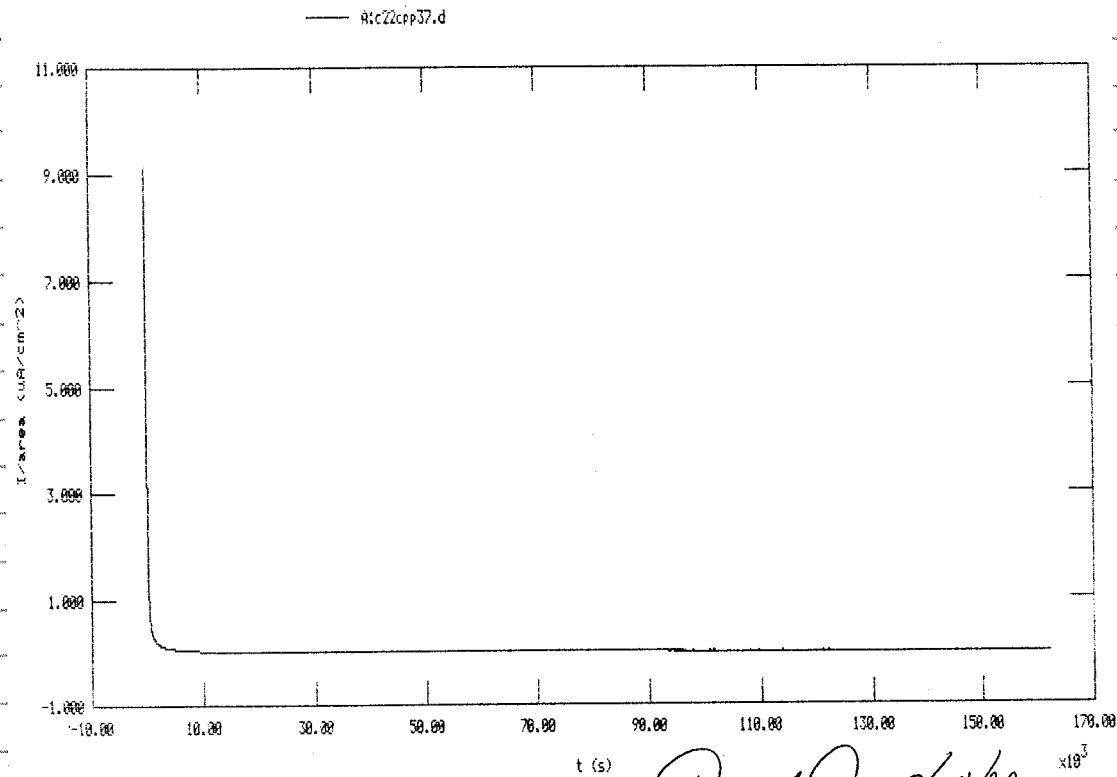
start 3/26/99

DATA SAVED AS C22 CPP37.PAT

MEASURED PASSIVE CURRENT DENSITY 0.0020-0.0030 μA/cm²

David 3/29/99

Model 352/252 Corrosion Analysis Software, v. 2.30
 PS POTENTIOSTATIC File Status: NORMAL Date Run: 03-26-99
 File Name: Atc22cpp37.dat Time Run: 09:14:51
 Pstat: UStat11 Ver 2
 Cond. Time CT pass s Initial Pot. IP 200.0E-3 V
 Cond. Pot. CP pass V Time Step 1 T1 162.0E3 s
 Initial Delay ID 15 s Stop On SD Pass
 Time/Pt. TP 54.00 s Curr. Range CR Auto
 No. of Points NP 3000
 Line Sync. LS no IR Mode IR none
 Rise Time RT high stability Filter FL Off
 Working Elec. WE Solid Ref. Elec. RE SCE 241.5E-3V
 Sample Area AR 9.500 cm² Equiv. Wt. EW 0.00000 g
 Density DE 8.000 g/ml AUX A/D AU no
 Open Circuit OC -251.0E-3 V
 Comment: C-22 1000 ppm Cl; R.T. +200mV sce; aerated w/zero air 3/26/99



David D 3/29/99

Model 352/252 Corrosion Analysis Software, v. 2.30
 File Name: Atc22cpp37.dat File Status: NORMAL
 Pstat: UStat11 Ver 2 Time Run: 09:14:51
 PS POTENTIOSTATIC
 Date Run: 03-26-99
 Cond. Time CT pass s Initial Pot. IP 200.0E-3 V
 Cond. Pot. CP pass V Time Step 1 T1 162.0E3 s
 Initial Delay ID 15 s Stop On SD Pass
 Time/Pt. TP 54.00 s Curr. Range CR Auto
 No. of Points NP 3000
 Line Sync. LS no IR Mode IR none
 Rise Time RT high stability Filter FL Off
 Working Elec. WE Solid Ref. Elec. RE SCE 241.5E-3V
 Sample Area AR 9.500 cm² Equiv. Wt. EW 0.00000 g
 Density DE 8.000 g/ml AUX A/D AU no
 Open Circuit OC -251.0E-3 V
 Comment: C-22 1000 ppm Cl; R.T. +200mV sce; aerated w/zero air 3/26/99

David D 3/29/99

C-22 Passive Current Density

Specimen: Same specimen as p.259

Solution: Same solution as p.259

T = Room Temp de-aerate w/99.999% N₂

Potentiostat: Versastat #20104

Counter electrode: Pt flag

Reference: SCE 13-620-51 s/n 9214074

wym 3/29/99

E_{com} +150mV -324V Keithly 614 s/n 704396

E_{PT} +150mV

E_{applied} +200mV

Start 3/29/99

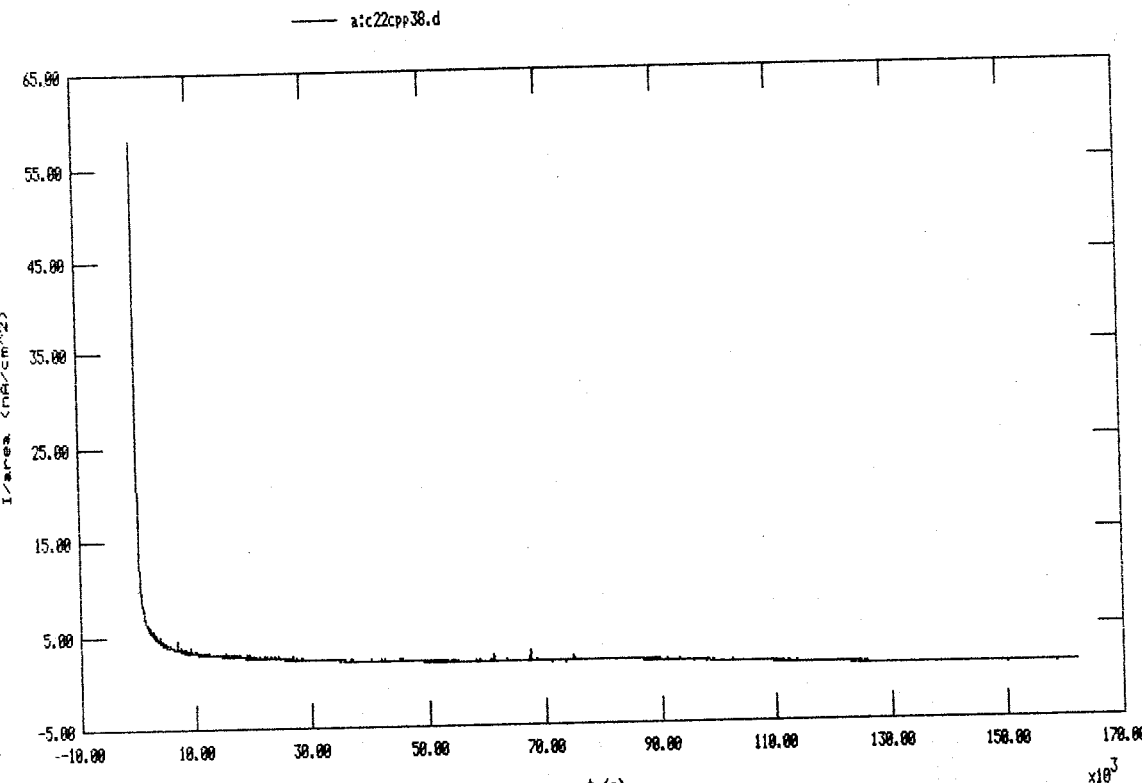
data saved as C22CPP38.DAT

not pitted or corroded

currents ~ 1.5 → 2.0 nA/cm²

Walter J Machowski
 7/12/99

Model 352/252 Corrosion Analysis Software, v. 2.38
 PS POTENTIOSTATIC File Status: NORMAL Date Run: 03-28-99 Time Run: 12:31:03
 CP PASS vs. R CT PASS IP 0.200 vs. R ID 15 S TP 5.400E+01 T1 1.620E+05
 CR AUTO HP 3000 SO Pass IR NONE FL NONE RT HIGH STABILITY
 REF 0.24150 SCE WPK SOLID AR 9.500E+00 LS NO EH 0.000E+00 DEH 0.000E+00 AU NO
 DC -0.032
 Comment: C-22 1000 ppm Cl; R.T. +200mV sce: deaerated w/nitrogen 3/29/99



Walter J Macdonald 4/12/99

Model 352/252 Corrosion Analysis Software, v. 2.38
 Filename: a:c22cpp38.dat
 Pstat: VStat1 Ver 2
 PS POTENTIOSTATIC File Status: NORMAL
 Date Run: 03-28-99 Time Run: 12:31:03
 Cond. Time CT pass s Initial Pot. IP 200.0E-3 V
 Cond. Pot. CP pass V Time Step 1 T1 162.0E3 s
 Initial Delay ID 15 s Stop On SO Pass
 Time/Pt. TP 54.00 s Curr. Range CR Auto
 No. of Points HP 3000
 Line Sync. LS no IR Mode IR none
 Rise Time RT high stability Filter FL Off
 Working Elec. WE Solid Ref. Elec. RE SCE 241.5E-3V
 Sample Area AR 9.500 cm² Equiv. Wt. EH 0.0000 g
 Density DE 8.000 g/ml AUX A/D AU no
 Open Circuit OC -32.00E-3 V
 Comment: C-22 1000 ppm Cl; R.T. +200mV sce: deaerated w/nitrogen 3/29/99

Walter J Macdonald 4/15/99

C-22 Repassivation Potential

Specimen: C-22 Heat 2277-8-3715
 Heat treated @ 800°C for 24 hrs. + water quenched

Start WT. 46.7359g
 End WT. 35.6555g

used PTFE crucible block @ 100 um of Torque

Solution: 4M Cl⁻ 85 ppm HCO₃⁻
 20 ppm SO₄²⁻ 10 ppm NO₃⁻ 2 ppm F⁻
 467.52g NaCl # 985302
 0.28610g NaHCO₃ # 897789
 40ml SO₄²⁻
 20ml NO₃⁻
 4ml F⁻ } 3/99

+ DI water to 2000ml

Start pH 7.308 End pH 9.13

Temp = 95°C de-aerated w/99.999% N₂

Potentiostat: EG&G 273 S/N 41108

Counter electrode: Pt flag

Reference SCE 13-620-51 S/N 8122010

E_{corr} -407mV

Kentaly 614 S/N 704936

E_{pt} -282mV

Specimen chipped to shreds - much attack
 did not do downward scan because of
 the high currents overnight

Walter J Macdonald 4/13/99

C-22 Repassivation Potential

Specimen: C-22 Welded (both sides)

600 grit polished

HEAT 22778-3235 ^{208/1/99} ~~XX104B~~ XX1045BG11

Start wt. 39.24732g

End wt. 39.19736g

used PTFE crevice block @ 100 in-oz torque

Solution: 4M Cl⁻ 85 ppm HCl₂⁻

20 ppm SO₄²⁻ 10 ppm NO₃⁻ 2 ppm F⁻

467.52g NaCl Lot # 985302

0.55576g NaNO₂ " # 897789

40 ml SO₄²⁻

20 ml NO₃⁻ } 3/99

4 ml F⁻ }

+ DI Water to 2000 mL

Start pH 7.328 End pH 7.991

Potentiostat: EG+C 273 S/N 41108

Counter electrode: Pt flag

Reference: SCE 13-620-51 S/N 9214074

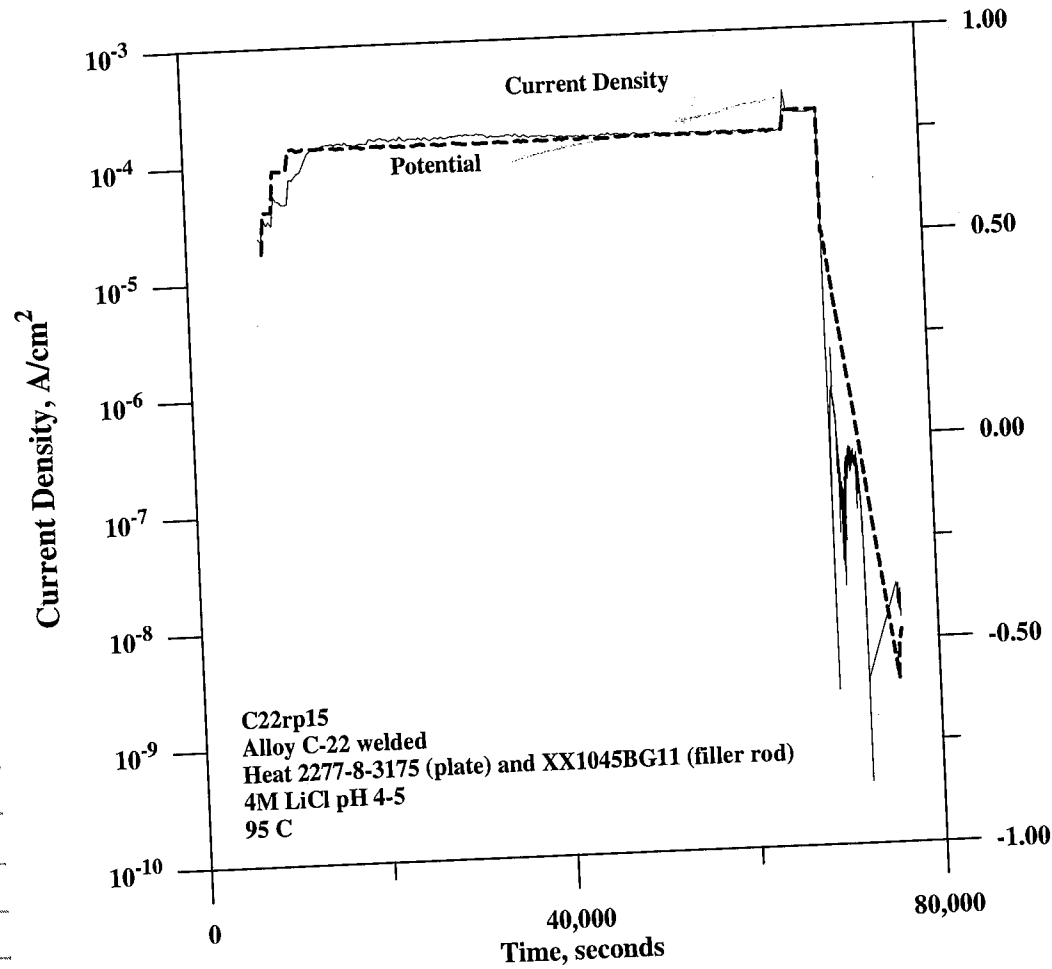
E_{can} -667 mV Keithly 614 S/N 704936

E_{Pt} -168 mV " "

Specimen had brown stain on it
one spot of crevice corrosion visible

David D
5/7/99

David D 8/7/99



$i = 2 \times 10^{-4} \text{ A/cm}^2$ AT 800 mV_{SCE}
 \downarrow TO $- 3 \times 10^{-4} \text{ A/cm}^2$ AT 500 mV_{SCE}
 NO POTENTIAL VALUES BETWEEN 800 AND 500 mV_{SCE}

Paul D 8/8/99

C-22 Passive current density

Specimen: C-22 Heat 2277-8-3175 heat treated @ 800°C for 24 hrs. + water quenched
 Polished to 600 grit.
 Start WT. 12.30569 g
 End WT.

Solution: 4M Cl^- 85 ppm HCO_3^-
 20 ppm SO_4^{2-} 10 ppm NO_3^- 2 ppm F^-
 467.52 g NaCl Lot # 985302
 0.25716 g NaHCO_3 Lot # 897789
 40 ml SO_4^{2-}
 20 ml NO_3^- } 3/99
 4 ml F^-
 + DI Water to 2000 mL

Start pH 6.682 End pH

$T = 95^\circ\text{C}$
~~acrated~~ deacrated w/99.999% N_2
 4/12/99 WJM

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

$E_{com} -591 \text{ mV}$ Keithly 614 S/N 704396
 $E_{Pt} -58 \text{ mV}$ " " " "
 Applied -200 mV_{SCE}

Current density $\approx 0.002 - 0.02 \mu\text{A/cm}^2$
 data saved as C22CP39.DAT
 DATA LOST!

Walter J. Moehrer
 4/13/99

Stock Solutions

SO_4^- 4/99
1000 ppm SO_4^- as Na_2SO_4

1.47819 g Na_2SO_4 Lot # 901213
4/13/99 WSM
+ DI water to 1 L
prep 4/13/99 exp 5/13/99

NO_3^- 4/99
1000 ppm NO_3^- as NaNO_3

1.37196 g NaNO_3 Lot # 961772A
+ DI water to 1 L
prep 4/13/99 exp 5/13/99

F^- 4/99
1000 ppm F^- as NaF

2.20481 g NaF Lot # 896405
+ DI water to 1 L
prep. 4/13/99 exp 5/13/99

David D.
5/31/2000

Walter J. Macomber
4/13/99

C-25 Passive Current Density

Specimen: Same specimen as p.267Solution: Same solution as p.267

Potentiostat: Same as p.267

Conditions: Same as p.267

E_{com} -241 mV Keithly 614 S/N 704396
 E_{PT} -135 mV " " "

 $E_{applied}$ ϕ mV

current density 9-50 nA/cm² SPIRES 400 nA/cm
 4/21/99 wjm

final wt. 12.30596 g

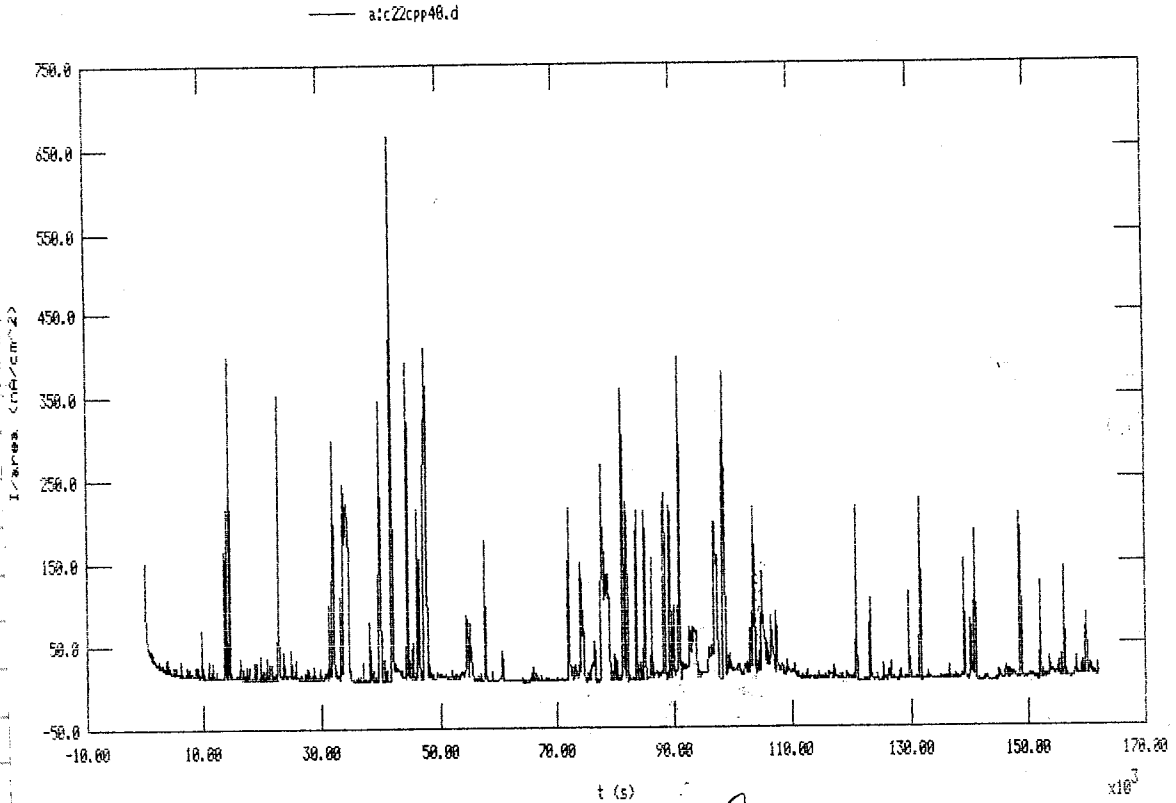
no pits or crevice attack

saved as C22CPP40.DAT

Walter J. Machowski
 4/21/99

David D. 4/13/99

Model 352/252 Corrosion Analysis Software, v. 2.30
 PS POTENTIOSTATIC File Status: NORMAL Date Run: 04-02-99 Time Run: 10:54:32
 CP PASS vs. R CT PASS IP 0.000 vs. R ID 15 S TP 5.400E+01 T1 1.620E+05
 CR AUTO HP 3000 SO Pass IR NONE FL NONE RT HIGH STABILITY
 REF 0.24150 SCE HW SOLID RR 9.500E+00 LS HO EW 0.000E+00 DEN 0.000E+00 AU HO
 OC -0.242
 Comment: C-22 4H Cl w/HCO3; 95°C; 0mV sce; deaerated w/N2 4/16/99



Walter J MacKowski 4/21/99

Model 352/252 Corrosion Analysis Software, v. 2.30
 Filename: a/c22cpp48.dat
 Pstat: VStat[] Ver 2
 PS POTENTIOSTATIC
 Date Run: 04-02-99
 File Status: NORMAL
 Time Run: 10:54:32
 Cond. Time CT Pass s Initial Pot. IP 0.000 V
 Cond. Pot. CP Pass u Time Step 1 T1 162.0E3 s
 Initial Delay ID 10 s Stop On 00 Pass
 Time/Pt. TP 54.00 s Curr. Range CR Auto
 No. of Points HP 3000
 Line Sync. LS no IR Mode IR none
 Rise Time RT high stability Filter FL Off
 Working Elec. WE Solid Ref. Elec. RE SCE 241.5E-3V
 Sample Area AR 9.500 cm^2 Equiv. Wt. EW 0.0000 g
 Density DE 8.000 g/ml AUX A/D AU no
 Open Circuit OC -242.0E-3 V
 Comment: C-22 4H Cl w/HCO3; 95°C; 0mV sce; deaerated w/N2 4/16/99

Walter J MacKowski 4/21/99

Walter J MacKowski 4/21/99

C-22 Passive Current Density

Specimen: Same specimen as p. 267
 Solution: Same solution as p. 267
 Potentiostat: Same as p. 267
 Conditions: Same as p. 267

$E_{can} = -234$
 $E_{pt} = -129$
 $E_{applied} = +200 mV SCE$ 0 mV SCE WD 5/11/99
 $5-20 \mu A/cm^2$
 SPIKES TO $60 \mu A/cm^2$

saved as C22CPP4.DAT

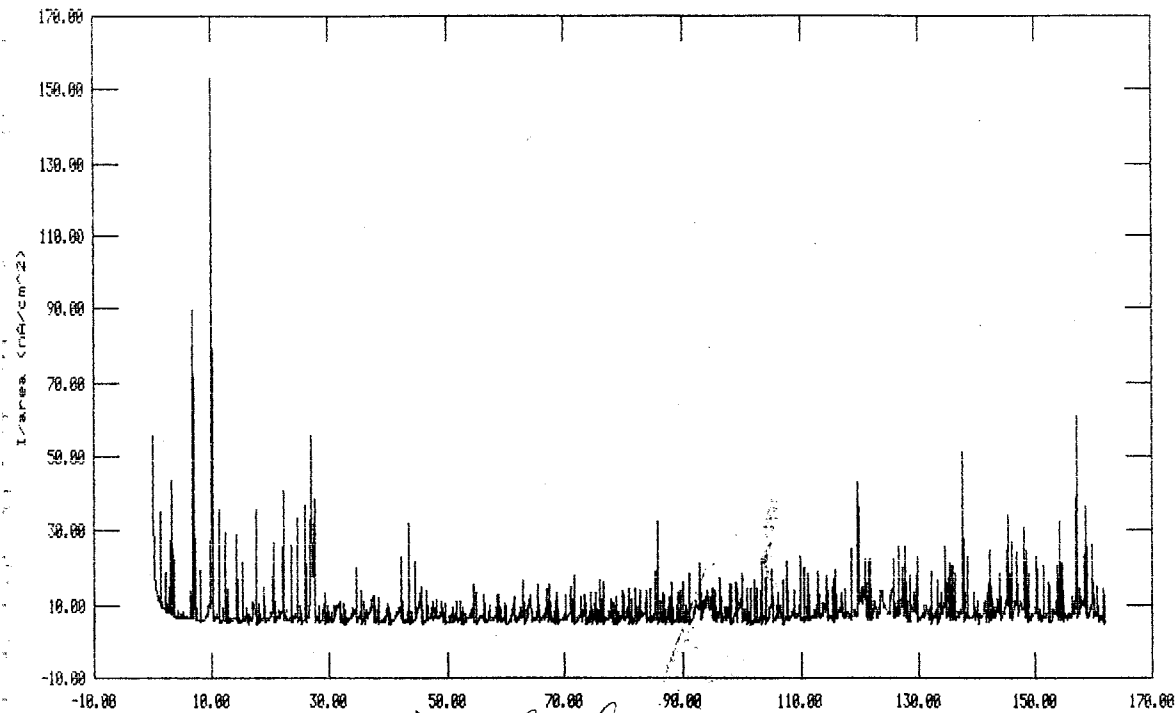
NO SIGN OF LOCALIZED CORROSION
 SPECIMEN HAS SLIGHT GOLD COLOR

#5-40 TAP USED TO CLEAN THREADS ON SPECIMEN
 WEIGHT AFTER THREAD CLEANING 12.30226 g

Walter J MacKowski 4/23/99

Model 352/252 Corrosion Analysis Software, v. 2.30
 PS POTENTIOSTATIC File Status: NORMAL Date Run: 04-04-99 Time Run: 18:53:00
 CP PASS vs. R CT PASS IP 0.000 vs. R ID 15 S TP 5.400E+01 T1 1.620E+05
 CR AUTO NP 3000 SO Pass IR NONE FL NONE RT HIGH STABILITY
 REF 9.24150 SCE WRK SOLID AR 9.500E+00 LS NO EH 0.000E+00 DEN 8.000E+00 AU NO
 OC -0.235
 Comment: C-22 4M Cl⁻ w/HCO₃⁻; 95°C; +200mV sce; deaerated w/N₂ 4/19/99

aic22cpp41.d



Walter J Machowski (S) 4/21/99

Model 352/252 Corrosion Analysis Software, v. 2.30
 Filename: aic22cpp41.d
 Pstat: VStat[] Ver 2
 PS POTENTIOSTATIC File Status: NORMAL
 Date Run: 04-04-99 Time Run: 18:53:00

| | | | | | | | |
|---------------|----|-------|---|--------------|----|---------|---|
| Cond. Time | CT | pass | s | Initial Pot. | IP | 0.0000 | V |
| Cond. Pot. | CP | pass | V | Time Step 1 | T1 | 162.0E3 | s |
| Initial Delay | ID | 15 | s | Stop On | SO | Pass | |
| Time/Pt. | TP | 54.00 | s | Curr. Range | CR | Auto | |
| No. of Points | NP | 3000 | | | | | |

Line Sync. LS no IR Mode IR none
 Rise Time RT high stability Filter FL OFF
 Working Elec. WE Solid Ref. Elec. RE SCE 241.5E-3V
 Sample Area AR 9.500 cm² Equiv. Wt. EH 0.0000 g
 Density DE 8.000 g/ml AUX A/D AU no
 Open Circuit OC -235.0E-3 V

Comment: C-22 4M Cl⁻ w/HCO₃⁻; 95°C; +200mV sce; deaerated w/N₂ 4/19/99
 Walter J Machowski 4/21/99

Walter J Machowski
 4/21/99

LT 825 P5 AC

Specimen: Alloy 825 Ht. 437IF6
 Start wt. 39.09134g
 End wt. 39.08451g 4/23/99 WPM
 2 PTFE washers @ 100 ~~psi~~ in '09

Solution: 1000 ppm Cl⁻ 85 ppm HCO₃⁻
 20 ppm SO₄²⁻ 10 ppm NO₃⁻ 2 ppm F⁻
 3.30614g NaCl # 985302
 0.24633g NaHCO₃ # 897789
 40ml SO₄²⁻
 20ml NO₃⁻
 4ml F⁻ } 4/99 p.269

+ DI water to 2000 mL
 Start pH 8.725 End pH 9.058 0323007
 Temp = 95° Hg thermometer # 183305
 4/23/99 WPM

Potentiostat: ESC 440 #1 Channel #1
 Counter Electrode Pt flag
 Reference: Fisher SCE 13-620-51 S/N 5129169

E_{corr} +0.004 V_{SCE} R_ETNLC7 467374
 E_{pp} +174mV_{SCE} R_ETNLC7 614 467344

Applied +100 mV

TGST STARTED 4/30/99 1:45 PM
 Test stopped 7/2/99

Daniel D 7/2/99

C22L1B

Specimen: C22 Heat 2277-8-3715
Start wt. 47.43068 g
End wt. 47.41868 g
2 PTFE washers @ 100 in-ay

Solution: 4M Cl⁻ 85 ppm HCO₃⁻
20 ppm SO₄²⁻ 10 ppm NO₃⁻ 2 ppm F⁻
467.52 g NaCl # 985302
0.23681 g NaHCO₃ # 897789
40 ml SO₄²⁻
20 ml NO₃⁻ } 4/99 p. 269
4 ml F⁻ }

+ DI water to 2000 mL
Start pH 7.047 End pH 8.857

T = 95°C

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

E_{com} -229 mV RE37N264 614 SN 467374
E_{pt} +167 mV "

E_{applied} +300 mV

TEST STARTED 4/30/99 1:45 PM
Test stopped 7/1/99

David D 7/2/99

DP 4/30/99
~~C22L2A~~ C22L4A

Specimen: C-22 Heat 2277-8-3175
Start wt. 31.17427 g
End wt.
2 PTFE washers @ 100 in-ay

Solution: 4M Cl⁻ 85 ppm HCO₃⁻
20 ppm SO₄²⁻ 10 ppm NO₃⁻ 2 ppm F⁻
467.52 g NaCl # 985302
0.23681 g NaHCO₃ # 897789
40 ml SO₄²⁻
20 ml NO₃⁻ } 4/99 p. 269
4 ml F⁻ }

+ DI water to 2000 mL

Start pH 7.074 T = 95°C
End pH 8.696

Potentiostat: ESC 440 #1 Channel #3
Counter electrode: Pt flag
Reference: Fisher SCE 13-620-51 S/N 3106337

E_{com} -233 mV_{sc} DP 4/30/99
+416 mV RE37N264 614 SN 467374
E_{pt} +178 mV_{sc} "
E_{applied} +500 mV SCE

TEST STARTED 4/30/99 1:45 PM
Test stopped 7/1/99

David D 7/2/99

C25L3B

Specimen: C22 Heat 2277-8-3175
Start wt. 47.2316g
End wt. 47.2160g
2 PTFE washes @ 100 in⁻¹g

Solution: 4M Cl⁻ 85 ppm HClO₃⁻
20 ppm SO₄²⁻ 10 ppm NO₃⁻ 2 ppm F⁻
467.52g NaCl # 985302
0.23591g NaHClO₃ # 897789
40ml SO₄²⁻
20ml NO₃⁻ } 4/99 p.269
4ml F⁻ }

+ DI Water to 2000 mL

Start pH 6.534 End pH 8.425

T=95°C aerated w/gew air

Potentiostat: ESC 440 #1 Chaml #4

Counter electrode: Pt flag

Reference: Fisher SCE 13620-51 S/N 555368

E_{com} -152mV SCE KEITHLEY 614 SN 467374

E_{pt} +116mV SCE

E_{applied} → kept @ open circuit

TEST STARTED 4/30/99 1:45 PM

Test Stopped 7/1/99

Shund D 7/2/99

OC 825 C2 Z

Specimen: Alloy 825 HH 4371FA
Start wt. 39.29286g
End wt. 39.29845g
2 PTFE washes @ 100 in⁻¹g

Solution: 1000 ppm Cl⁻ 85 ppm HClO₃⁻
20 ppm SO₄²⁻ 10 ppm NO₃⁻ 2 ppm F⁻
3.29754g NaCl # 985302
0.23829g NaHClO₃ # 897789
40ml SO₄²⁻
20ml NO₃⁻ } 4/99 p.269
4ml F⁻ }

T=95°C Hythermont 183302 aerated w/gew air

Potentiostat: ESC 440 #1 Channel #5

Counter electrode: none

Reference: Fisher SCE 13620-51 S/N 5129169

E_{com} -92mV SCE KEITHLEY 614 SN 467374

E_{pt} +62mV SCE

Keep @ open circuit

TEST STARTED 4/30/99 1:45 PM

Test Stopped 7/1/99 End pH 9.441

Shund D 7/2/99

C-22 PASSIVE CURRENT DENSITY

SPECIMEN C-22 SAME AS P267

SOLUTION 4MCl- SAME AS P 267

TEMP = 95°C HQ THERMOMETER H 98-162

POTENTIOSTAT VERSASTAT SN 28104

COUNTER ELECTRODE Pt FLAG

REFERENCE FISHER SCE 13-626-51 SN 8122010

E_{CORR} -188mV KEITHLEY 614 SN 704936

E_{PT} -166mV

E_{APPLIED} F400 mV/sce DD 4/28/99 +200 mV/sce

TEST STARTED 4/28/99 8:00 AM

END WEIGHT 12.30596g

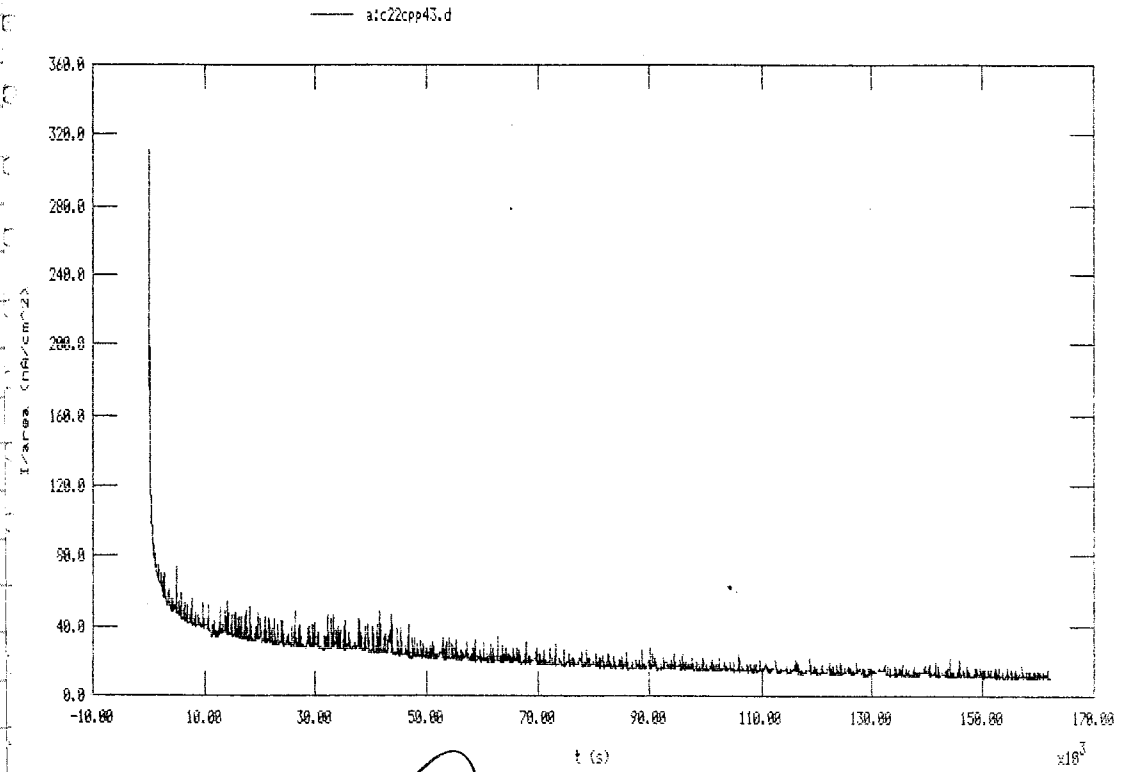
CURRENT 10-21 nA/cm²

SPECIMEN HAS GOLD COLOR - NO SIGN OF LOCALIZED CORROSION

CURRENT PLOT P 281.

Handwritten signature and date: 5/3/99

Model 352/252 Corrosion Analysis Software, v. 2.30 Filename: a:c22cpp43.dat Pstat: VStat[] Ver 2
 PS POTENTIOSTATIC File Status: NORMAL Date Run: 04-07-99 Time Run: 05:09:34
 CP PASS vs. R CT PASS IP 0.200 vs. R ID 15 S TP 5.400E+01 T1 1.620E+05
 CR AUTO NP 3000 SD Pass IR NONE FL NONE RT HIGH STABILITY
 REF 0.24150 SCE WP: SOLID AR 9.500E+00 LS NO EH 0.000E+00 SEN 0.000E+00 AU 00
 OC -0.186
 Comment: C-22 4M Cl w/HClO3; 95°C; +200mV sce; deaerated w/N2 4/28/99



Handwritten signature and date: 5/3/99

Model 352/252 Corrosion Analysis Software, v. 2.30
 Filename: a:c22cpp43.dat
 Pstat: VStat[] Ver 2
 PS POTENTIOSTATIC File Status: NORMAL
 Date Run: 04-07-99 Time Run: 05:09:34

| | | | | | | | |
|---------------|----|----------------|-----------------|--------------|----|---------------|---|
| Cond. Time | CT | pass | s | Initial Pot. | IP | .200, 0E-3 | V |
| Cond. Pot. | CP | pass | V | Time Step 1 | T1 | 162.0E3 | s |
| initial delay | td | | s | stop on | oo | pass | |
| Time/Pt. | TP | 54.00 | s | Curr. Range | CR | Auto | |
| No. of Points | NP | 3000 | | | | | |
| Line Sync. | LS | no | | IR Mode | IR | none | |
| Rise Time | RT | high stability | | Filter | FL | Off | |
| Working Elec. | WE | Solid | | Ref. Elec. | RE | SCE 241.5E-3V | |
| Sample Area | AR | 9.500 | cm ² | Equiv. Wt. | EW | 0.0000 | g |
| Density | DE | 8.000 | g/ml | ARM A/D | AU | no | |
| Open Circuit | OC | -186.0E-3 | V | | | | |

Comment: C-22 4M Cl w/HClO3; 95°C; +200mV sce; deaerated w/N2 4/28/99

Handwritten signature and date: 5/3/99

C-22 PASSIVE CURRENT DENSITY.

SPECIMEN C-22 HEAT 2277-8-3175 HEAT
TREATED AT 870°C FOR 24 HOURS/WATER QUENCHING
SAME AS P 267

SOLUTION 4 MCl⁻ 85 PPM HCO₃ 20 PPM SO₄⁻
10 PPM NO₃⁻ 2 PPM F⁻
SAME AS P 267
START PH 6.682
T=95°C
END PN 8.875 FISHER 950 SN 3340

POTENTIOSTAT VERSASTAT # 20104
COUNTER ELECTRODE Pt FLAG
REFERENCE SCG 13-620-S1 SN 8122010

E_{corr} -179 mV_{SCS} KEITHLEY 614 SN 704936
E_{pt} -161 mV_{SCS} "
E_{APPLIED} 400 mV_{SCS}

TEST STARTED 5/3/99

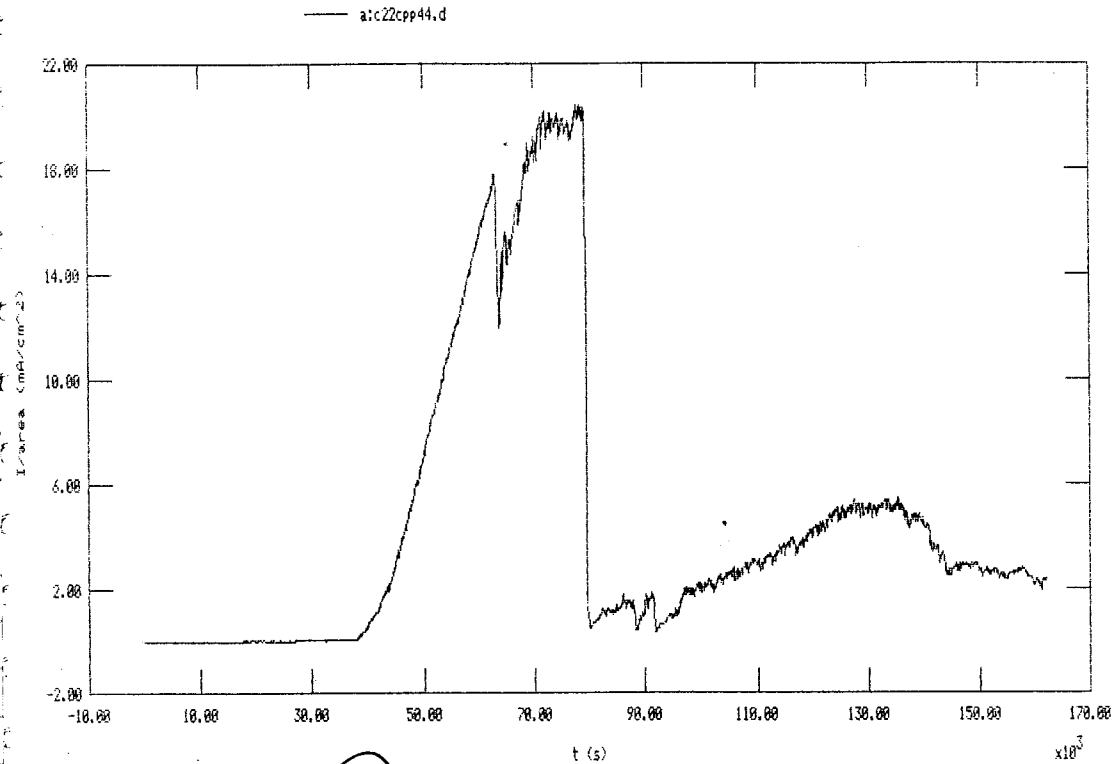
I VERY HIGH UNTIL SPECIMEN CORRODED
INTO 2 PIECES

i_{max} = 21 mA/cm²

SEVERE INTERGRANULAR CORROSION

David D 5/5/99

Model 352/252 Corrosion Analysis Software, v. 2.30
PS POTENTIOSTATIC File Status: NORMAL Date Run: 04-11-99 Time Run: 05:25:01
CP PASS vs. R CT PASS IP 0.400 vs. R ID 15 S TP 5.400E+01 T1 1.620E+05
CR AUTO NP 3000 SO Pass IR NONE FL NONE RT HIGH STABILITY
REF 0.2415E SCE WK SOLID AR 9.500E+00 LS NO EH 0.000E+00 DEN 0.000E+00 AU NO
OC -0.179
Comment: C-22 4M Cl w/HCO3; 95°C; +400mV sce; deaerated w/N2 4/28/99



David D 5/5/99

Model 352/252 Corrosion Analysis Software, v. 2.30
Filename: aic22cpp44.dat
Pstat: VStat() Ver 2
PS POTENTIOSTATIC File Status: NORMAL
Date Run: 04-11-99 Time Run: 05:25:01
Cond. Time CT pass s Initial Pot. IP 400.0E-3 V
Cond. Pot. CP pass V Time Step 1 T1 162.0E3 s
Initial Delay ID 15 s Stop On SO Pass
Time/Pt. TP 54.00 s Curr. Range CR Auto
No. of Points NP 3000
Line Sync. LS no IR Mode IR none
Rise Time RT high stability Filter FL Off
Working Elec. WE Solid Ref. Elec. RE SCE 241.5E-3V
Sample Area AR 9.500 cm² Equiv. Wt. EW 0.0000 g
Density DE 8.000 g/ml AUX A/D AU no
Open Circuit OC -179.0E-3 V

Comment: C-22 4M Cl w/HCO3; 95°C; +400mV sce; deaerated w/N2 4/28/99

David D 5/5/99

STOCK SOLUTIONS 5/99

SO₄ - 5/99

1000 PPM SO₄²⁻ AS Na₂SO₄
1.47395 g Na₂SO₄ LOT 901213
+ DI WATER TO 1000 mL
PREP 5/14/99 EXP 6/14/99

NO₃ - 5/99

1000 PPM NO₃⁻ AS NaNO₃
1.37290 g NaNO₃ LOT 961772A
+ DI WATER TO 1000 mL
PREP 5/14/99 EXP 6/14/99

F - 5/99

1000 PPM F⁻ AS NaF
2.21133 g NaF LOT 896405
+ DI WATER TO 1000 mL
PREPARED 5/14/99 EXP 6/14/99

[Signature] 5/14/99

C 22 REPASSIVATION POTENTIAL

OBJECTIVE MEASURE E_{RP} OF WELDED ALLOY C-22

SPECIMEN WELDED C-22 CREVICE REPASSIVATION SPECIMEN

HEAT 2277-8-3235 WELDED USING
HEAT XX1045B611 FILLER

SPECIMEN SURFACES POLISHED TO 600 GRIT FINISH
DE GREASED IN ACETONE

START WT 38.89245 g SARTORIUS RC 210P^{SN} 10704379
END WT

PTFE CREVICE BLOCKS ATTACHED & TORQUED TO 50 IN. OZ
USING PROTO 6103

2 ML EL 6/14/99 WGM

SOLUTION 4 ML ACET 85 PPM HCO₃ 20 PPM SO₄²⁻ 10 PPM NO₃⁻
2 PPM F⁻ 2000 ML PREPARED AS FOLLOWS

233.76 g NaCl LOT 985302

0.24130 g NaHCO₃ LOT 897789

40 ML SO₄ - 5/99 STOCK SOLUTION P 284

20 ML NO₃ - 5/99 "

4 ML F - 5/99 "

+ DI WATER TO 2000 ML

START pH 7.778 ORION EA 940 SN 4274

END pH ~~8.573~~ 7.322

5/20/99 WGM

POTENTIostat EG&G 273 SN 41108

COUNTER ELECTRODE Pt FLAG

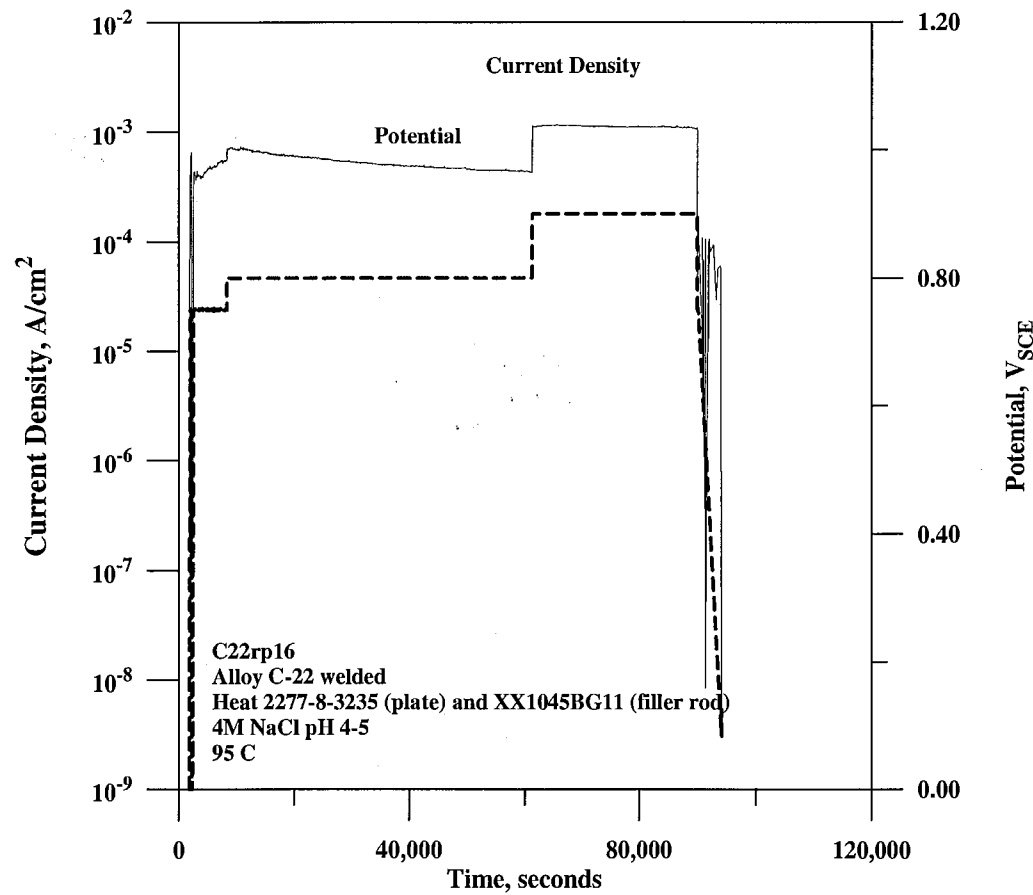
REFERENCE FISHER SCE

E_{corr} -654 mV KSIYNL64 614 SN 704934

E_{RP} -120 mV "

TEST STARTED 5/20/99 2:10 PM

[Signature] 5/22/99



$i < 10^{-5} \text{ A/cm}^2$ 616 mV_{SCE}
 $i < 10^{-6} \text{ A/cm}^2$ 573 mV_{SCE}
 $i < 0$ 543 mV_{SCE}

David D 5/22/99

C-22 Repassivation Potential ^{5/28/99 WJM}
 not welded
 Objective: Measure E_{ap} of welded alloy C-22
 Specimen: alloy C-22 Heat # 2277-8-3175
 polished to 600 grit finish
 PTFE cradle washers attached @ 100 μm - my
 neoprene gasket between specimen + mounting rod
 start wt. 39.99459 g
 end wt. not taken
 2M 6/14/99 WJM
 Solution: 4M Cl⁻ 85 ppm HCO₃⁻
 20 ppm SO₄²⁻ 10 ppm NO₃⁻ 2 ppm F⁻
 233.67 g NaCl Lot # 986519
 0.23672 g NaHCO₃ " 897789
 40ml SO₄²⁻
 20ml NO₃⁻ } 5/99 } stock sol'n p. 284
 4ml F⁻ }
 + DI water to 2000 mL
 Start pH 7.081
 End pH
 Potentiostat EG&G 273 S/N 41108
 Counter electrode Pt flag
 Reference Fisher SCE S/N 8238321
 did not take OCV @ start of test
 specimen a golden brown color
 No localized attack
 will polish this specimen and re-use.
 C22RP17.DAT
 DATA NOT SAVED
 David D 6/8/99
 6/7/99
 Walter J MacKowski

C-22 Passive Current Density

Specimen: C-22 Heat # 2277-8-3175
Heat treated @ 870°C for 4Hrs (water quenched)

Start wt. 12.23564g

Solution: 2M HCl^- 6/14/99 wgm
85 ppm HCl_3^-
20 ppm SO_4^- 10 ppm NO_3^- 2 ppm F
233.67g NaCl Lot # 986519
0.23461g $NaHCO_3$ Lot # 897789
40 ml SO_4^- }
20 ml NO_3^- } 5/99 Stock sol'n p284
4 ml F. }
+ DI water to 2000 mL

Start pH 6.737

95°C de-aerated w/ yew mixer

Potentiostat Venostat # 20104

Counter electrode Pt flag

Ref. SCE 13-620-51 S/N 8122010

E_{cor} -391 mV_{SCE}

E_{Pt} -548 mV_{SCE}

$E_{applied}$ -200 mV_{SCE}

TEST STARTED 5/29/99 8:50 AM

Lost connection w/ reference electrode - test no good
data not saved.

Daniel D
5/31/2000

6/1/99
Walter J Machowski

C-22 Passive Current Density

Specimen: C-22 Heat # 2277-8-3175
Heat treated @ 870°C for 8 hrs + water quenched

start wt. 12.25262 g. end 12.25270 g
2M 6/4/99 wjm

Solution: 4M Cl⁻ 85 ppm HCO₃⁻
20 ppm SO₄⁻ 10 ppm NO₃⁻ 2 ppm F⁻
233.67 g NaCl Lot # 986519
6/1/99 0.2346 g 0.23516 g NaHCO₃ Lot # 897789
wjm 40 ml SO₄⁻ }
20 ml NO₃⁻ } 5/99 stock sol'n p. 284
4 ml F⁻ }

+ DI Water to 2000 mL

Start pH not taken

95°C deaerated w/ gaseous N₂

Potentiostat Versastat # 20104
Counter electrode Pt flag
Ref. SCE 13-620-51 S/N 8122010

E_{can} -438 mV RESTNLCY 614 704936
E_{pt} -169 mV "

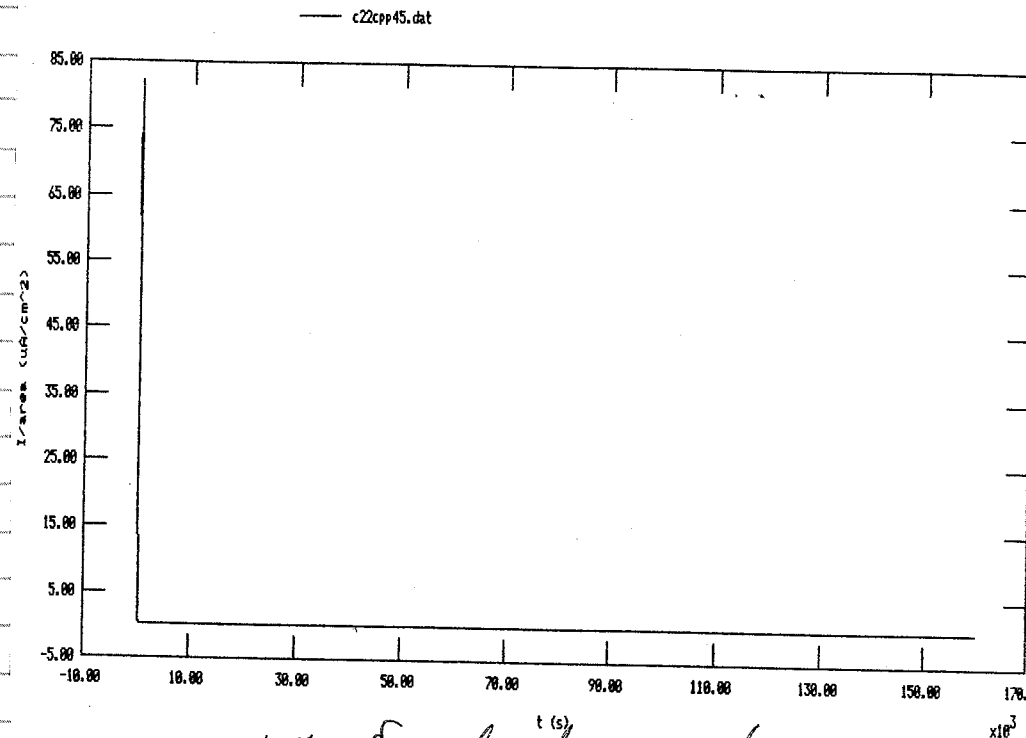
E_{applied} -200 mV_{SCE}

saved as C22CPP45.DAT

Current ± 0.005 μA/cm²

Printed On 5/31/2000

Model 332/252 Corrosion Analysis Software, v. 2.30
PS POTENTIOSTATIC File Status: NORMAL Date Run: 05-26-99 Time Run: 06:51:07 Pstat: VStat() Ver 2
CP PASS vs. R CT PASS IP -8.288 vs. R ID 5 S TP 5.333E+01 T1 1.680E+05
CR AUTO HP 3000 SQ Pass IR NONE FL 1 5.3Hz RT HIGH STABILITY
REF 0.24150 SCE WRK SOLID AR 8.000E+00 LS YES EN 0.000E+00 DEN 8.900E+00 AU NO
OC -0.435
Comment: Alloy C-22 2277-8-3175 treated @ 870°C for 8 hrs; 4M Cl 95%



Walter J Macchowski 6/4/99

Model 332/252 Corrosion Analysis Software, v. 2.30
Filename: a:\c22cpp45.dat
Pstat: VStat() Ver 2
PS POTENTIOSTATIC File Status: NORMAL
Date Run: 05-26-99 Time Run: 06:51:07
Cond. Time CT pass s Initial Pot. IP -288.8E-3 V
Cond. Pot. CP pass V Time Step 1 T1 160.8E3 s
Initial Delay ID 5 s Stop On SQ Pass
Time Pt. TP 53.33 s Curr. Range CR Auto
No. of Points HP 3000
Line Sync. LS yes IR Mode IR none
Rise Time RT high stability Filter FL 1 5.3Hz
Working Elec. WE Solid Ref. Elec. RE SCE 241.5E-3V
Sample Area AR 8.000 cm² Equiv. Wt. EN 8.0000 g
Density DE 8.900 g/ml ALK A/B AU no
Open Circuit OC -435.8E-3 V

Comment: Alloy C-22 2277-8-3175 treated @ 870°C for 8 hrs; 4M Cl 95%

Walter J Macchowski 6/4/99

Walter J Macchowski 6/4/99

C-22 Passive Current Density

Specimen: C-22 same one as p. 290

Start WT, 12.25270g

END WT 12.24260g

Solution: Same solution as p. 290
re-used for continuation

⊕ note solution was incorrect molality
will remake solution and rerun @ -200mV

PASSIVE CURRENT RATE 0.002 $\mu\text{A}/\text{cm}^2$

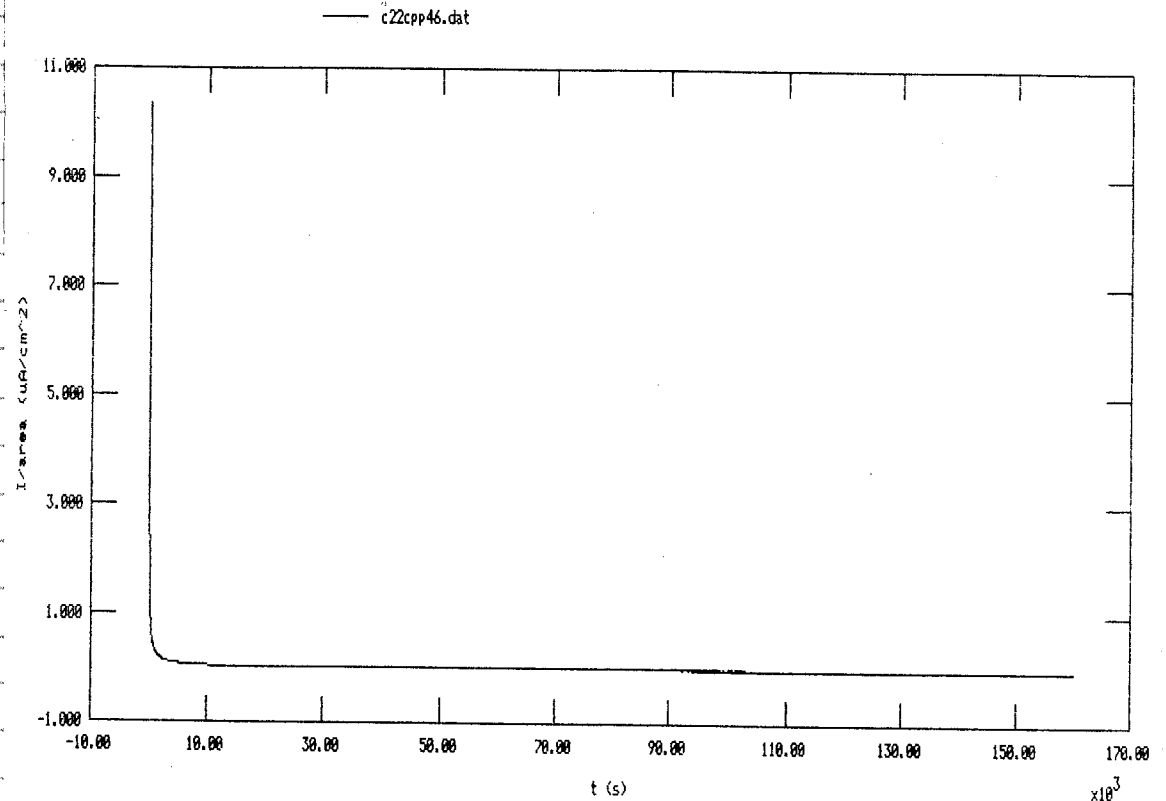
Solution: 4M Cl^- 85ppm HCO_3^-
20ppm SO_4^{2-} 10ppm NO_3^- 2ppm F^-
467.52g NaCl Lot # 986519
0.23610g NaHCO_3 " # 897789
40ml SO_4^{2-}
20ml NO_3^- } 5/99 p. 284
9ml F^- }

+ DI Water to 2000 mL

Start pH 6.870

David D 5/31/2000

Model 352/252 Corrosion Analysis Software, v. 2.30
PS POTENTIOSTATIC File Status: NORMAL Date Run: 05-27-99 Time Run: 12:22:09
CP PASS vs. R CT PASS IP -0.200 vs. R ID 5 S TP 5.333E+01 T1 1.600E+05
CR AUTO HP 3000 SO Pass IR NONE FL 1.5.3Hz RT HIGH STABILITY
REF 0.24150 SCE WPK SOLID AR 8.000E+00 LS YES EN 0.000E+00 DEN 8.900E+00 AU NO
OC -0.632
Comment: Alloy C-22 2277-8-3175 treated @ 870°C for 8 hrs; 4M Cl 95%



David D 6/7/99

Model 352/252 Corrosion Analysis Software, v. 2.30
Filename: a:\c22cpp46.dat
Pstat: VStat[] Ver 2
Date Run: 05-27-99 Time Run: 12:22:09
File Status: NORMAL
PS POTENTIOSTATIC
Cond. Time CT pass s Initial Pot. IP -200.0E-3 V
Cond. Pot. CP pass V Time Step 1 T1 168.0E3 s
Initial Delay ID 5 s Stop On SO Pass
Time/Pt. TP 53.33 s Curr. Range CR Auto
No. of Points HP 3000
Line Sync. LS yes IR Mode IR none
Rise Time RT high stability Filter FL 1.5.3Hz
Working Elec. WE Solid Ref. Elec. RE SCE 241.5E-3V
Sample Area AR 8.000 cm^2 Equiv. Wt. EW 0.0000 g
Density DE 8.900 g/ml AUX A/D AU no
Open Circuit OC -632.0E-3 V

Comment: Alloy C-22 2277-8-3175 treated @ 870°C for 8 hrs; 4M Cl 95%

David D 6/7/99

C-22 Repassivation Potential

Objective: Measure Exp of C22

Specimen: Alloy C-22 Heat # 2277-8-3175

Same specimen as p. 287 repolished to 600 grit PTFE crevice washer, attached under test solution neoprene gasket as p. 287; completely immersed

Solution: 4M Cl⁻ 85 ppm HCO₃⁻
 20 ppm SO₄²⁻ 10 ppm NO₃⁻ 2 ppm F⁻
 467.52 g NaCl # 986519
 0.25573 g NaHCO₃ # 897789
 40 ml SO₄²⁻
 20 ml NO₃⁻ } 5/99 p. 284
 4 ml F⁻
 + DI water to 2000 ml

Start pH 4-5

initial act: not taken

Potentiostat: EA+B 273 S/N 41108

Counter electrode: Pt flag

Ref. SCE 13-620-51 S/N 9214874

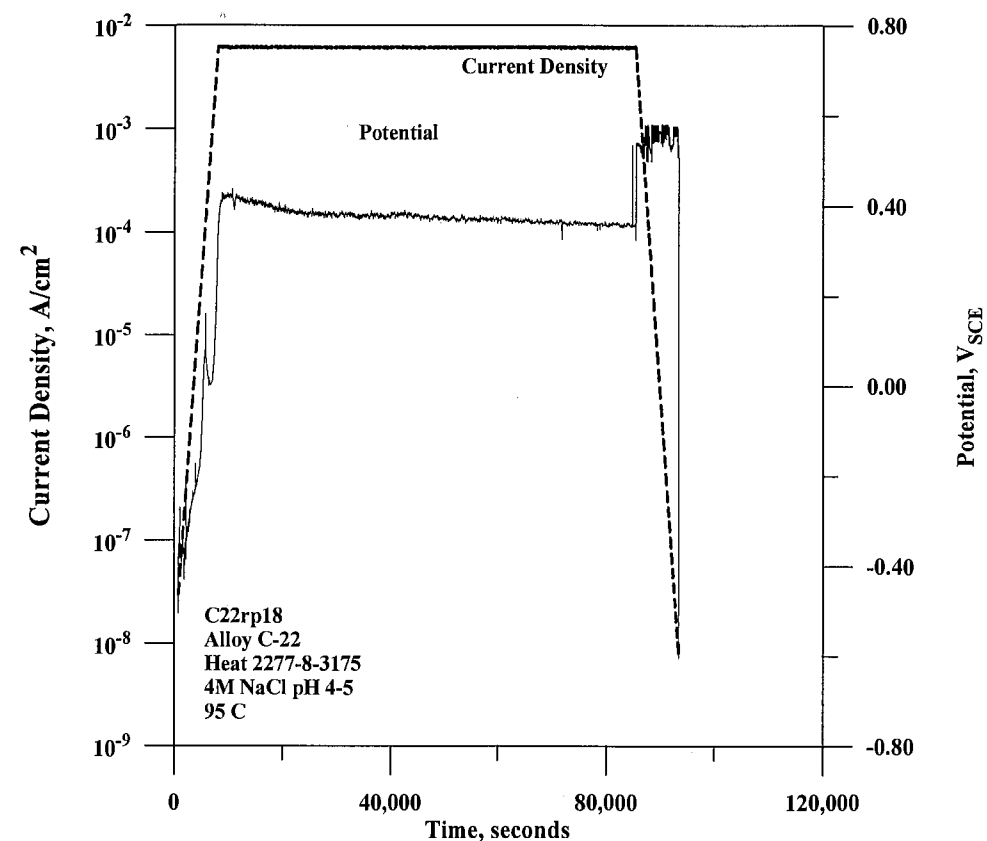
E_{corr} -476 mV Keithly 614 704934

E_{pt} -43 mV " " "

some crevice attach noted
 data looked strange

will re-run C22RP18.DAT

Darrell Dunn 5/31/2000



Darrell D
 5/31/2000

C-22 Passive Current Density

Specimen: C-22 same as p.290

Start wt. 12.24260g
end wt. 12.24215g
Solution same as p.292
re-used for continuation

$E_{com} = -240$ Keckly 614 704982
 $E_{PS} = -206$ " "

$E_{applied} \text{ } \emptyset \text{ mV}$

$T = 95^{\circ}C$ de-aerated w/ zero N_2

Potentiostat Versatstat #20104
Counter PT flange
Ref SCE 13-620-51 s/n 3106337

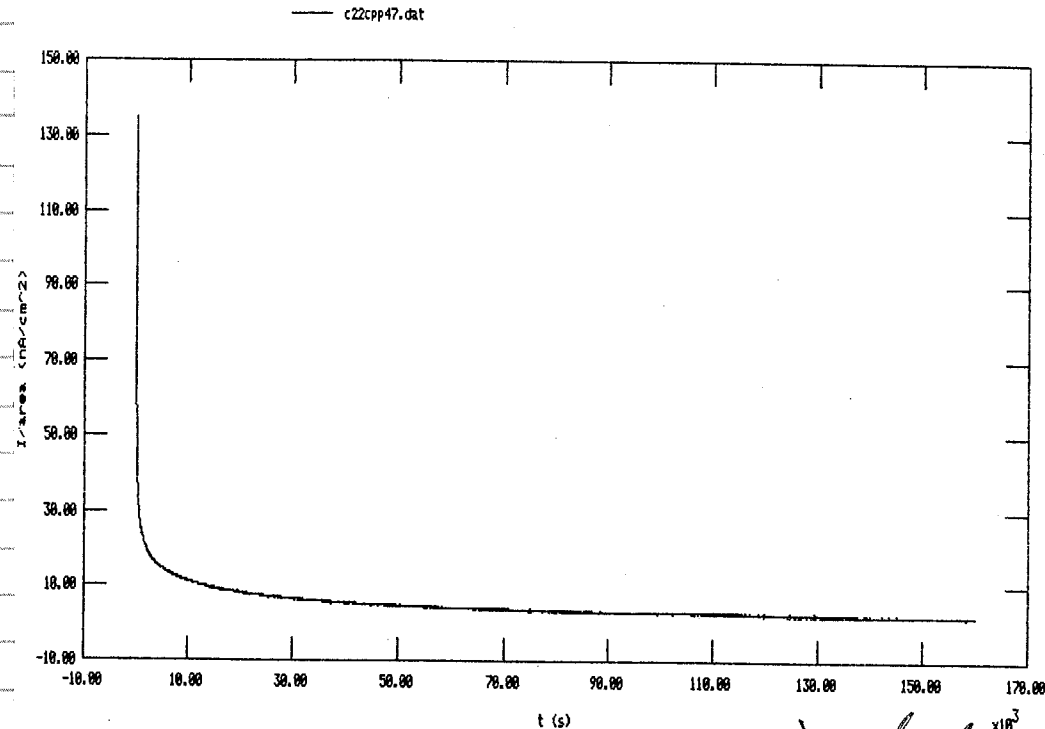
specimen still silvery, no attack

current $\approx 2.25 \rightarrow 3.65 \mu A/cm^2$

saved as C22CPP47.DAT

6/10/99
Walter J MacKowski

Model 352/252 Corrosion Analysis Software, v. 2.38
PS POTENTIOSTATIC File Status: NORMAL Date Run: 05-30-99 Time Run: 06:34:22 Pstat: VStat[] Ver 2
CP PASS vs. R CT PASS IP 0.000 vs. R ID 5 S TP 5.333E+01 T1 1.600E+05
CR AUTO HP 3000 SD Pass IR NONE FL 1 5.3Hz RT HIGH STABILITY
REF 0.24150 SCE WK SOLID AR 8.000E+00 LS YES EM 0.000E+00 DEN 8.900E+00 AU NO
OC -0.238
Comment: Alloy C-22 2277-0-3175 treated @ 870°C for 8 hrs; 4M Cl 95%



6/10/99 Walter J MacKowski

Model 352/252 Corrosion Analysis Software, v. 2.38
Filename: a:\c22cpp47.dat
Pstat: VStat[] Ver 2
PS POTENTIOSTATIC File Status: NORMAL
Date Run: 05-30-99 Time Run: 06:34:22
Cond. Time CT pass s Initial Pot. IP 0.0000 V
Cond. Pot. CP pass V Time Step 1 T1 160.0E3 s
Initial Delay ID 5 s Stop On SO Pass
Time/Pt. TP 53.33 s Curr. Range CR Auto
No. of Points HP 3000
Line Sync. LS yes IR Mode IR none
Rise Time RT high stability Filter FL 1 5.3Hz
Marking Elec. ME Solid Ref. Elec. RE SCE 241.5E-3V
Sample Area AR 8.000 cm² Equiv. Wt. EW 0.0000 g
Density DE 8.900 g/ml AUX A/B AU no
Open Circuit OC -238.0E-3 V

Comment: Alloy C-22 2277-0-3175 treated @ 870°C for 8 hrs; 4M Cl 95%
6/10/99 Walter J MacKowski

6/10/99
Walter J MacKowski

C-22 Repassivation Potential

Objective: Measure E_{RP} of C-22

Specimen: Same as p. 294 replished to 600 grit gasket, PTFE, the same

Solution: 4M Cl⁻ 85 ppm HCO₃⁻
 20 ppm SO₄²⁻ 10 ppm NO₃⁻ 2 ppm F⁻
 467.52 g NaCl # 986519
 0.23577 g NaHCO₃ # 897789
 40 ml SO₄²⁻
 20 ml NO₃⁻
 4 ml F⁻ } 5/99 p 284

+ DI Water to 2000 mL

start pH 7.863

Potentiostat: EG&G 273 s/n 41108

Counter electrode: Pt flag

Ref. SCE 13-620-51 s/n 9214094

E_{com} -493 mV Keithly 614 704934

E_{Pt} -492 mV

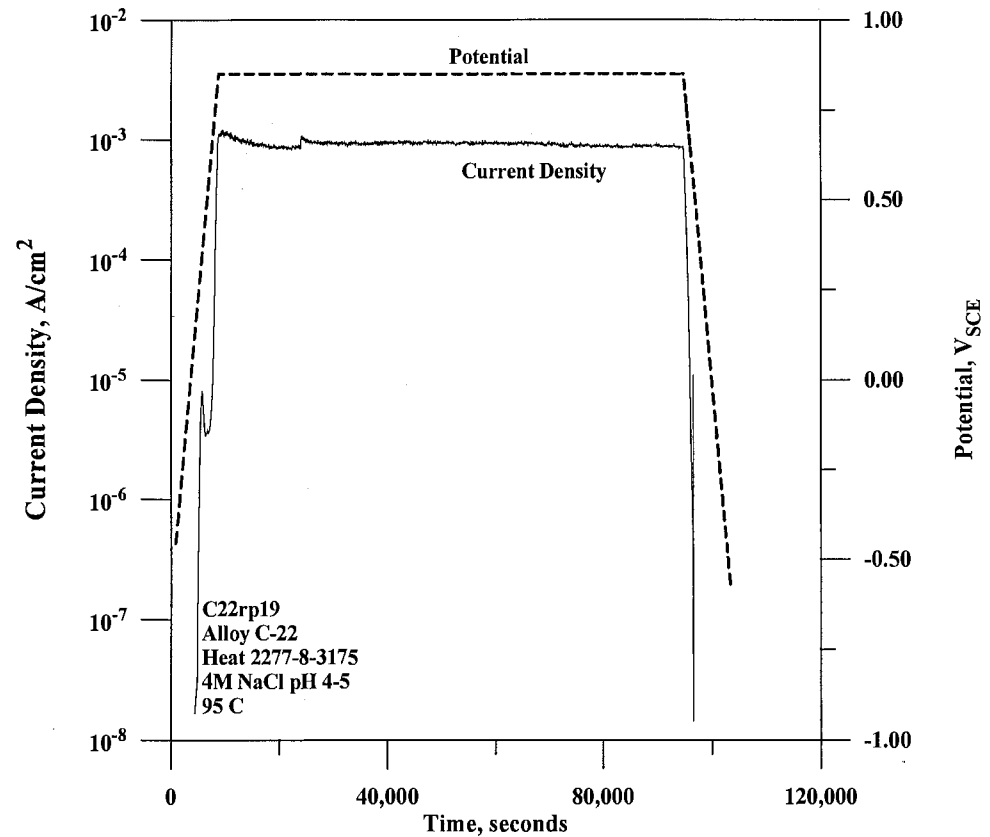
held @ +850 mV for 24 hours

specimen had black smut - easily rinsed off several areas of crevice attack

end wt. 38.86901g int wt: not taken

saved as C22RP19.DAT

6/11/99 Walter J Machowski



Paul Dunn 5/31/2000

C-22 Passive Current Density

Specimen: C-22 same as p. 290

Start wt. 12.24215 g

end wt. 12.21397 g

Solution: same as p. 292
re-used for continuation

E_{con} -165 mV Keithly 614 #704936

E_{PT} -206 mV

E applied +200 mV

T_{env} = 95°C de-aerated w/geo N₂

Potentiostat: Vestat #20104

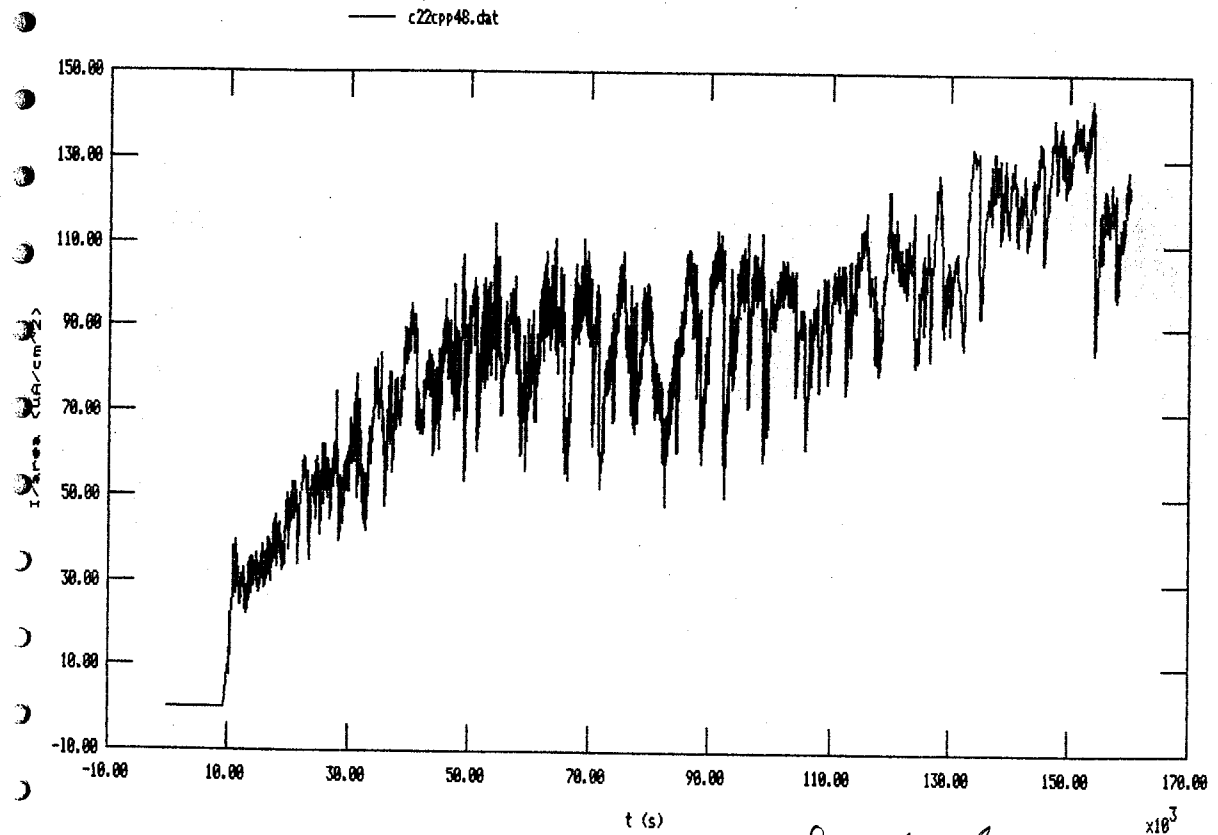
Counter: Pt flag

Reference: SCE 13-620-51 #3106337

saved as C22CPP48.DAT
some attack at non-immersed regions, however
salt bridge may have lost contact w/ref
test will be re-run

Duane Dunn 5/31/2000

Model 352/252 Corrosion Analysis Software, v. 2.30
PS POTENTIOSTATIC File Status: NORMAL Date Run: 05-31-99 Time Run: 10:42:48 Pstat: VStat() Ver 2
CP PASS vs. R CT PASS IP 0.200 vs. R ID 5 S TP 5.333E+01 T1 1.600E+05
CR AUTO HP 3000 SO Pass IR NONE FL 1 5.3Hz RT HIGH STABILITY
REF 0.24150 SCE MPK SOLID AR 0.000E+00 LS YES EM 0.000E+00 IEN 0.900E+00 AU NO
OC -0.165
Comment: Alloy C-22 2277-0-3175 treated @ 870°C for 8 hours; 4M Cl 95°C; +200mV



6/23/99 Walter J Macdonald

Model 352/252 Corrosion Analysis Software, v. 2.30
Filename: a:\c22cpp48.dat
Pstat: VStat() Ver 2
PS POTENTIOSTATIC File Status: NORMAL
Date Run: 05-31-99 Time Run: 10:42:48
Cond. Time CT pass s Initial Pot. IP 200.0E-3 V
Cond. Pot. CP pass V Time Step 1 T1 160.0E3 s
Initial delay IN 0 s stop on SO Pass
Time/Pt. TP 53.33 s Curr. Range CR Auto
No. of Points NP 3000
Line Sync. LS yes IR Mode IR none
Rise Time RT high stability Filter FL 1 5.3Hz
Working Elec. WE Solid Ref. Elec. RE SCE 241.5E-3V
Sample Area SA 0.000 cm² Equiv. Wt. EW 0.0000 g
Density DE 8.900 g/ml AUX A/D AU no
Open Circuit OC -165.0E-3 V

Comment: Alloy C-22 2277-0-3175 treated @ 870°C for 8 hours; 4M Cl 95°C; +200mV

6/23/99 Walter J Macdonald

6/23/99
Walter J Macdonald

C-22 Passive Current Density

Specimen: C-22 same as p.290
start wt, 12.21397 g
end wt

Solution: same as p.292

E_{corr} -329 mV Keithly 614 #704936
 E_{Pt} -252 mV " "

$E_{applied}$ +200mV

Temp = 95°C de-aerated w/zero N₂

Potentiostat: Versastat #20104
Counter electrode: Pt flag
Reference: SCE # 13-620-51 SW 3106337

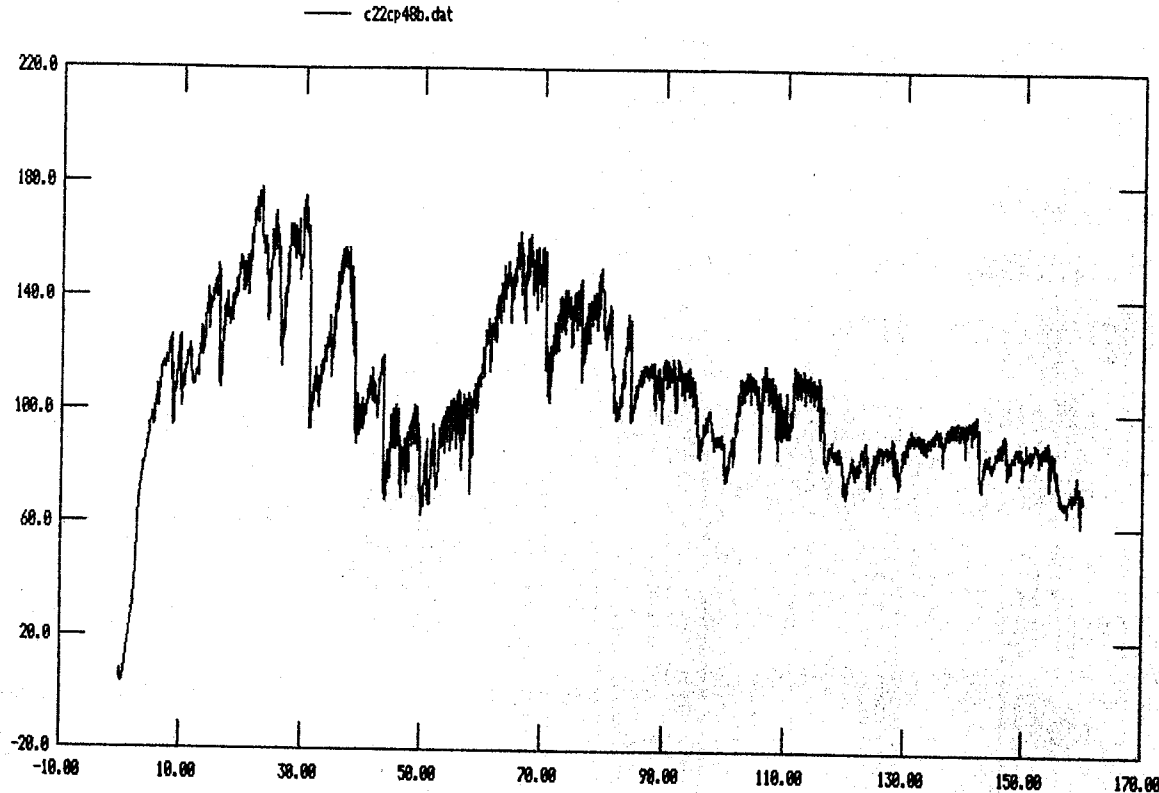
saved as C22CP48B.DAT

end pH 8.620

local corrosion especially at interface region
at the liquid level line

[Signature] 5/31/2000

Model 352/252 Corrosion Analysis Software, v. 2.38
 PS POTENTIOSTATIC File Status: NORMAL Date Run: 06-03-99 Time Run: 05:17:25
 CP PASS vs. R CT PASS JP 0.200 vs. R ID 5 S TP 5.333E+01 T1 1.600E+05
 CR AUTO NP 3000 SO Pass IR NONE FL 1 5.3Hz RT HIGH STABILITY
 REF 0.24150 SCE WRK SOLID AR 8.000E+00 LS YES EN 0.000E+00 DEN 8.900E+00 AU NO
 OC -0.330
 Comment: Alloy C-22 2277-0-3175 treated @ 870°C for 4 hrs; 4M Cl 95%; +200mV; RE-RUN



6/23/99 *[Signature]*

Model 352/252 Corrosion Analysis Software, v. 2.38
 Filename: a:\c22cp48b.dat
 Pstat: VStat[] Ver 2
 PS POTENTIOSTATIC File Status: NORMAL
 Date Run: 06-03-99 Time Run: 05:17:25

| | | | | | | | |
|---------------|----|----------------|-----------------|--------------|----|---------------|---|
| Cond. Time | CT | pass | s | Initial Pot. | IP | 200.0E-3 | V |
| Cond. Pot. | CP | pass | v | Time Step 1 | T1 | 160.0E3 | s |
| Initial delay | ID | 0 | s | stop on | SO | pass | |
| Time/Pt. | TP | 53.33 | s | Curr. Range | CR | Auto | |
| No. of Points | NP | 3000 | | | | | |
| Line Sync. | LS | yes | | IR Mode | IR | none | |
| Rise Time | RT | high stability | | Filter | FL | 1 5.3Hz | |
| Working Elec. | WE | Solid | | Ref. Elec. | RE | SCE 241.5E-3V | |
| Sample Area | AR | 8.000 | cm ² | Equiv. Wt. | EW | 0.0000 | g |
| Density | DE | 8.900 | g/ml | AUX A/D | AU | no | |
| Open Circuit | OC | -330.0E-3 | v | | | | |

Comment: Alloy C-22 2277-0-3175 treated @ 870°C FOR 0 hrs; 4M Cl 95%; +200mV; RE-RUN
6/23/99 *[Signature]*

6/23/99 *[Signature]*

I have reviewed this notebook and find it in compliance with QAP-001. There is sufficient information regarding procedures used for conducting tests, acquiring and analyzing data so than another qualified individual could repeat the activity.

N. Sridhar
8/8/2000

ADDITIONAL INFORMATION FOR SCIENTIFIC NOTEBOOK #: 086

| | |
|--|---|
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| File Types: (.exe, .bat, .zip, etc.) | dat, asci, binder, lst |
| Remarks: (computer runs, etc.) | Media contains: Data files containing electrochemical information |