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Scientific Notebook # 027: Stress Corrosion Cracking of Alloy 825, 316L Stainless Steel, and U Bend Tests (09/01/1994 through 04/01/1997)

IWPE CNWRA-027

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INTEGRATED WASTE PACKAGE EXPERIMENTS

TASK 2 _ STRESS CORROSION CRACKING.
SUBTASK 2.2 SLOW STRAIN RATE TESTS

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SUBTASK 2.2 SLOW STRAIN RATE TESTS (SSRT)

The objective of this task is to determine the environmental conditions (potential, solution composition, temperature, pH, etc) that may promote stress corrosion cracking (SCC) of the candidate alloys for HLW containers.

The test plan for this subtask (IWPE Intermediate Milestone 203704042-205, under IWPE Project Plan Revision 3) describe the experimental conditions for the SSRT.

The equipment to be used in these tests is described below.

A) Two slow strain rate or constant extension rate machines, designated #1 and #2. Each machine is composed of a frame, power drive (electric motor with speed controller), speed reducers and screw jack. The machines were built in SwRI and borrowed from Div 06. They were reconditioned and equipped with a load cell to measure the load during straining and a linear voltage differential transducer (LVDT) to measure the displacement of the machine cross-head (or the extension of the specimen).

The cross-head displacement rate (inches/sec) is given in the following tables as a function of rotation speed (ie time per revolution in sec) of the sprocket wheel of the gear box.

GEAR BOX RATIO = 1600:1
WORM GEAR BOX RATIO 24 TURNS = 1" DISPLACMENT

ALL SEC PER TURN RATES ARE LOOKING AT FAST END
OF 1600:1 GEAR BOX , NOT MOTOR

SEC/TURN	HEAD RATE (INCHES/SEC)
0. 5000000	5. 2083335E-05
1. 000000	2. 6041667E-05
1. 500000	1. 7361112E-05
2. 000000	1. 3020834E-05
2. 500000	1. 0416667E-05
3. 000000	8. 6805558E-06
3. 500000	7. 4404761E-06
4. 000000	6. 5104168E-06
4. 500000	5. 7870370E-06
5. 000000	5. 2083333E-06
5. 500000	4. 7348485E-06
6. 000000	4. 3402779E-06
6. 500000	4. 0064101E-06
7. 000000	3. 7202381E-06
7. 500000	3. 4722223E-06
8. 000000	3. 2552084E-06
8. 500000	3. 0637254E-06
9. 000000	2. 8935185E-06
9. 500000	2. 7412282E-06
10. 00000	2. 6041666E-06
10. 50000	2. 4801586E-06
11. 00000	2. 3674243E-06
11. 50000	2. 2644927E-06
12. 00000	2. 1701389E-06
12. 50000	2. 0833334E-06
13. 00000	2. 0032051E-06
13. 50000	1. 9290123E-06
14. 00000	1. 8601190E-06
14. 50000	1. 7959770E-06
15. 00000	1. 7361111E-06
15. 50000	1. 6801075E-06
16. 00000	1. 6276042E-06
16. 50000	1. 5782829E-06
17. 00000	1. 5318627E-06
17. 50000	1. 4880952E-06
18. 00000	1. 4467593E-06
18. 50000	1. 4076577E-06
19. 00000	1. 3706141E-06
19. 50000	1. 3354701E-06
20. 00000	1. 3020833E-06
20. 50000	1. 2703252E-06
21. 00000	1. 2400793E-06
21. 50000	1. 2112403E-06
22. 00000	1. 1837121E-06
22. 50000	1. 1574074E-06
23. 00000	1. 1322463E-06
23. 50000	1. 1081561E-06
24. 00000	1. 0850695E-06
24. 50000	1. 0629252E-06
25. 00000	1. 0416667E-06
25. 50000	1. 0212418E-06
26. 00000	1. 0016025E-06
26. 50000	9. 8270436E-07
27. 00000	9. 6450617E-07
27. 50000	9. 4696969E-07

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28. 00000	9. 3005951E-07
28. 50000	9. 1374267E-07
29. 00000	8. 9798851E-07
29. 50000	8. 8276835E-07
30. 00000	8. 6805557E-07
30. 50000	8. 5382516E-07
31. 00000	8. 4005376E-07
31. 50000	8. 2671960E-07
32. 00000	8. 1380210E-07
32. 50000	8. 0128206E-07
33. 00000	7. 8914144E-07
33. 50000	7. 7736320E-07
34. 00000	7. 6593136E-07
34. 50000	7. 5483092E-07
35. 00000	7. 4404761E-07
35. 50000	7. 3356807E-07
36. 00000	7. 2337963E-07
36. 50000	7. 1347034E-07
37. 00000	7. 0382885E-07
37. 50000	6. 9444445E-07
38. 00000	6. 8530704E-07
38. 50000	6. 7640690E-07
39. 00000	6. 6773504E-07
39. 50000	6. 5928270E-07
40. 00000	6. 5104166E-07
40. 50000	6. 4300411E-07
41. 00000	6. 3516262E-07
41. 50000	6. 2751002E-07
42. 00000	6. 2003966E-07
42. 50000	6. 1274511E-07
43. 00000	6. 0562013E-07
43. 50000	5. 9865903E-07
44. 00000	5. 9185606E-07
44. 50000	5. 8520601E-07
45. 00000	5. 7870369E-07
45. 50000	5. 7234433E-07
46. 00000	5. 6612316E-07
46. 50000	5. 6003586E-07
47. 00000	5. 5407804E-07
47. 50000	5. 4824562E-07
48. 00000	5. 4253474E-07
48. 50000	5. 3694157E-07
49. 00000	5. 3146260E-07
49. 50000	5. 2609425E-07
50. 00000	5. 2083334E-07
50. 50000	5. 1567656E-07
51. 00000	5. 1062091E-07
51. 50000	5. 0566342E-07
52. 00000	5. 0080126E-07
52. 50000	4. 9603176E-07
53. 00000	4. 9135218E-07
53. 50000	4. 8676014E-07
54. 00000	4. 8225309E-07
54. 50000	4. 7782873E-07
55. 00000	4. 7348485E-07
55. 50000	4. 6921923E-07
56. 00000	4. 6502976E-07
56. 50000	4. 6091446E-07
57. 00000	4. 5687133E-07
57. 50000	4. 5289855E-07
58. 00000	4. 4899426E-07
58. 50000	4. 4515670E-07

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CALIBRATION OF LOAD CELLS AND LVDTs

1. The two load cells and two LVDTs (used to measure extension) were each calibrated as units with their respective amplifiers, as follows:

Load cells, Sensotec Model 31/2328-01, 0-2000 lbs and Shaevitz Model ATA 101D Analog Transducer Amplifier, p/n 2291319-000.
System ~~1~~ 2 transducer s/n 45, amplifier s/n 275743
System ~~2~~ 1 transducer s/n 14, amplifier s/n 275744
gae 1/17/92

LVDTs, Shaevitz Model 249XS-B and Shaevitz Model ATA101 Amplifier, p/n 2291301-000.
System 1: transducer s/n 512, amplifier s/n 1385
System 2: transducer s/n 492, amplifier s/n 1438

2. Standards used for calibration:

Load cell calibration:
Morehouse Proving Rings, a) 1000 lb. capacity, s/n 3668-C-707, calibrated 5/21/90, due 5/21/92, by National Standards Testing Laboratories (SwRI Qualified Vendor) b) 10000 lb. capacity, s/n 5616, calibrated 4/26/90, due 4/26/92, by National Standards Testing Laboratory. ASTM Method E 74 was utilized to calibrate the proving rings and copies of the proving ring calibration certificates were provided for incorporation into the Scientific Notebook.

Digital Voltmeter HP 3465A, s/n 1621A14242, calibrated 6/10/91, due 12/10/91.

LVDT calibration:
Drum Micrometer (accuracy .0001"), s/n 2-1, calibrated 4/19/91, due 10/19/91.

Digital Voltmeter HP 3465B, s/n 1530A02153, calibrated 2/6/91, due 8/6/91.

3. Calibrations were performed by V. Aaron, SwRI Nuclear QA Program qualified Calibration and Test Technician.

4. Load cell calibrations were performed in accordance with ASTM Method E 4, with applied loads from 0 to 1000 lbs. in 50 lb. increments, and 0 and from 700 to 2000 lbs. in 100 lb. increments with the heavier proving ring. Measurements at each load were made and repeated for three sets of data, which were averaged. The signal output was calculated and averaged approximately 300 lbs./volt. The load cells were also placed on a frame with a constant dead weight to determine drift. After about three hours of warm-up, the signal stabilized, varying about 2% with room temperature variations.

4. The LVDT calibration was from the range of -.250" to +.250", in increments of .025", with output signals from -5 to +5 volts (about .05 inch/volt). The LVDTs were accurate to within approximately 1%.

5. No deviations from the referenced documents were observed.

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(1)

Standard Used: Morehouse Proving Ring Serial No: 5616 - (1KIP)
Calibration of: 2.0 KIP Sensotec L.C. Serial No: 275744
Amplifier: Schaevitz ATA-101D Serial No: 229131,9-000 -14
Digital Voltmeter: HP 3465 A Serial No: 1621 A 14242
Frame No. Instron By: ODQ Tens. or Comp.: Only
Date: 6-28-91 Temp: 72°F Cal. Volts A: 4.408 ~~B~~: Shunt Res = 75KΩ

Load (Lbs)	Ring (Defl)	Run #1 Volts	Run #2 Volts	Run #3 Volts	Avg. Volts	Conversion (Lbs)	
0	+11.1	.001	-.001	.000	.000	0	
50	62.1	0.166	0.167	0.168	.1669	50.04	299.58
100	113.0	0.336	0.331	0.333	.3333	99.93	300.03
200	214.2	0.670	0.664	0.665	.6663	199.78	300.16
300	314.9	1.004	1.000	1.000	1.0013	300.23	299.61
400	414.9	1.335	1.330	1.335	1.3333	399.77	300.0
500	514.4	1.667	1.663	1.670	1.6666	499.71	300.0
600	613.2	2.005	1.995	2.004	2.0013	600.06	299.80
700	711.3	2.335	2.331	2.338	2.3346	700.00	299.83
800	809.2	2.670	2.662	2.668	2.6671	799.70	299.95
900	906.2	3.005	2.997	3.007	3.0030	900.41	299.7
1000	1002.5	3.338	3.334	3.339	3.3370	1000.56	299.67

Y intercept : ______ R fit of slope: 299.8
Slope : 299.8 volt * 4.408 = 1321.73 Lbs 4.407
Poly. Fit Coeff. a0 :
a1 :
a2 :

Witnessed by ...

Standard Used: Morehouse Proving Ring Serial No: 3668C-709. (10 KIP)
Calibration of: 2.0 KIP Sensotec L.C. Serial No: 27574 4
Amplifier: Schaevitz ATA-101D Serial No: 2291319-000-14
Digital Voltmeter: HP 3465A Serial No: 1621 A 14242
Frame No. Instron By: D.D.A. Tens or Comp.: Only
Date: 6-28-91 Temp: 72° F Cal. Volts A: 4.408 ~~B~~: Shunt Res. = 75KΩ

Load (Lbs)	Ring (Defl)	Run #1 Volts	Run #2 Volts	Run #3 Volts	Avg. Volts	Conversion (Lbs)	
0	+21	.000	.000	.001	.001	0	
700	80.3	2.306	2.330	2.333	2.323	697.3	301.33
800	88.7	2.662	2.663	2.665	2.663	799.3	300.41
900	97.2	3.002	3.000	3.001	3.001	900.8	299.90
1000	105.6	3.331	3.334	3.335	3.333	1000.4	300.0
1200	122.5	4.001	4.000	4.002	4.001	1200.9	299.92
1400	139.4	~~8~~ 4.661	4.664	4.668	4.664	1399.9	300.17
1600	156.3	5.334	5.333	5.337	5.334	1601.1	299.96
1800	173.1	6.003	6.000	6.005	6.003	1801.9	299.85
2000	189.9	6.666	6.667	6.669	6.667	2001.2	299.98

Y intercept : ______ R fit of slope: 300.16

Slope : 300.16 volt * 4.408 = 1323.11 Lbs

Poly. Fit Coeff. a_0 : ______
a_1 : ______
a_2 : ______
a_3 :

4.427

$v = a_0 + a_1 * X + a_2 * X^2 + a_3 * X^3$

(2)

Standard Used: Morehouse Proping Rings Serial No: 5616 (1KIP)

Calibration of: 2.0 KIP Sensotec L.C. Serial No: 275743

Amplifier: Schaevitz Serial No: 2291319-000-45

Digital Voltmeter: HP 3465 A Serial No: 1621 A 14242

Frame No. Instron By: U.D.A. Tens. or Comp.: Only

Date: 6-28-91 Temp: 72° F Cal. Volts A: 4.395 ~~B~~: Shunt Res. = 75K Ω

Load (Lbs)	Ring (Refl)	Run #1 Volts	Run #2 Volts	Run #3 Volts	Avg. Volts	Conversion (Lbs)	
0	+11.1	.001	.000	.000	.000	0	
50	62.1	0.167	0.166	0.168	0.167	50.08	299.4
100	113.0	0.333	0.335	0.334	0.334	100.16	299.4
200	214.2	0.667	0.664	0.665	0.665	199.43	300.7
300	314.9	1.003	1.006	1.000	1.003	300.79	299.1
400	414.9	1.335	1.330	1.334	1.333	399.76	300.0
500	514.4	1.668	1.660	1.663	1.664	499.03	300.5
600	613.2	2.003	2.000	1.995	1.999	599.5	300.2
700	711.3	2.334	2.333	2.337	2.334	699.96	299.9
800	809.2	2.660	2.667	2.669	2.665	799.23	300.18
900	906.2	3.000	2.997	2.999	2.998	899.10	300.2
1000	1002.5	3.334	3.333	3.330	3.332	999.26	300.1

Y intercept : ____________ R fit of slope: 299.9

Slope : 4.395 volt * 299.9 = 1318.47 Lbs

Witnessed by K Barin WZOUA 6/28/91

Poly. Fit Coeff. a_0 : ____________
a_1 : ____________
a_2 : ____________
a_3 :

$y = a_0 + a_1 * X + a_2 * X^2 + a_3 * X^3$

Standard Used: Morehouse Proving Ring Serial No: 3668C-709 (10KIP)

Calibration of: 2.0KIP Sensotec L.C. Serial No: 275743

Amplifier: Schaevitz Serial No: 2291319-000 -45

Digital Voltmeter: HP 3465 A Serial No: 1621A14242

Frame No. Instron By: U.D.A. Tens. or Comp.: only

Date: 6-28-91 Temp: 72°F Cal. Volts A: 4.395 Shunt Res. = 75KΩ

Load (Lbs)	Rns (Defl.)	Run #1 Volts	Run #2 Volts	Run #3 Volts	Avg. Volts	Conversion (Lbs)
0	+21	.001	.004	.002	.003	.6
700	80.3	2.335	2.331	2.330	2.332	699.6
800	88.7	2.668	2.660	2.667	2.665	799.5
900	97.2	3.001	2.998	3.000	2.999	899.7
1000	105.6	3.335	3.331	3.334	3.333	999.8
1200	122.5	4.002	3.997	3.999	3.999	1,199.7
1400	139.4	4.667	4.666	4.667	4.667	1,399.9
1600	156.3	5.338	5.337	5.334	5.336	1,600.8
1800	173.1	6.002	6.001	6.003	6.002	1,800.5
2000	189.9	6.668	6.669	6.667	6.668	2000.3

Y intercept :

R fit of slope: 299.99

Slope : 299.99

volt * 4.395 = 1,318.47 Lbs

Witnessed by C.Briest cc20QA 6/28/91

Poly. Fit Coeff. a0 :

a1 :

a2 :

a3 :

$y = a_0 + a_1 * X + a_2 * X^2 + a_3 * X^3$

(1)

Standard Used: Drum Mic Serial No: 2-1

Calibration of: LVDT 249XS-B Serial No: 512

Amplifier: Schaevitz ATA-101 Serial No: 1385

Digital Voltmeter: HP 3465 B Serial No: 1530A02153

Frame No. N/A By: URQ. Tens. or Comp.: ______

Date: 7-2-91 Temp: 72°F Cal. Volts A: N/A B: N/A

Mic (inches)	Range (%)	Run #1	Run #2	Run #3	Avg.	Conversion (in)
-.250	0	-4.987	-4.983	-4.979	-4.983	0.247
-.225	5	-4.486	-4.488	-4.474	-4.482	0.222
-.200	10	-3.995	-4.000	-3.986	-3.994	0.198
-.175	15	-3.508	-3.509	-3.501	-3.506	0.174
-.150	20	-3.021	-3.019	-3.015	-3.018	0.149
-.125	25	-2.538	-2.533	-2.528	-2.533	0.125
-.100	30	-2.045	-2.041	-2.033	-2.039	0.101
-.075	35	-1.543	-1.546	-1.533	-1.541	0.076
-.050	40	-1.041	-1.038	-1.028	-1.036	0.051
-.025	45	-0.533	-0.530	-0.521	-0.528	0.026
±.000	50	-0.021	-0.017	-.011	-0.016	0.0008
.025	~~56~~ 55	0.492	0.494	+0.503	+0.496	0.024
.050	60	1.004	1.008	1.016	1.009	0.050
.075	65	1.516	1.518	1.527	1.520	0.075
.100	70	2.028	2.032	2.037	2.032	0.101
.125	75	2.534	2.531	2.543	2.536	0.125
.150	80	3.032	3.035	3.044	3.037	0.151
.175	85	3.533	3.530	3.542	3.535	0.175
.200	90	4.027	4.023	4.037	4.029	0.199
.225	95	4.528	4.523	4.537	4.529	0.224
.250	100	5.046	5.050	5.055	5.050	0.250

Y intercept : ______ R fit of slope: ______

Slope : 0.049595 volt * ______ = ______

Poly. Fit Coeff. a0 : ______
a1 : ______
a2 : ______

Witnessed by
[illegible]
7/8/91

2

Standard Used: Drum Mic Serial No: 2-1

Calibration of: LVDT 249XS-B Serial No: ~~429~~ 492 Jrc 1/17/92

Amplifier: Schaevitz ATA-101 Serial No: 1438

Digital Voltmeter: HP 3465 B Serial No: 1530A02153

Frame No. N/A By: QPQ. Tens. or Comp.:

Date: 7-2-91 Temp: 72°F Cal. Volts A: N/A B: N/A

mic. (inches)	Range %	Run #1	Run #2	Run #3	Avg.	Conversion (in)
-.250	0	-4.913	-4.931	-4.928	-4.924	0.246
-.225	5	-4.389	-4.387	-4.402	-4.393	0.219
-.200	10	-3.913	-3.912	-3.925	-3.917	0.195
-.175	15	-3.447	-3.446	-3.460	-3.451	0.172
-.150	20	-2.972	-2.972	-2.988	-2.977	0.148
-.125	25	-2.497	-2.499	-2.512	-2.502	0.124
-.100	30	-2.006	-2.008	-2.021	-2.011	0.100
-.075	35	-1.505	-1.508	-1.523	-1.512	0.075
-.050	40	-1.006	-1.005	-1.022	-1.011	0.050
-.025	45	-0.500	-0.500	-0.513	-.504	0.025
±.000	50	+.008	+.008	+0.003	0.006	0.0003
.025	55	0.522	0.524	0.509	0.518	0.026
.050	60	1.036	1.036	1.020	1.031	0.051
.075	65	1.556	1.548	1.535	1.546	0.077
.100	70	2.059	2.058	2.044	2.053	0.102
.125	75	2.566	2.564	2.549	2.559	0.127
.150	80	3.056	3.065	3.052	3.057	0.152
.175	85	3.564	3.563	3.547	3.558	0.177
.200	90	4.054	4.052	4.038	4.048	0.202
.225	95	4.541	4.541	4.527	4.536	0.226
.250	100	5.037	5.037	5.021	5.031	0.251

Y intercept : 0.049869 R fit of slope:

Slope : 0.049869 " / volt * ________ = ________

Poly. Fit Coeff. ao:

Witnessed
[signature]
7/8/91

B) Two potentiostats were included as part of the testing system to control the potential of the specimens during SSRT.

Model 410 Potentiostatic Controller with Model 420 A auxiliar power source (The Electrosynthesis Company). The circuit (see drawing below) was slightly modified to permit external monitoring of the applied voltage

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

The Electrosynthesis Co., Inc. Potentiostatiac Controller. Model 410 Schematics for Circuits and Connections. 1994.

AUSTIN 386. gre 9/1/94

C) a PC was connected by using an Analog/Digital converter to acquire data during testing. The connections are shown in the diagram below

D) A software: WORKBENCH (STRAWBERRY TREE) was used for data acquisition. The channels for each variable of interest: potential, current, load, extension are indicated above for MACHINE #1 and MACHINE #2.

STRAWBERRY TREE ADC INPUTS

CHANNEL #1		CHANNEL #2	
1	POTENTIAL	6	POTENTIAL
2	REF. (BLU +)	7	REF. (BLU +)
3	CURRENT	8	CURRENT
9 ~~4~~ GC 1/17/92	LOAD CELL	4 ~~9~~ GC 1/17/92	LOAD CELL
5	LVDT	10	LVDT

POTENTIAL
The voltage read on the potential channel is the precision reference voltage that is set by the front panel polarity selection switch, one volt steps switch and the one volt vernier control. The controller was modified with internal wiring and a rear panel jack to permit the external monitoring of this potential.

REF. (BLU+)
The blue wire connects this voltage to the analog-to-digital input. The front panel jack that this wire is connected to provides the capability to observe the electrometer output. The reference for this measurement is the WORKING terminal (green).

CURRENT
The current is measured by measuring the voltage across the rear panel current shunt jacks. These terminals provide a voltage output linearly proportional to cell current (1 volt = 1 ampere). Any instrument connected to these jacks must be floating (i.e. **not grounded**).

LOAD CELL
Leads for connecting to the load cell amplifier.

LVDT
Leads for connecting to the LVDT signal conditioner/amplifier.

11/19/91

	Channel #1	Channel #2
Potentiostat	SNo. 9105556	SNo. 9105557
Power Supply	SNo. 9105504	SNo. 9029495

E) Two electrochemical cells, made of Pyrex glass with Teflon lids, were designed according to drawings below. Counter-electrodes are made of Platinum mesh spot-welded to a Platinum wire.

Modified .04-1060.03 CONDENSER with ₮ 12/30 joint at bottom and jacket at 15° angle from joint axis.

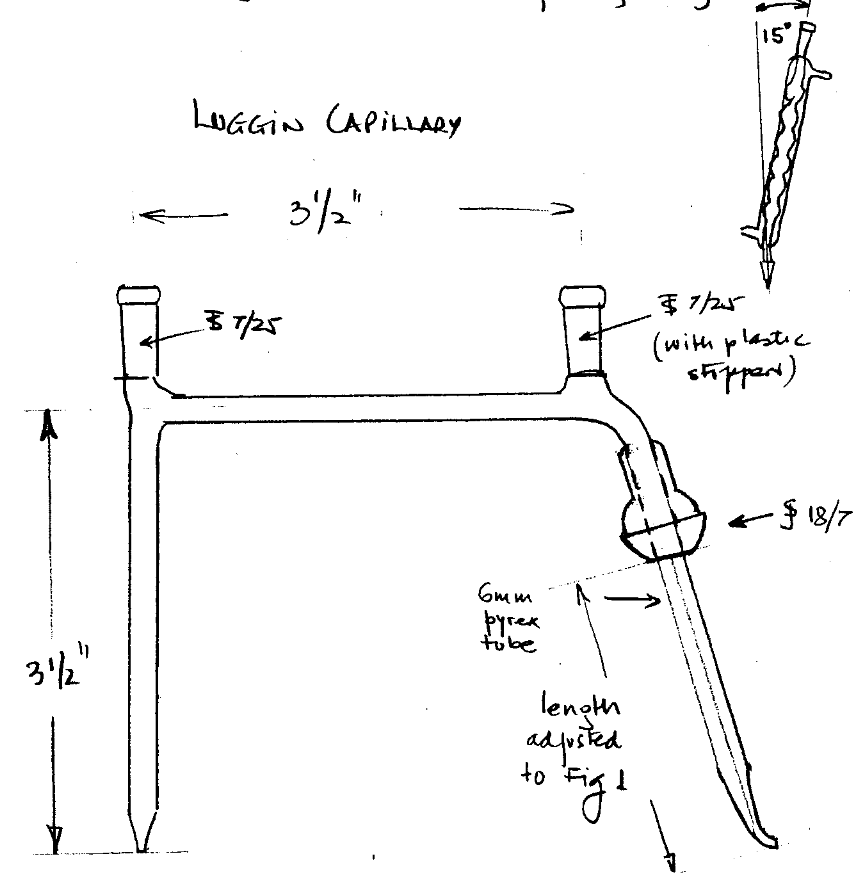


Fig 3

CRAGNOLINO

E) Two electrochemical cells, made of Pyrex glass with Teflon lids, were designed according to drawings below. Counter-electrodes are made of Platinum mesh spot-welded to a Platinum wire.

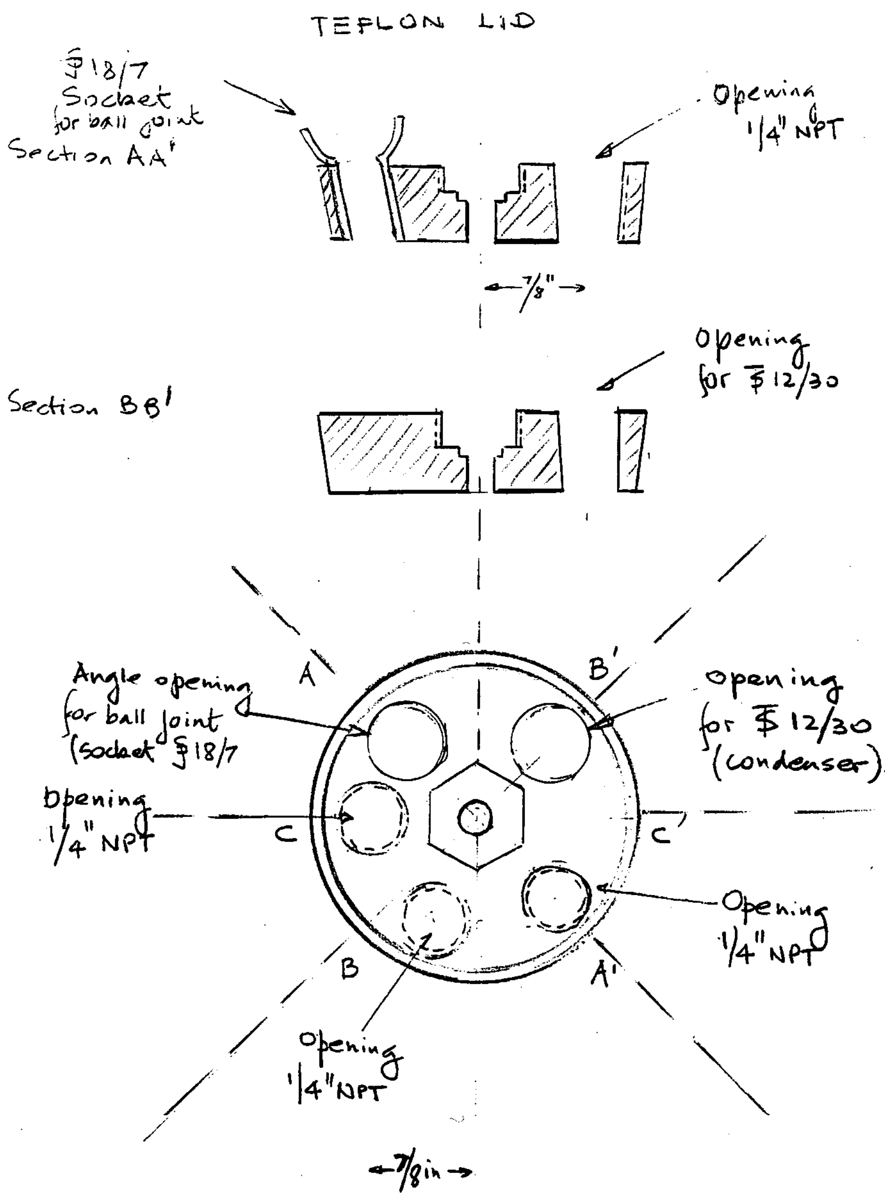


Fig 2

CRAGNOLINO

E) Two electrochemical cells, made of Pyrex glass with Teflon lids, were designed according to drawings below. Counter-electrodes are made of Platinum mesh spot-welded to a Platinum wire.

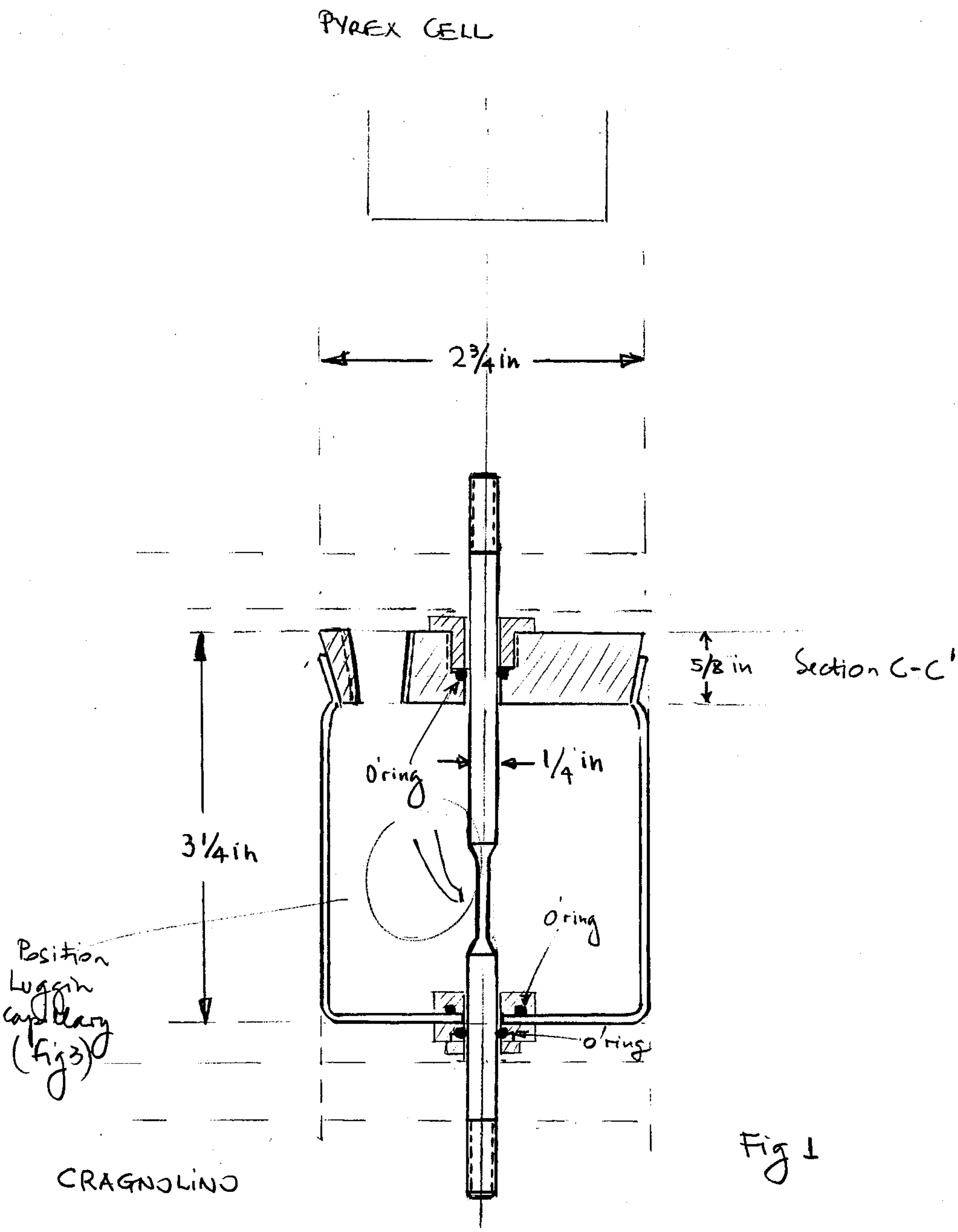


Fig 1

MATERIALS:

The chemical composition of the alloys to be tested are shown in the table below.

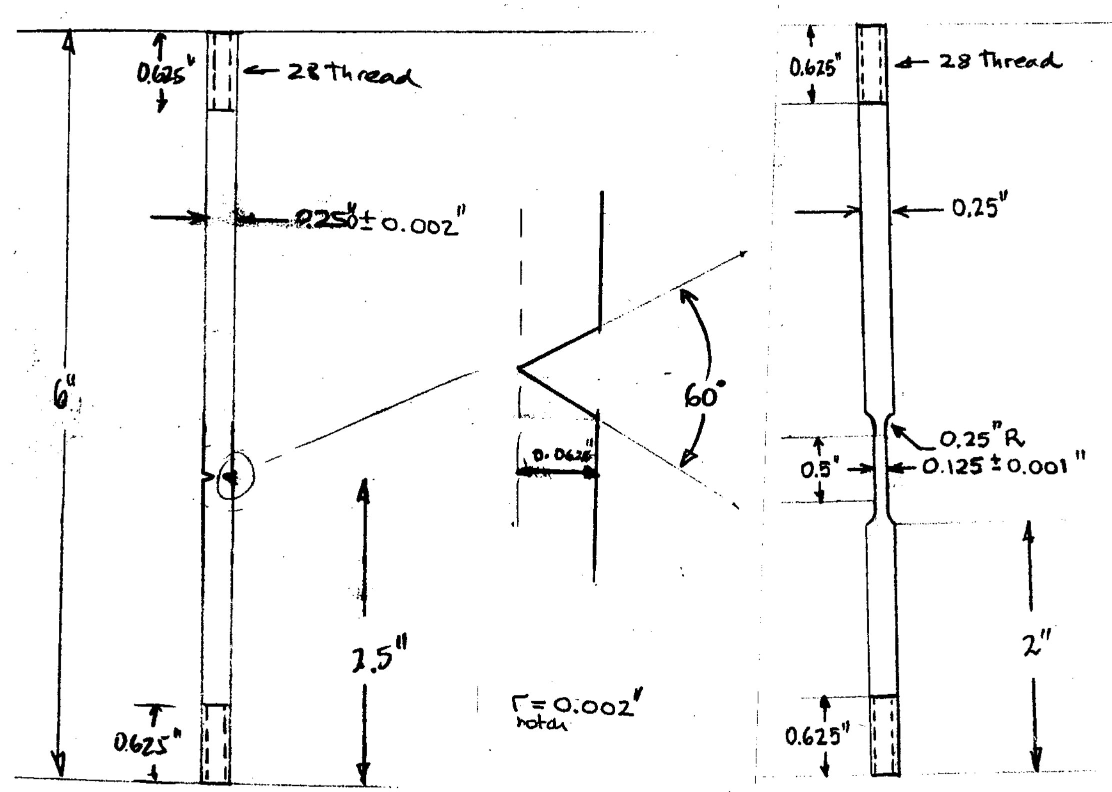
CHEMICAL COMPOSITION IN WT% OF ALLOYS IN IWPE

MATERIAL	304L	304L	316L	316L	IN825	IN825	HA C-22	HA C-22	CDA 102	CDA 102	CDA 613	CDA 613	CDA 715	CDA 715
ORIGIN	G.O.CARLSON		EASTERN STAINLESS		INCO/METAL GOODS		HAYNES/CORR MATLS		REVERE		AMPCO METAL		REVERE	
HEAT NO.	T0954		P80746		HH4371FG		2277-8-3175		6681 gal 1/17/92		M5459		7037-61326	
ELEMENTS	VENDOR	KAWIN	VENDOR	KAWIN	VENDOR	KAWIN	VENDOR	KAWIN	VENDOR	KAWIN	VENDOR	KAWIN	VENDOR	KAWIN
Ag												<0.01		
Al		<0.01		<0.01	0.07	0.05		0.18			6.66	7.05		
As												<0.01		<0.01
B														
C	0.022	0.029	0.014	0.019	0.010	0.013	0.004	0.015*				0.005	0.013	0.019
Cb														
Cd												<0.001		<0.001
Co			0.17				0.09	0.87						
Cr	18.27	18.44	16.35	16.64	22.09	22.98	21.40	21.97				<0.005		0.01
Cu		0.19	0.27	0.29	1.79	1.80			99.95 MIN.		90.61		69.20	BAL.
Fe	BAL.	BAL.	BAL.	BAL.	30.41	28.09	3.80	4.42			2.44	2.56	0.54	0.55
Mg														
Mn	1.46	1.38	1.58	1.56	0.35	0.33	0.12	0.13			<0.01	0.02	0.57	0.62
Mo		0.15	2.07	2.16	3.21	3.56	13.60	14.25						
N	0.07	0.07	0.06	0.06										
Ni	9.14	9.00	10.04	10.43	41.06	41.76	BAL.	BAL.			0.03	0.02	29.57	29.85
P	0.026	0.024	0.026			0.008	0.008	0.005			0.006	0.001	0.004	0.001
Pb											<0.01	0.008	0.010	0.004
S	0.005	0.005	0.018		<0.001	0.003	<0.002	0.002				0.001	0.006	0.011
Sb												<0.01		<0.01
Si	0.47	0.44	0.49		0.19	0.13	0.03	0.06			<0.01	0.02		0.01
Sn											0.27	0.29		
Ta														
Ti		0.01			0.82	0.93		<0.01						
V		0.05				0.04	0.15	0.16						
W							3.00	2.98						

All the materials to be tested are available in the form of 0.5 in. thick plates. Bars were cut from these plates and were centerless ground in order to machine round tensile specimens (0.25 in in diameter). Unless it is specifically stated all tests will be conducted using materials in the "as received" condition with the tensile axis perpendicular to the rolling direct[ion] GAL/1

Drawings for the machining of SSRT specimens are shown below. The right drawing corresponds a smooth-round tensile specimen, while the other has a circumferential notch. Notched specimens will be dimensionally inspected at the SwRI Machine Shop to assure the acuity of the notch.

Starting material: 1. 0.5" thick plate
2. To be machined in the transverse direction.



Note: 1. Do not undercut radii
2. Use low stress machining procedures

G. CRAGNOLINO X5539

PROCEDURE FOR TESTING:

The standard to be adopted for conducting slow strain rate tests is the International Standard ISO-7539-7:1989(E) issued by the International Organization for Standardization. This standard has been adopted because ASTM still has not issued a standard for SSRT.
Additional information regarding this type of testing is provided in:
"Stress Corrosion Cracking - Test Methods" by A.J. Sedriks. National Association of Corrosion Engineers. HOUSTON, TX 1989

In tests conducted above room temperature solutions will be heated and the desired temperature maintained during the test by using a cylindrical jacket made of copper sheet and surrounded by a BRISHEAT Heating Tape (Cat # BIH051020) that supplied a maximum of 104 Watts.
Temperature will be controlled using a DYNA-SENSE Model 2158-40 electronic temperature controller and a Platinum RTD as a sensing element. Temperature values will be set by using calibrated glass thermometers, according to NIST.
1/17/92

Preparation of specimens before testing is made according to CNWRA TOP-003-01 "Procedure for Preparing Electrochemical/Corrosion Test Specimens" as applicable to tensile specimens.

INTERNATIONAL STANDARD ISO 7539-7 : 1989 (E)

Corrosion of metals and alloys — Stress corrosion testing —

Part 7: Slow strain rate testing

Information potentially subject to copyright protection was redacted from this location. The redacted material is from the International Standard, ISO 7539-7 as listed above.

In all the tests conducted under potentiostatic control the general description of the procedures described in CNWRA TOP-008 "Procedure for Conducting and Verifying Cyclic Polarization Tests" and CNWRA TOP-009 "Procedure for Conducting and Verifying Potentiodynamic Polarization Tests" will be followed as applicable. However no verification ~~will be conducted~~ is necessary [illegible] of polarization curves because slow strain rate tests will be carried out at a constant applied potential or under open circuit conditions. In any case independent verification of the potential will be done with calibrated instruments. For this purpose Keithley Model 614 Electrometer Serial N° 467374 will be used.

Solutions will be prepared according to CNWRA TOP-010 "Technical Operating Procedure for Preparing Simulated J-13 Water and its Modifications".

Gcragnolino

1/17/92

Participants:

Gustavo CRAGNOLINO set up the experimental equipment and will conduct preliminary tests.
Walter Machowski will colaborate in the preparation and running of some tests

GCragnolino
9/1/92

SLOW STRAIN RATE TESTS OF CDA-102 (OXYGEN-FREE COPPER)

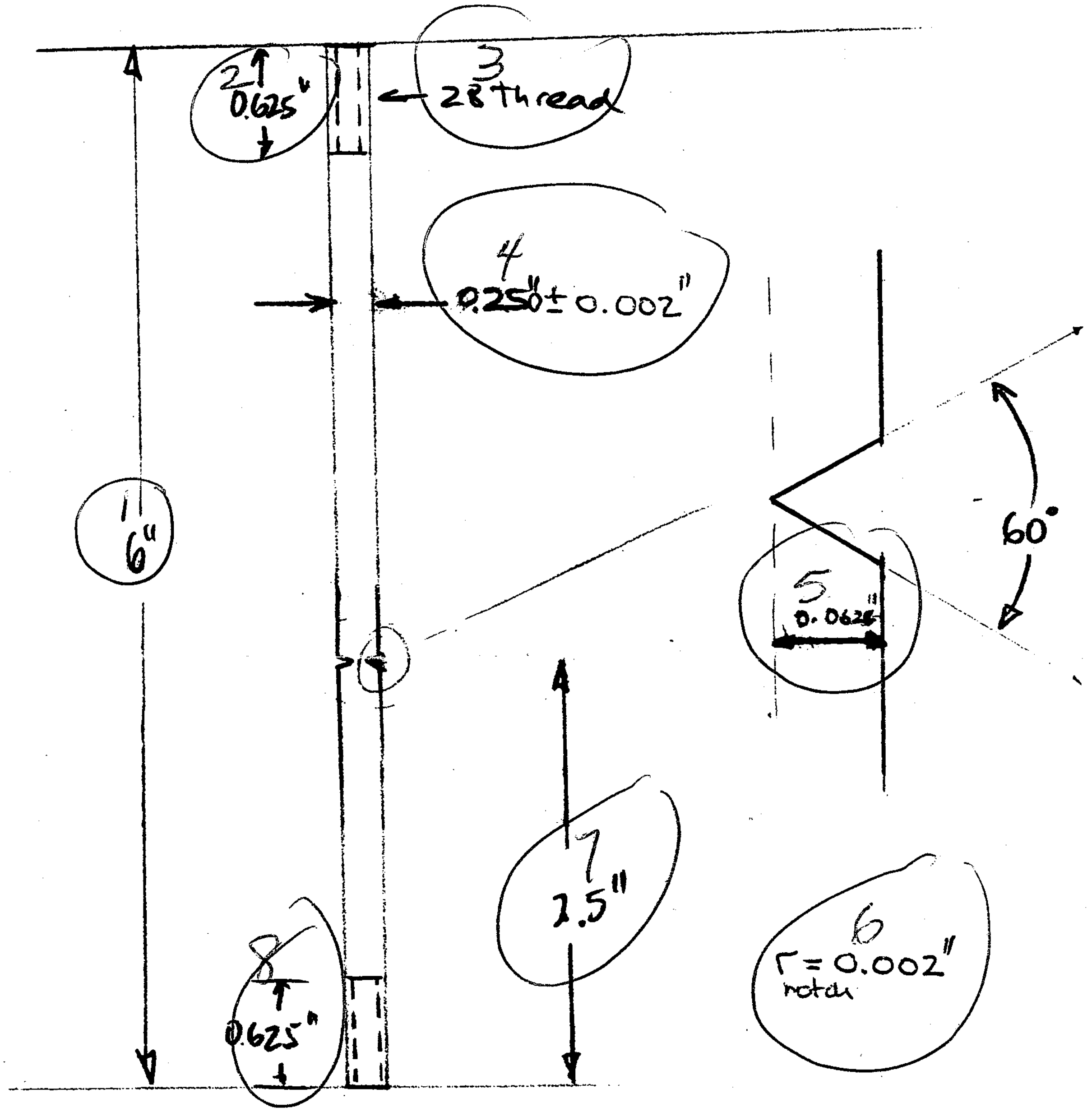
Purpose:
A series of tests will be conducted using CDA-102 in order to explore the possibility of stress corrosion cracking in solutions containing a relatively high concentration of HCO_3^- (8500 ppm). Cyclic polarization experiments conducted under Task 1 indicated that at room temperature the formation of a thick black surface film is a dominant process in 8500 ppm HCO_3^- solutions. This film may be a precursor to the initiation of environmentally assisted cracking.

As indicated in the ISO Standard 7539-7:1989 (page 19) is convenient to conduct tests in an inert environment for the purpose of normalizing the data obtained when SCC occurs. For that reason and also for verification of the operational conditions of the slow strain rate test machines two tests are conducted in air.

Test Cu01N:

Notched specimen of CDA-102 tested in Machine #1 in air at room temperature using empty electrochemical cell to verify system operation.
Specimens dimensionally inspected as noted in attached sheet (the specimen used in this particular test was not inspected but other specimens from the same set of machined specimens were inspected at a later date)

DIMENSIONAL INSPECTION



G. CRAGNOLINO x 5539
20-3704-042
MATERIAL: Oxygen free Cu (CDA 102) 12 tensile specimens

DIMENSIONAL INSPECTION RECORD

Page 1 of 1

Project:	Drawing /Part No.:	Part Name:	Procedure:
20-3704-042		CDA102	OP-10-30-102
Serial No.: (Single Part)	E. O.:	Work Order ☐ Job Card ☐ MPS ☐	Location: MACHINE SHOP
No. of Articles Inspected: 12		DACS Required: ☐ Yes ☒ No	NR (NA if None) NA

Drawing Zone	B/P Dim.	Accept	Reject	Comments
1	6"	FEB 6 1992		Comparator 7188
2	.0625			Mic. 5056-1
3	28Thd.			
4	.250	FEB 6 1992		
5	.0625			
6	.002			
7	2.5	FEB 6 1992		
8	.625			
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				

No. of Articles Accepted:	No. of Articles Rejected:	Inspector Signature:	Date:
12	0	SwRI 24 QA	FEB 6 1992

SwRI Form QA-114-0

Test Cu-01

Round tensile specimen of CDA-102 tested in Machine #2 in air at room temperature

Gauge length (between shoulders) 0.925"
Gauge diameter 0.024"

Dimensional measurements: Fisher micrometer S/N 20-M-1 (cal 10/21/91, due 4/21/92); Fowler caliper S/N 20-8C-1 (cal 12/19/91, due: 6/19/92)

Both tests (Cu-01 and Cu-01N) were conducted at a constant extension rate, given for a rotation speed of the sprocket wheel equal to 52 rpm, which is equivalent to 5.00×10^{-7} in/s according to table in pag 9.

Test Cu-01: Initiated 1/17/92 Completed 1/26/92

Test data stored in disk SSRT DATA 1

Maximum load: 341.8 lbs.
Time to failure: 6.014×10^{5} sec = 167 hours.
Elongation to failure: $\frac{0.348 \text{ in}}{0.500 \text{ in}} = 69.6\%$

Estimated extension rate: 5.8×10^{-7} in/s.

Final gauge length (between shoulders) 1.270"

Estimated elongation: 0.345 in

Test Cu-01N: Initiated 1/20/92 Completed 1/23/92

Test data stored in disk SSRTDATA 1

Maximum load: 577 lbs
Time to failure: 2.407×10^5 sec = 66.9 hours.
Elongation to failure: 0.053 in (extension)

Estimated extension rate: 2.2×10^{-7} in/s.

GKCragnolino
9/1/94

Test Cu-02N: 1/23/92

Purpose: to conduct exploratory test in solution containing 8500 ppm HCO_3^- at room temperature under open circuit conditions in air saturated solution.

Notched specimen of CDA-102.

Solution prep: To 500 ml of 17 MΩ water in a 1-L volumetric flask, add 12.2024 g $NaHCO_3$ (Fisher lot # 897789). Pipet 2.0 ml of F stock, 10.0 ml of NO_3 stock, 10.0 ml of Cl stock, and 20.0 ml of SO_4 stock solutions (SN CNWRA #1s. 019-191, 025-66, 019-127, and 025-71 respectively). dilute to the mark with 17 MΩ water.

Gcragnolino
9/1/94

Test was conducted in Machine #1.
The electrochemical cell was continuously purged with air to maintain air saturated conditions at room temperature (18°C)
Potential was monitored using a saturated calomel reference electrode (Fischer Mod. 13-620-51, S/N 8211163. and recorded using a ABB Model SE 120 Strip chart recorder, S/N 0515265 (cal. 12/2/91, due 6/2/92).
A Dataplex 10 was used to measure sequentially

the potential of the specimen and platinum.

Initial potentials ($t=0$)   1/23/92   18:20

$E_{Cu} = -125\ mV_{SCE}$

$E_{Pt} = 240\ mV_{SCE}$

After 20 hs exposure to the solution

1/24/92   15:20

$E_{Cu} = -120\ mV_{SCE}$

$E_{Pt} = 155\ mV_{SCE}$

Straining was initiated at 52 rpm = 5.0×10^{-7} in/s, after aplying an initial load of 18 lbs.

The specimen was covered by a blackish film. ~~and~~ The potential was monitored continuously during straining. No variation of potential was noted except for a period of 24 hs (1/25/92 → 1/26/92) in which the salt bridge with a Luggin capillary, connected to the reservoir for the SCE reference electrode exhibited a discontinuity in the conducting path.

gu 1/27

$E_{Cu} = -105\ mV_{SCE}$

$E_{Pt} = 145\ mV_{SCE}$

during all the straining period.

Test data stored in disk SSRT-DATA #1

Test initiated 1/23/92   Completed 1/27/92.

Maximum load: 566.1 lbs.
Time to failure: 2.469×10^{5} sec = 68.6 hrs.
Elongation to failure: 0.063 in   (extension)

Estimated extension rate: 2.6×10^{-7} in/sec.

Time to failure and elongation to failure similar to those of notched specimen tested in air (Cu-01N) indicates ductile failure. Visual observation with low magnification in the stereoscope (70x) did not show signs of stress corrosion cracking.

Guerragrolino
1/27/92

Test Cu-03N 1/28/92

Purpose: To conduct test in solution containing 8500 ppm HCO_3^- at room temperature under an applied potential of 400 mV$_{SCE}$

Notched specimen of CDA-102 was tested in Machine #1. Same solution that in Test Cu-02N (p. 25)

Deaeration of the solution with N_2 purging was initiated at 10:35

$$E_{Cu}(t=0) = -80\ mV_{SCE}$$

$$E_{Pt}(t=0) = 225\ mV_{SCE}$$

after 4 hs of deaeration

$$E_{Cu}(t=4hs) = -150\ mV_{SCE}$$

$$E_{Pt}(t=4hs) = 112\ mV_{SCE}$$

A potential of +400 mV$_{SCE}$ was applied and straining was started at 52 rpm = 5.0×10^{-7} in/s. An initial load of 20 lbs was applied before straining.

Specimen surface was covered with a blackish film. Ductile failure observed in stereoscope. Data was collected as in previous tests, but it was lost in an attempt to transfer the files after test was completed ~~on~~ ~~1/28/92~~

Sal 1/31/92

Gallegos 1/31/92

Test Cu-02 1/30/92

Purpose: same as test Cu-03N, but round tensile specimen without notch was used instead of notched specimen.

Round tensile specimen of CDA-102 tested in Machine #2, after slight polishing with 600 grit SiC paper

Gauge length (between shoulders): 0.925 in
Gauge diameter: 0.023 in

Deaeration of the solution with N_2 purging was initiated and after 4 hours

$$E_{Cu} \sim -150\ mV_{SCE}$$

$$E_{Pt} \sim 110\ mV_{SCE}$$

A potential of 400 mV$_{SCE}$ was applied and straining was started at 52 rpm = 5.0×10^{-7} in/s. An initial load of 20 lbs was applied before straining.

Specimen surface was covered with a blackish film
Ductile failure observed in the stereoscope

Data was collected as in previous tests, but file was lost when transfer to the GRAPHER directory after completing the test.

Final gauge length (between shoulders) 1.250 in

Estimated elongation: $\frac{0.325\ in}{0.500\ in} \times 100 = 65\%$.

Gallegos 2/8/92

DESCRIPTION OF SOFTWARE ~~AND~~ PROGRAM FOR DATA ACQUISITION

All the slow strain rates tests for CDA-102 described before (p. 21 to 29) were conducted in accordance with the program designated as SSRTSET1.WBB ~~fors~~ for data acquisition. The worksheet is shown in the following page for Machine #1 (left) and Machine #2 (right) where the designations for the different icons are 1 and 2 respectively. The description of the worksheet, and all the icons involved, is also attached to the following page.

Since some difficulties were experienced in the updating of the meters readings, the sample rate was raised from 10 Hertz to 1 Hertz during the course of additional testing for the analog inputs.

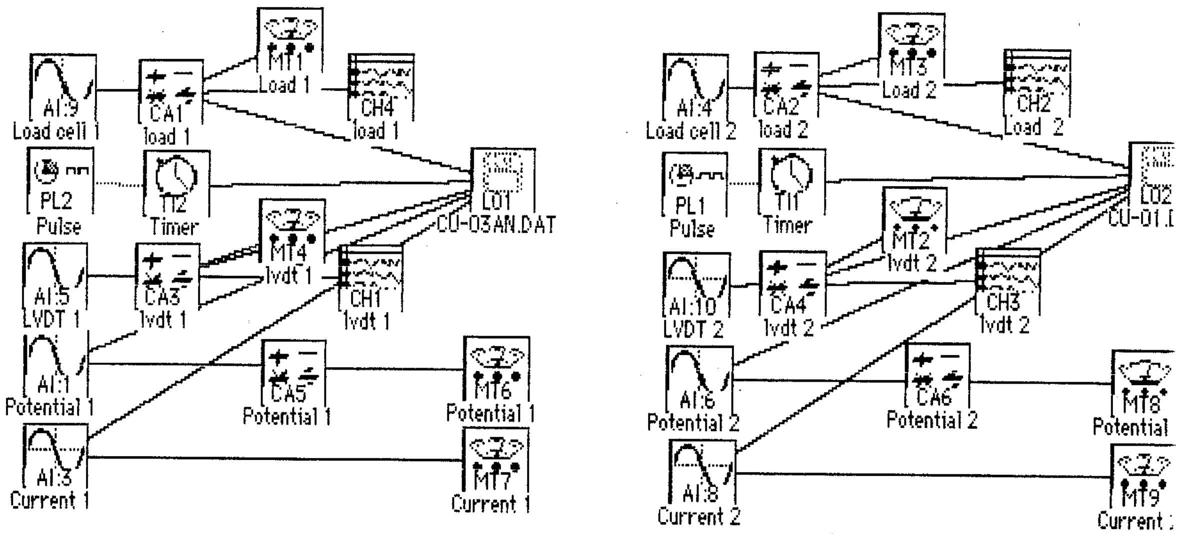
The data is logged according to the filename in L01 and L02. In the copy attached Cu-03RN.DAT and Cu-01.DAT appears for Machine #1 and #2 respectively.

After these initial tests the sample rate for the logging was changed from 5 to 30 minutes to avoid collecting an unnecessary high number of data points.

Jgallapolin
2/19/92


```
Inputs:
    AI:8  Current 2
Outputs:
    < None >

Type: Chart

Name:                         CH1   lvdt 1
Chart Color:                  White
X Axis Label:                 Hours
X Axis Min:                   0.0
X Axis Max:                   150.0
Y Axis Label:                 Elongation, in
Y Axis Min:                   0.0
Y Axis Max:                   0.5
Inputs:
    CA3   lvdt 1
Outputs:
    < None >

Name:                         CH2   Load  2
Chart Color:                  White
X Axis Label:                 Hours
X Axis Min:                   0.0
X Axis Max:                   150.0
Y Axis Label:                 Pounds
Y Axis Min:                   0.0
Y Axis Max:                   600.0
Inputs:
    CA2   load 2
Outputs:
    < None >

Name:                         CH3   lvdt 2
Chart Color:                  White
X Axis Label:                 Hours
X Axis Min:                   0.0
X Axis Max:                   150.0
Y Axis Label:                 Elongation,  in
Y Axis Min:                   0.0
Y Axis Max:                   1.0
Inputs:
    CA4   lvdt 2
Outputs:
    < None >

Name:                         CH4   load 1
Chart Color:                  White
X Axis Label:                 Hours
X Axis Min:                   0.0
X Axis Max:                   150.0
Y Axis Label:                 pounds
Y Axis Min:                   0.0
Y Axis Max:                   600.0
Inputs:
    CA1   load 1
Outputs:
    < None >
```

SSRTSET1.WBB 19-Feb-92 15:34:50 Page 1



Worksheet Name: SSRTSET1.WBB

Hardware list:

Name	AIs	AOs	DIOs	CTs	DIs	DOs
STI ACPC-16	16	0	16	0	0	0

Maximum icons: 1000
Grid size: 4
Snap to grid: < disabled >
Report Unsynch: < disabled >
Fast Mode: < disabled >
Fast Mode samples: 1000
Fast Mode rate: 1.0 Kilohertz
Trigger level: -10.0
Trigger source: Positive
Trigger slope: Analog
Trigger mode: None
Pre-trigger samples: 0
Com ports: 2

Port: COM 1
Comment: Mouse connected

Port: COM 2
Baud rate: 9600
Data bits: 8
Stop bits: 1
Duplex: Half
Parity: None
XonXoff: < disabled >
Echo wait: < disabled >
Line delay: < disabled >

IEEE: < disabled >

Type: Analog Input

Name: AI:1 Potential 1
Card Type: STI ACPC-16
Channel Number: 1
Range: Auto V
Resolution: Lo Noise (17ms)
Output Type: Voltage
Sample rate: 10.0 Hertz
Fast Mode: < disabled >
Inputs:
< None >
Outputs:
MT6 Potential 1 LO1 CU-03AN.DAT

Name: AI:3 Current 1
Card Type: STI ACPC-16
Channel Number: 3
Range: Auto V
Resolution: Lo Noise (17ms)
Output Type: Voltage
Sample rate: 10.0 Hertz
Fast Mode: < disabled >
Inputs:
< None >
Outputs:
MT7 Current 1 LO1 CU-03AN.DAT

Name:	AI:4 Load cell 2
Card Type:	STI ACPC-16
Channel Number:	4
Range:	+|-Auto V
Resolution:	Lo Noise (17ms)
Output Type:	Voltage
Sample rate:	10.0 Hertz
Fast Mode:	< disabled >
Inputs:	
< None >	
Outputs:	
CA2 load 2	

Name:	AI:5 LVDT 1
Card Type:	STI ACPC-16
Channel Number:	5
Range:	+|-Auto V
Resolution:	Lo Noise (17ms)
Output Type:	Voltage
Sample rate:	0.1 Seconds
Fast Mode:	< disabled >
Inputs:	
< None >	
Outputs:	
CA3 lvdt 1	

Name:	AI:6 Potential 2
Card Type:	STI ACPC-16
Channel Number:	6
Range:	Auto V
Resolution:	Lo Noise (17ms)
Output Type:	Voltage
Sample rate:	10.0 Hertz
Fast Mode:	< disabled >
Inputs:	
< None >	
Outputs:	
MT8 Potential 2	LO2 CU-01.DAT

Name:	AI:8 Current 2
Card Type:	STI ACPC-16
Channel Number:	8
Range:	Auto V
Resolution:	Lo Noise (17ms)
Output Type:	Voltage
Sample rate:	10.0 Hertz
Fast Mode:	< disabled >
Inputs:	
< None >	
Outputs:	
MT9 Current 2	LO2 CU-01.DAT

Name:	AI:9 Load cell 1
Card Type:	STI ACPC-16
Channel Number:	9
Range:	+|-Auto V
Resolution:	Lo Noise (17ms)
Output Type:	Voltage
Sample rate:	10.0 Hertz

```
Fast Mode:                    < disabled >
Inputs:
    < None >
Outputs:
    CA1   load 1

Name:                         AI:10 LVDT 2
Card Type:                    STI ACPC-16
Channel Number:               10
Range:                        +|-Auto V
Resolution:                   Lo Noise (17ms)
Output Type:                  Voltage
Sample rate:                  10.0   Hertz
Fast Mode:                    < disabled >
Inputs:
    < None >
Outputs:
    CA4   lvdt 2

Type: Timer____________________________________________________________

Name:                         TI1   Timer
Inputs:
    PL1   Pulse
Outputs:
    LO2   CU-01.DAT

Name:                         TI2   Timer
Inputs:
    PL2   Pulse
Outputs:
    LO1   CU-03AN.DAT

Type: Pulse____________________________________________________________

Name:                         PL1   Pulse
High Duration:                1.0e+05   Hours
Low Duration:                 0.1   Seconds
Start Value:                  Low
Reset on exit                 enabled
Inputs:
    < None >
Outputs:
    TI1   Timer

Name:                         PL2   Pulse
High Duration:                10000.0   Hours
Low Duration:                 0.1   Seconds
Start Value:                  Low
Reset on exit                 enabled
Inputs:
    < None >
Outputs:
    TI2   Timer

Type: Calculation______________________________________________________

Name:                         CA1   load 1
Function:                     aX / bY
X input:                      AI:9  Load cell 1
```

```
Y input:                    1.0
"a" constant:               299.8
"b" constant:               1.0
"c" constant:               0.0
Inputs:
    AI:9  Load cell 1
Outputs:
    MT1   Load 1            CH4   load 1            LO1   CU-03AN.DAT

Name:                       CA2   load 2
Function:                   aX / bY
X input:                    AI:4  Load cell 2
Y input:                    1.0
"a" constant:               299.9
"b" constant:               1.0
"c" constant:               0.0
Inputs:
    AI:4  Load cell 2
Outputs:
    CH2   Load  2           MT3   Load 2            LO2   CU-01.DAT

Name:                       CA3   lvdt 1
Function:                   aX + bY
X input:                    AI:5  LVDT 1
Y input:                    0.247
"a" constant:               0.05
"b" constant:               1.0
"c" constant:               0.0
Inputs:
    AI:5  LVDT 1
Outputs:
    CH1   lvdt 1            MT4   lvdt 1            LO1   CU-03AN.DAT

Name:                       CA4   lvdt 2
Function:                   aX + bY
X input:                    AI:10 LVDT 2
Y input:                    0.0
"a" constant:               0.05
"b" constant:               0.241
"c" constant:               0.0
Inputs:
    AI:10 LVDT 2
Outputs:
    MT2   lvdt 2            CH3   lvdt 2            LO2   CU-01.DAT

Name:                       CA5   Potential 1
Function:                   aX + bY
X input:                    0.0
Y input:                    0.0
"a" constant:               -1.0
"b" constant:               0.0
"c" constant:               0.0
Inputs:
    < None >
Outputs:
    < None >

Name:                       CA6   Potential 2
Function:                   aX + bY
X input:                    0.0
```

Y input:	0.0
"a" constant:	-1.0
"b" constant:	0.0
"c" constant:	0.0

Inputs:
< None >
Outputs:
< None >

Type: Log

Name:	LO1 CU-03AN.DAT		
Log Status:	< disabled >		
Sample Rate:	5.0 Minutes		
Gate:	< None >		
Data Format:			
Heading:	SSRT Cu/8500 ppm HCO3/notch		
File Path:	C:\WB\CLIPBRD		
File Name:	CU-03AN.DAT		
Date Stamp:	enabled		
Time Stamp:	enabled		
Inputs:			
CA3 lvdt 1	TI2 Timer	CA1 load 1	
AI:3 Current 1	AI:1 Potential 1		
Outputs:			
< None >			

Name:	LO2 CU-01.DAT		
Log Status:	< disabled >		
Sample Rate:	5.0 Minutes		
Gate:	< None >		
Data Format:			
Heading:	SSRT for CU CDA-102 /Air Frame #2		
File Path:	C:\WB\CLIPBRD		
File Name:	CU-01.DAT		
Date Stamp:	enabled		
Time Stamp:	enabled		
Inputs:			
TI1 Timer	CA2 load 2	CA4 lvdt 2	
AI:6 Potential 2	AI:8 Current 2		
Outputs:			
< None >			

Type: Meter

Name:	MT1 Load 1
Output Type:	Fixed Point
Units:	Pounds
Integer:	6
Decimal:	3
Inputs:	
CA1 load 1	
Outputs:	
< None >	

Name:	MT2 lvdt 2
Output Type:	Fixed Point
Units:	inches
Integer:	5
Decimal:	4

Inputs:
CA4 lvdt 2
Outputs:
< None >

Name: MT3 Load 2
Output Type: Fixed Point
Units: Pounds
Integer: 6
Decimal: 3
Inputs:
CA2 load 2
Outputs:
< None >

Name: MT4 lvdt 1
Output Type: Fixed Point
Units: Inches
Integer: 5
Decimal: 4
Inputs:
CA3 lvdt 1
Outputs:
< None >

Name: MT6 Potential 1
Output Type: Fixed Point
Units: V sce
Integer: 6
Decimal: 3
Inputs:
AI:1 Potential 1
Outputs:
< None >

Name: MT7 Current 1
Output Type: Exponential
Units: Amps
Integer: 6
Decimal: 3
Inputs:
AI:3 Current 1
Outputs:
< None >

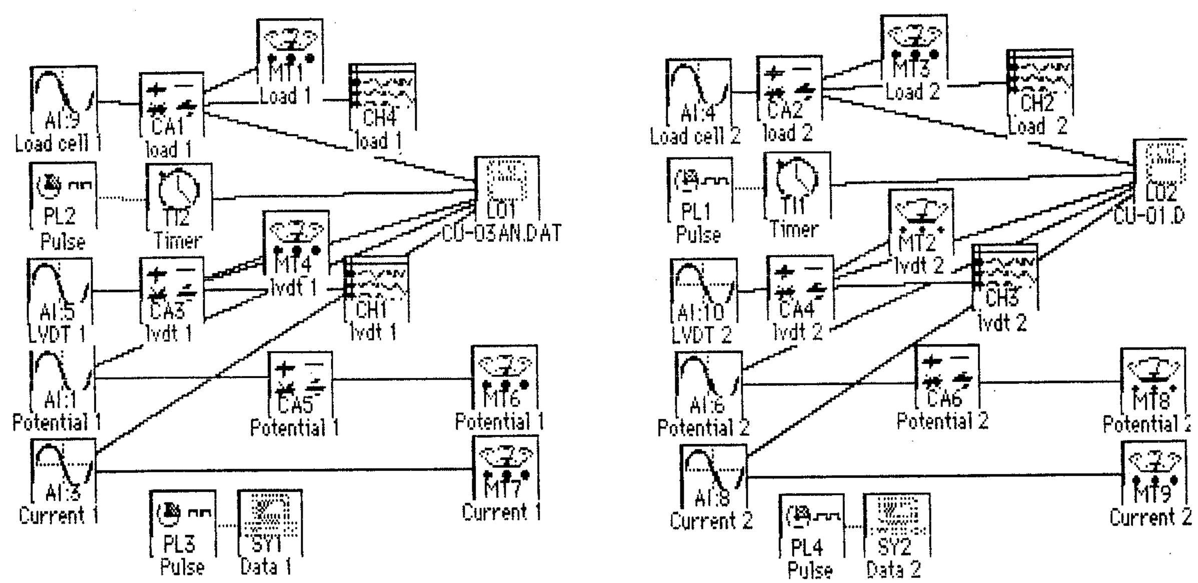
Name: MT8 Potential 2
Output Type: Fixed Point
Units: V sce
Integer: 6
Decimal: 3
Inputs:
AI:6 Potential 2
Outputs:
< None >

Name: MT9 Current 2
Output Type: Exponential
Units: Amps
Integer: 6
Decimal: 3

Modification of program SSRTSET.WBB.

The program was modified to include the copy of the file containing the data being collected in a diskette in drive B of the computer, to avoid lost of the data by mistake. This is shown in the worksheet attached below, by the addition of icons SY1 and SY2 for machines #1 and #2 respectively.

SSRTSET1.WBB 4-Mar-92 15:08:23 Page 1



3/4/92

SLOW STRAIN RATE TESTS OF TYPE 316L SS

According to Test Plan No 20-3704-042-205 a serie of tests will be conducted using Type 316L SS in solutions of various compositions containing Cl^-, SO_4^{2-} and low concentrations of F^-, NO_3^- and HCO_3^-.

The first solution for testing has the following composition:

10000 ppm Cl^- as NaCl
10000 ppm SO_4^{2-} as Na_2SO_4
85 ppm HCO_3^- as $NaHCO_3$
10 ppm NO_3^- as $NaNO_3$
2 ppm F^- as NaF
Initial pH = 7.86

and the pH was adjusted to pH = 4.00 by adding HCl.

Test Solution Prep: To 500 ml of 17 MΩ water in a 1-L volumetric add 14.9038 g of Na_2SO_4 and 16.4749 g of NaCl (Fisher lot #'s 901213 and 885407 resp.). Add 0.1225 g of $NaHCO_3$ (Fisher lot # 897789). Pipet 10.0 ml of NO_3 stock solution (SN CNWRA 025-66) and 2.0 ml of F stock solution (SN CNWRA 019-191). Dilute to the mark. Check pH and adjust to pH 4.0 w/a few drops of reagent grade HCl (aq).

Specimen Prep: Specimen cleaned in ultrasonic bath w/detergent for 5 minutes, rinsed w/tap water, then rinsed w/hi-purity water, then reagent grade acetone and dried under a hot air blower. Specimen dimensions measured w/Fowler micrometer SwRI No. 20-8C-1 (cal'd 12/19/91 due 6/19/92. Spec's are 316L SS ht # P80946

Spec. SSRTSS01 gage = .9391" φ = .1241"
" SSRTSS02 " = .9359" φ = .1248"

Walter J Machowski 3/10/92

Test SSRTSS01: 3/11/92

Test was conducted in a deaerated solution purged with N_2 under an applied potential of 0.0 V_{SCE} in machine # 1

Solution was heated up to 95°C, Temperature was measured with calibrated thermometer Temperature controller setting: Coarse 37; Fine 50

After potential was applied, straining was started at 52 rpm = 0.5×10^{-7} in/sec. An initial load of 25 lbs was applied to the specimen

Test data stored in disk SSRTDATA 1

Test initiated 3/11/92 17:00 Test completed 3/14/92 4:30

Maximum load: 376.2 lbs
Time to failure: 2.142×10^5 sec = 59.5 hrs.
Elongation to failure: $\frac{0.101 \text{ in}}{0.5 \text{ in}} \times 100 = 20.2\%$

Final gauge length (between shoulders) 1.018 in
Estimated elongation: $\frac{0.0789 \text{ in}}{0.5 \text{ in}} \times 100 = 15.8\%$

Estimated extension rate: 4.7×10^{-7}/s

Current during testing ~ 1.0×10^{-2} A/cm
gae 9/1/94

Specimen failed due to extensive pitting corrosion. Severe crevice corrosion was observed in the location of the cell sealing with O-rings.

Galeapulino
3/14/92

Test SSRTSS02: 3/11/92

Test was conducted in the same solution that the Test SSRTSS01, under open circuit conditions in the presence of air in machine # 2

Solution was heated up to 95°C, Temperature was measured with calibrated thermometer. Temperature controller setting: Coarse: 32 Fine: 37

Straining was started at 52 rpm = 0.5×10^{-7} in/sec Initial load of 30 lbs was applied to the specimen.

Open circuit potential varied during test from 0 to -200 mV_{SCE} with oscillations. Potential was monitored and recorded with ABB Strip Chart Recorder.

Test data stored in disk SSRTDATA 1.
Test initiated 3/11/92 15:00 Test completed 3/18/92 15:30
Maximum load: 928 lbs.
Time to failure: 6.044×10^5 sec = 167.9 hrs.
Elongation to failure: $\frac{0.289 \text{ in}}{0.500 \text{ in}} \times 100 = 57.8\%$

Final gauge length (between shoulders): 1.225 in
Estimated elongation: $\frac{0.289 \text{ in}}{0.500 \text{ in}} \times 100 = 57.8\%$

Estimated extension rate: 4.8×10^{-7}/s

Specimen failed by ductile failure. No signs of localized corrosion in gauge area, except for a spot with rust.

Galeapulino
3/18/92

SSRT 03 Slow Strain Rate Test on 316L SS (P80746)

Specimen cleaned and degreased as described on p. 33.

Specimen dimensions: gage = 0.9353" ϕ = 0.1249"

Solution Prep: To 500ml of 17MΩ water in a 1-L volumetric flask add 0.1225 $NaHCO_3$ and 1.6465 g NaCl and 1.4286 g Na_2SO_4 (same lot #'s as p. 33). Pipet 10.0ml of NO_3 stock and 2.0 ml of F stock solutions (same lot #'s as p. 33). Dilute to mark. Check pH and adjust to ~4.0 w/HCl (aq.) Initial pH 7.91 @25°C adjusted pH 3.99

Test SSRT 03

Test was conducted in solution containing 1000 ppm Cl^- and 1000 ppm SO_4^{2-} adjusted to pH ≈ 4.0 in machine # 1.

Solution was heated up to 95°C and temperature measured with calibrated thermometer. Nitrogen was bubbled for deaeration of the solution.
A potential of 0.0 V_{SCE} was applied and straining was started at 52 rpm = 0.5×10^{-7} in/sec. An initial load of 35.6 lbs was applied to the specimen

Test initiated 3/15/92 12.00 Test interrupted 3/16/92 12.00

Test data stored in disk SSRT DATA 1.

Test was interrupted due to leaks of the solution from the cell. However, no displacement was measured by the LVDT even though the load increased up to ~450 lbs. Current was cathodic most of the time. Above 450 lbs extension was noted through a change in LVDT readings.

Estimated extension rate: 4.4×10^{-7} in/sec. in this range. However, there is no explanation for the lack of displacement in the initial part of the test.

3/16/92

9/7/94

MODIFICATIONS OF THE EXPERIMENTAL SET-UP:

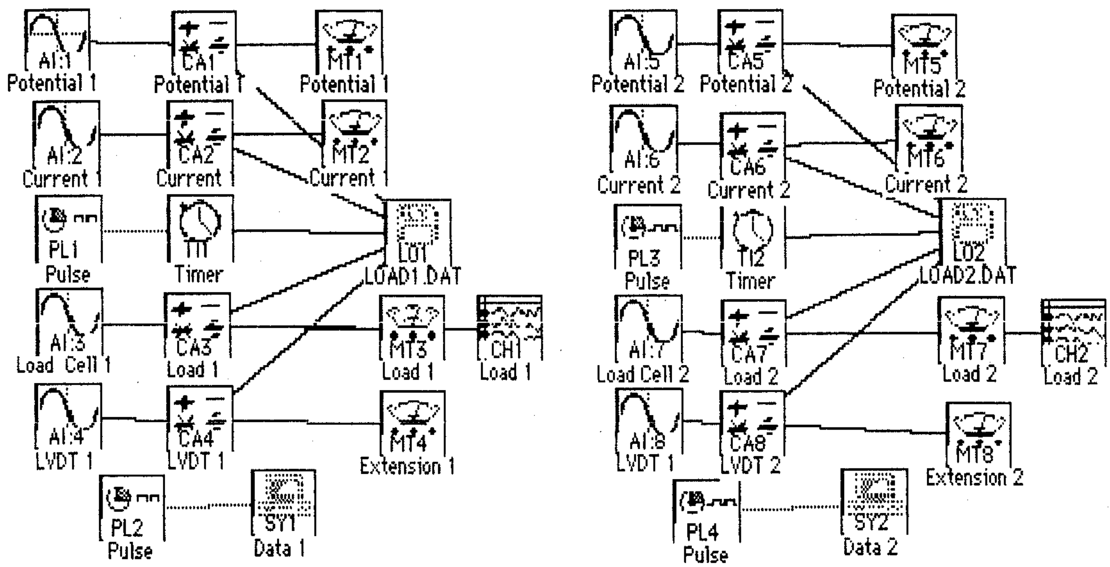
The two Model 410 Potentiostatic controllers were replaced by a Electrosynthesis Company Model 440 Multichannel Potentiostat.

Two of the channels of the Model 440 Potentiostat was used for controlling the potential of specimens in MACHINE #1 and MACHINE #2.

Connections were similar to that used with the two potentiostats, but only the reference voltage was measured and connected to the analog to digital input. All the analog inputs (load cell, LVDT, potential and current) were consolidated in a single board. The Model 440 Multichannel potentiostat has a digital readout which allows for each channel setting to measure the open circuit potential and the potential to be applied. The potential to be applied is selected manually by using a potentiometer in the corresponding channel board.

As a consequence of this change a new program was arranged for new testing. The worksheet of this program designated as SSRTSET2.WBB. is attached in the next page, as well as the description of all the items, including ranges, sample rate, etc.

These modifications were made in the week of 3/23/92 to 3/27/92, but the attached pages were printed on 4/17/92 after additional tests were conducted.


AI:1
Potential 1
CA1
Potential 1
MT1
Potential 1
AI:2
Current 1
CA2
Current
MT2
Current 1
PL1
Pulse
TI1
Timer
LO1
LOAD1.DAT
AI:3
Load Cell 1
CA3
Load 1
MT3
Load 1
CH1
Load 1
AI:4
LVDT 1
CA4
LVDT 1
MT4
Extension 1
PL2
Pulse
SY1
Data 1
AI:5
Potential 2
CA5
Potential 2
MT5
Potential 2
AI:6
Current 2
CA6
Current 2
MT6
Current 2
PL3
Pulse
TI2
Timer
LO2
LOAD2.DAT
AI:7
Load Cell 2
CA7
Load 2
MT7
Load 2
CH2
Load 2
AI:8
LVDT 1
CA8
LVDT 2
MT8
Extension 2
PL4
Pulse
SY2
Data 2

Worksheet Name:	SSRTSET2.WBB					
Hardware list:						
Name	AIs	AOs	DIOs	CTs	DIs	DOs
STI ACPC-16	16	0	16	0	0	0
Maximum icons:	500					
Grid size:	16					
Snap to grid:	< disabled >					
Report Unsynch:	< disabled >					
Fast Mode:	< disabled >					
Fast Mode samples:	1000					
Fast Mode rate:	1.0 Kilohertz					
Trigger level:	-10.0					
Trigger source:	Positive					
Trigger slope:	Analog					
Trigger mode:	None					
Pre-trigger samples:	0					
Com ports:	2					

Port:	COM 1
Comment:	Mouse connected

Port:	COM 2
Baud rate:	9600
Data bits:	8
Stop bits:	1
Duplex:	Half
Parity:	None
XonXoff:	< disabled >
Echo wait:	< disabled >
Line delay:	< disabled >

IEEE: < disabled >

Type: Analog Input

Name:	AI:1 Potential 1
Card Type:	STI ACPC-16
Channel Number:	1
Range:	+|-Auto V
Resolution:	Lo Noise (17ms)
Output Type:	Voltage
Sample rate:	1.0 Hertz
Fast Mode:	< disabled >

Inputs:
< None >
Outputs:
CA1 Potential 1

Name:	AI:2 Current 1
Card Type:	STI ACPC-16
Channel Number:	2
Range:	+|-Auto V
Resolution:	Lo Noise (17ms)
Output Type:	Voltage
Sample rate:	1.0 Hertz
Fast Mode:	< disabled >

Inputs:

```
Name:                   AI:3  Load  Cell 1
Card Type:              STI ACPC-16
Channel Number:         3
Range:                  Auto V
Resolution:             Lo Noise (17ms)
Output Type:            Voltage
Sample rate:            1.0   Hertz
Fast Mode:              < disabled >
Inputs:
    < None >
Outputs:
    CA3   Load 1

Name:                   AI:4  LVDT 1
Card Type:              STI ACPC-16
Channel Number:         4
Range:                  +|-Auto V
Resolution:             Lo Noise (17ms)
Output Type:            Voltage
Sample rate:            1.0   Hertz
Fast Mode:              < disabled >
Inputs:
    < None >
Outputs:
    CA4   LVDT 1

Name:                   AI:5  Potential 2
Card Type:              STI ACPC-16
Channel Number:         5
Range:                  +|-Auto V
Resolution:             Lo Noise (17ms)
Output Type:            Voltage
Sample rate:            1.0   Hertz
Fast Mode:              < disabled >
Inputs:
    < None >
Outputs:
    CA5   Potential 2

Name:                   AI:6  Current 2
Card Type:              STI ACPC-16
Channel Number:         6
Range:                  +|-Auto V
Resolution:             Lo Noise (17ms)
Output Type:            Voltage
Sample rate:            1.0   Hertz
Fast Mode:              < disabled >
Inputs:
    < None >
Outputs:
    CA6   Current 2

Name:                   AI:7  Load Cell 2
Card Type:              STI ACPC-16
Channel Number:         7
Range:                  +|-Auto V
Resolution:             Lo Noise (17ms)
Output Type:            Voltage
Sample rate:            1.0   Hertz
Fast Mode:              < disabled >
Inputs:
    < None >
```

Name:	AI:8 LVDT 1
Card Type:	STI ACPC-16
Channel Number:	8
Range:	+|-Auto V
Resolution:	Lo Noise (17ms)
Output Type:	Voltage
Sample rate:	1.0 Hertz
Fast Mode:	< disabled >

Inputs:
< None >
Outputs:
CA8 LVDT 2

Type: Timer

Name:	TI1 Timer

Inputs:
PL1 Pulse
Outputs:
LO1 LOAD1.DAT

Name:	TI2 Timer

Inputs:
PL3 Pulse
Outputs:
LO2 LOAD2.DAT

Type: Pulse

Name:	PL1 Pulse
High Duration:	10000.0 Hours
Low Duration:	1.0 Seconds
Start Value:	Low
Reset on exit	enabled

Inputs:
< None >
Outputs:
TI1 Timer

Name:	PL2 Pulse
High Duration:	1.0 Minutes
Low Duration:	6.0 Hours
Start Value:	Low
Reset on exit	enabled

Inputs:
< None >
Outputs:
SY1 Data 1

Name:	PL3 Pulse
High Duration:	10000.0 Hours
Low Duration:	1.0 Seconds
Start Value:	Low
Reset on exit	enabled

Inputs:
< None >
Outputs:
TI2 Timer

Name:	PL4 Pulse
High Duration:	1.0 Minutes
Low Duration:	6.0 Hours
Start Value:	Low

```
Outputs:
    SY2   Data 2

Type: Calculation

Name:                      CA1   Potential 1
Function:                  aX + bY
X input:                   AI:1  Potential 1
Y input:                   0.0
"a" constant:              -1.0
"b" constant:              0.0
"c" constant:              0.0
Inputs:
    AI:1  Potential 1
Outputs:
    MT1   Potential 1      LO1   LOAD1.DAT

Name:                      CA2   Current 1
Function:                  aX + bY
X input:                   AI:2  Current 1
Y input:                   0.0
"a" constant:              -0.1
"b" constant:              0.0
"c" constant:              0.0
Inputs:
    AI:2  Current 1
Outputs:
    MT2   Current 1        LO1   LOAD1.DAT

Name:                      CA3   Load 1
Function:                  aX / bY
X input:                   AI:3  Load  Cell 1
Y input:                   1.0
"a" constant:              299.8
"b" constant:              1.0
"c" constant:              0.0
Inputs:
    AI:3  Load  Cell 1
Outputs:
    CH1   Load 1           MT3   Load 1              LO1   LOAD1.DAT

Name:                      CA4   LVDT 1
Function:                  aX + bY
X input:                   AI:4  LVDT 1
Y input:                   0.247
"a" constant:              0.049595
"b" constant:              1.0
"c" constant:              0.0
Inputs:
    AI:4  LVDT 1
Outputs:
    MT4   Extension 1      LO1   LOAD1.DAT

Name:                      CA5   Potential 2
Function:                  aX + bY
X input:                   AI:5  Potential 2
Y input:                   0.0
"a" constant:              -1.0
"b" constant:              0.0
"c" constant:              0.0
Inputs:
    AI:5  Potential 2
Outputs:
```

```
Name:                          CA6   Current 2
Function:                      aX + bY
X input:                       AI:6  Current 2
Y input:                       0.0
"a" constant:                  -0.1
"b" constant:                  0.0
"c" constant:                  0.0
Inputs:
    AI:6   Current 2
Outputs:
    MT6    Current 2           LO2   LOAD2.DAT

Name:                          CA7   Load 2
Function:                      aX / bY
X input:                       AI:7  Load Cell 2
Y input:                       1.0
"a" constant:                  299.99
"b" constant:                  1.0
"c" constant:                  0.0
Inputs:
    AI:7   Load Cell 2
Outputs:
    CH2    Load 2              MT7   Load 2               LO2   LOAD2.DAT

Name:                          CA8   LVDT 2
Function:                      aX + bY
X input:                       AI:8  LVDT 1
Y input:                       0.246
"a" constant:                  0.049869
"b" constant:                  1.0
"c" constant:                  0.0
Inputs:
    AI:8   LVDT 1
Outputs:
    MT8    Extension 2         LO2   LOAD2.DAT

Type: Log______________________________________________________________

Name:                          LO1   LOAD1.DAT
Log Status:                    < disabled >
Sample Rate:                   30.0   Minutes
Gate:                          < None >
Data Format:
Heading:                       Slow strain rate test
File Path:                     C:\WB
File Name:                     LOAD1.DAT
Date Stamp:                    enabled
Time Stamp:                    enabled
Inputs:
    TI1    Timer               CA3   Load 1               CA4   LVDT 1
    CA1    Potential 1         CA2   Current 1
Outputs:
    < None >

Name:                          LO2   LOAD2.DAT
Log Status:                    < disabled >
Sample Rate:                   30.0   Minutes
Gate:                          < None >
Data Format:
Heading:                       Slow strain rate test
File Path:                     C:\WB
File Name:                     LOAD2.DAT
Date Stamp:                    enabled
Time Stamp:                    enabled
```

```
    CA5   Potential 2          CA6   Current 2
Outputs:
    < None >

Type: Meter

Name:                          MT1   Potential 1
Output Type:                   Fixed Point
Units:                         Volts
Integer:                       6
Decimal:                       3
Inputs:
    CA1   Potential 1
Outputs:
    < None >

Name:                          MT2   Current 1
Output Type:                   Exponential
Units:                         Amps
Integer:                       7
Decimal:                       2
Inputs:
    CA2   Current 1
Outputs:
    < None >

Name:                          MT3   Load 1
Output Type:                   Fixed Point
Units:                         Pounds
Integer:                       8
Decimal:                       1
Inputs:
    CA3   Load 1
Outputs:
    < None >

Name:                          MT4   Extension 1
Output Type:                   Fixed Point
Units:                         Inches
Integer:                       6
Decimal:                       3
Inputs:
    CA4   LVDT 1
Outputs:
    < None >

Name:                          MT5   Potential 2
Output Type:                   Fixed Point
Units:                         Volts
Integer:                       6
Decimal:                       3
Inputs:
    CA5   Potential 2
Outputs:
    < None >

Name:                          MT6   Current 2
Output Type:                   Exponential
Units:                         Amps
Integer:                       7
Decimal:                       2
Inputs:
    CA6   Current 2
Outputs:
```

Name: MT7 Load 2
Output Type: Fixed Point
Units: Pounds
Integer: 8
Decimal: 1
Inputs:
CA7 Load 2
Outputs:
< None >

Name: MT8 Extension 2
Output Type: Fixed Point
Units: Inches
Integer: 6
Decimal: 3
Inputs:
CA8 LVDT 2
Outputs:
< None >

Type: Chart

Name: CH1 Load 1
Chart Color: White
X Axis Label: Hours
X Axis Min: 0.0
X Axis Max: 180.0
Y Axis Label: Load, lbs
Y Axis Min: 0.0
Y Axis Max: 1000.0
Inputs:
CA3 Load 1
Outputs:
< None >

Name: CH2 Load 2
Chart Color: White
X Axis Label: Hours
X Axis Min: 0.0
X Axis Max: 180.0
Y Axis Label: Load, lbs
Y Axis Min: 0.0
Y Axis Max: 1000.0
Inputs:
CA7 Load 2
Outputs:
< None >

Type: System

Name: SY1 Data 1
Enabled: Yes
Run Commands:
Copy File ... C:\WB\CLIPBRD\SSRTSS04
To ... B:\SSRTSS04
Inputs:
PL2 Pulse
Outputs:
< None >

Name: SY2 Data 2
Enabled: Yes
Run Commands:
Copy File ... C:\WB\CLIPBRD\SSRTSS05

```
    [illegible]
Outputs:
    < None >
```

Test SSRTSS04:

Specimen cleaned and degreased as described in p. 33, after being polished in the longitudinal direction with 600 SiC grit paper.
Specimen dimensions:
Gauge length: 0.9478 in
Gauge diameter: 0.125 in

Test was conducted in solution containing 1000 ppm Cl^- and 1000 ppm SO_4^{2-} and lower amounts of HCO_3^-, NO_3^- and F^-. The preparation is as described in page 36, but without pH adjustment. Solution was heated up to 95°C and temperature measured with calibrated thermometer. Solution was deaerated by bubbling nitrogen.
Test was conducted in Machine #1. Data stored in disk SSRT DATA 1.
Test initiated 3/27/92 9:54 Test completed: 4/5/92
Applied potential: 0.0 V_{SCE}; Initial load: 30.6 lb

Maximum load: 895.0 lbs.
Time to failure: 221.5 hrs = 7.97×10^6 sec
Elongation to failure: $\frac{0.305}{0.5\ in} \times 100 = 61.0\%$

Final gauge length (between shoulders) 1.240 in
Estimated elongation: $\frac{0.292\ in}{0.5\ in} \times 100 = 58.4\%$
Estimated extension rate = 3.8×10^{-8} in/sec ?

Current density during testing fluctuate between 1.0×10^{-5} A and -1.0×10^{-6} A, being predominantly anodic

Jaragualin
4/5/92

Test SSRTSS05

Specimen prepared as before (p 40)
Specimen dimensions:
Gauge length: 0.9422 in
Gauge diameter: 0.125 in.

Test was conducted in same solution as Test SSRTSS04 under similar conditions of temperature and deaeration.
Test was conducted in Machine #2. Data stored in disk SSRT DATA 1
Test initiated: 3/27/92 9:57 Test completed: 4/2/92 12:57
Applied potential: 0.047 V_{SCE}, Initial load: 28.8 lbs

Maximum load: 939.4 lbs (straining was interrupted
Time: 147 hs = 5.29×10^5 sec.
Elongation 0.268 in

Final gauge length (between shoulders) 1.245 in
Estimated elongation $\frac{0.3028\ in}{0.5\ in} \times 100 = 60.1\%$.
Estimated extension rate: 5.0×10^{-7} in/sec

Current density during testing was consistently anodic increasing from 9.9×10^{-6} A up to 1.3×10^{-3} A, but decreasing later. Cathodic currents were noted as associated to leakage of solution.

Test was interrupted due to solution leakage from the cell on 4/2/92. Crevice corrosion was noted in the bottom o-ring position of the specimen, with signs of corrosion and rust deposit in the lower end of the specimen.

Jaragualin
4/2/92

Test SSRTS506 5/10/92

Specimen prepared as before. No polishing because it is a notched specimen

Test was conducted in solution containing 1000 ppm Cl^-, 1000 ppm SO_4^{2-} and low amounts of HCO_3^-, NO_3^- and F^- as in tests described before (p. 40 and 41). Solution was heated to 95°C. Deaeration with nitrogen was initiated on 5/10/92 18.06 $E_C = 0.353 V_{SCE}$
5/11/92 8.06 $E_C = -0.142 V_{SCE}$
Test was conducted in Machine #1. Data stored in disk SSRT Data 1

Test initiated 5/11/92
Applied potential: $0.050 V_{SCE}$.

Experiment interrupted due to solution leakage. Data lost in the transfer of file to GRAPHER.

Intense crevice corrosion in the lower end of the specimen in a circumferential pattern corresponding to the O-ring seal of the cell forming a groove.

Gmagnolin
5/11/92

Test SSRTS507: 6/22/92

Notched specimen cleaned and degreased with acetone as before. A O-ring was located in the notch

Test was conducted in solution containing 1000 ppm Cl^- and low amounts of SO_4^{2-}, HCO_3^-, NO_3^- and F^-. Solution was heated to 95°C. Deaeration and acidification was conducted by bubling CO_2 into the solution.
Test conducted in Machine #1. Data stored in Disk SSRT Data 1.
After bubling with CO_2 $E_C = -0.256 V_{SCE}$.

Straining started on 6/22/92 at 16:34.
Applied potential: $0.000 V_{SCE}$. $i \cong 5.2 \times 10^{-6}$ Amp
Initial load: 35 lbs.

Maximum load: 1338 lbs.
Time to failure: 2.069×10^5 sec. = 57.5 hrs.

Current density became cathodic at times with large oscillations.
On 6/24/92 potential control was lost, probably due to solution evaporation. Straining was continued with cathodic potential of $-0.280 V_{SCE}$.

No signs of SCC in fracture surface.

Gmagnolin
6/25/92

Test SSRT SS08 DAtgar 6/22/92

Notched specimen cleaned and defreased with acetone as before. A O-ring was located in the notch.

Test was conducted in the same solution as in Test SSRT SS07 (p.43) Similar deaeration with CO_2.
Test conducted in Machine #2. Data stored in Disk SSRT Data 1

Straining started on 6/22/92 at 16:37
Applied potential : 0.050 V_{SCE} $i = 5.3 \times 10^{5}$ Amp
Initial load: 33.8 lbs.

Maximum load: 1377.8 lbs
Time to failure: 1.76×10^{5} sec = 48.9 hrs
Elongation (LVDT): 0.070 in

Current becomes cathodic at time with large oscillations. Potential was stable during tests.

No sign of SCC on fracture surface.

Jalagonlin
6/25/92

MODIFICATIONS TO THE EXPERIMENTAL SET-UP

An additional modification was introduced to set up the potential by means of an analog to digital converter. All these modifications are documented in document issued by W. Peters on May 1992 (time at which modifications were done). Modif. for ESC Model 440-3 Multichannel Potentiostat with LVDT & Load Cell Inst.
Two additional modifications were:
1) change of LVDTs

Machine #1 Schaevitz GCA-121-250 Serial No 6235
Machine #2 Schaevitz GCA-121-250 Serial No 6221

These are spring return LVDTs which were calibrated jointly with the corresponding signal conditioner as described in page 10. Calibration records are included in following page. Same for load cells.

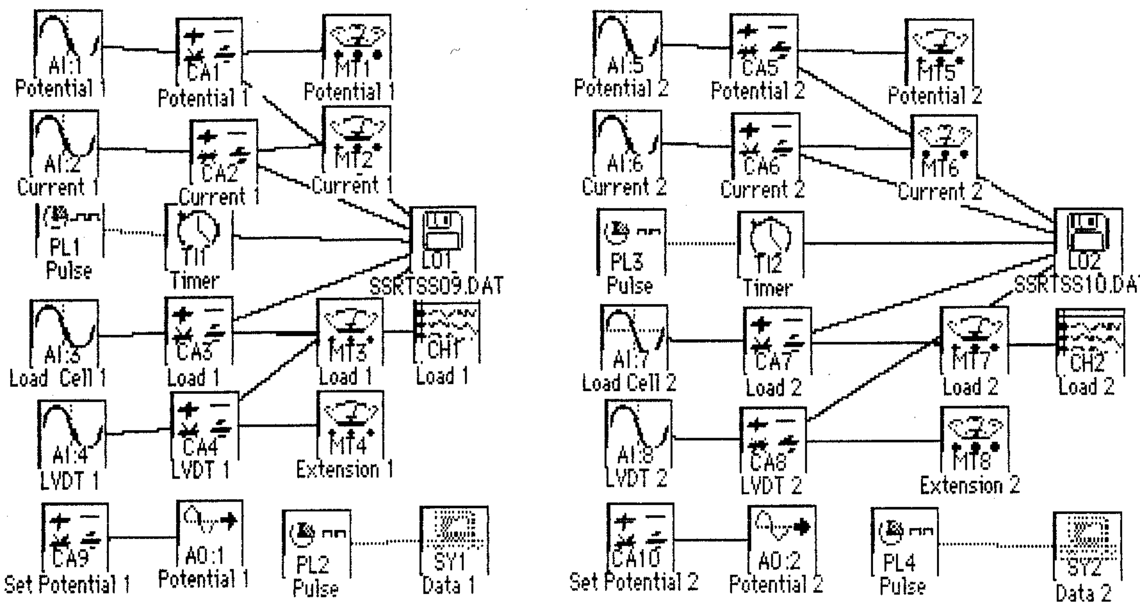
2) electrical insulation of the pull road and associated universal joint (bottom) from the machine frame to avoid ground loops.

These last modifications were conducted later during July and August.

Finally the Workbench program was modified as indicated in the attached pages (see page 46). The new set up. was designated SSRTSET3. WBB.

Jalagonlin
10/19/92

SSRTSET3.WBB 19-Oct-92 13:01:30 Page 1



```
Worksheet Name:                SSRTSET3.WBB
Hardware list:
    Name                       AIs    AOs    DIOs   CTs    DIs    DOs
    STI ACPC-16                16     0      16     0      0      0
    STI ACAO-12                0      8      8      0      0      0
Maximum icons:                 500
Grid size:                     16
Snap to grid:                  < disabled >
Report Unsynch:                < disabled >
Fast Mode:                     < disabled >
Fast Mode samples:             1000
Fast Mode rate:                1.0 Kilohertz
Trigger level:                 -10.0
Trigger source:                Positive
Trigger slope:                 Analog
Trigger mode:                  None
Pre-trigger samples:           0
Com ports:                     2

    Port:                      COM 1
    Comment:                   Mouse connected

    Port:                      COM 2
    Baud rate:                 9600
    Data bits:                 8
    Stop bits:                 1
    Duplex:                    Half
    Parity:                    None
    XonXoff:                   < disabled >
    Echo wait:                 < disabled >
    Line delay:                < disabled >

IEEE:                          < disabled >

Type: Analog Input_____________________________________________________________

Name:                          AI:1  Potential 1
Card Type:                     STI ACPC-16
Channel Number:                1
Range:                         +|-Auto V
Resolution:                    Lo Noise (17ms)
Output Type:                   Voltage
Sample rate:                   0.1   Hertz   gal
Fast Mode:                     < disabled >
Inputs:
    < None >
Outputs:
    CA1   Potential 1

Name:                          AI:2  Current 1
Card Type:                     STI ACPC-16
Channel Number:                2
Range:                         +|-Auto V
Resolution:                    Lo Noise (17ms)
Output Type:                   Voltage
Sample rate:                   0.1   Hertz   gal
Fast Mode:                     < disabled >
Inputs:
    < None >
Outputs:
```

CA2 Current 1

Name: AI:3 Load Cell 1
Card Type: STI ACPC-16
Channel Number: 3
Range: Auto V
Resolution: Lo Noise (17ms)
Output Type: Voltage
Sample rate: ~~0.~~1 Hertz gac
Fast Mode: < disabled >
Inputs:
< None >
Outputs:
CA3 Load 1

Name: AI:4 LVDT 1
Card Type: STI ACPC-16
Channel Number: 4
Range: +|-Auto V
Resolution: Lo Noise (17ms)
Output Type: Voltage
Sample rate: ~~0.~~1 Hertz gac
Fast Mode: < disabled >
Inputs:
< None >
Outputs:
CA4 LVDT 1

Name: AI:5 Potential 2
Card Type: STI ACPC-16
Channel Number: 5
Range: +|-Auto V
Resolution: Lo Noise (17ms)
Output Type: Voltage
Sample rate: ~~0.~~1 Hertz gac
Fast Mode: < disabled >
Inputs:
< None >
Outputs:
CA5 Potential 2

Name: AI:6 Current 2
Card Type: STI ACPC-16
Channel Number: 6
Range: +|-Auto V
Resolution: Lo Noise (17ms)
Output Type: Voltage
Sample rate: ~~0~~.1 Hertz gac
Fast Mode: < disabled >
Inputs:
< None >
Outputs:
CA6 Current 2

Name: AI:7 Load Cell 2
Card Type: STI ACPC-16
Channel Number: 7
Range: +|-Auto V
Resolution: Lo Noise (17ms)
Output Type: Voltage

Sample rate: ~~0.~~1 Hertz
Fast Mode: < disabled >
Inputs:
< None >
Outputs:
CA7 Load 2

Name: AI:8 LVDT 2
Card Type: STI ACPC-16
Channel Number: 8
Range: +|-Auto V
Resolution: Lo Noise (17ms)
Output Type: Voltage
Sample rate: ~~0.~~1 Hertz
Fast Mode: < disabled >
Inputs:
< None >
Outputs:
CA8 LVDT 2

Type: Timer

Name: TI1 Timer
Inputs:
PL1 Pulse
Outputs:
LO1 SSRTSS09.DAT

Name: TI2 Timer
Inputs:
PL3 Pulse
Outputs:
LO2 SSRTSS10.DAT

Type: Pulse

Name: PL1 Pulse
High Duration: 10000.0 Hours
Low Duration: 1.0 Seconds
Start Value: Low
Reset on exit enabled
Inputs:
< None >
Outputs:
TI1 Timer

Name: PL2 Pulse
High Duration: 1.0 Minutes
Low Duration: 6.0 Hours
Start Value: Low
Reset on exit enabled
Inputs:
< None >
Outputs:
SY1 Data 1

Name: PL3 Pulse
High Duration: 10000.0 Hours
Low Duration: 1.0 Seconds
Start Value: Low

```
Reset on exit                 enabled
Inputs:
    < None >
Outputs:
    TI2   Timer

Name:                         PL4   Pulse
High Duration:                1.0   Minutes
Low Duration:                 6.0   Hours
Start Value:                  Low
Reset on exit                 enabled
Inputs:
    < None >
Outputs:
    SY2   Data 2

Type: Calculation
```

```
Name:                         CA1   Potential 1
Function:                     aX + bY
X input:                      AI:1  Potential 1
Y input:                      0.0
"a" constant:                 -1.0
"b" constant:                 0.0
"c" constant:                 0.0
Inputs:
    AI:1  Potential 1
Outputs:
    MT1   Potential 1         LO1   SSRTSS09.DAT

Name:                         CA2   Current 1
Function:                     aX + bY
X input:                      AI:2  Current 1
Y input:                      0.0
"a" constant:                 -0.1
"b" constant:                 0.0
"c" constant:                 0.0
Inputs:
    AI:2  Current 1
Outputs:
    MT2   Current 1           LO1   SSRTSS09.DAT

Name:                         CA3   Load 1
Function:                     aX / bY
X input:                      AI:3  Load  Cell 1
Y input:                      1.0
"a" constant:                 301.216
"b" constant:                 1.0
"c" constant:                 0.0
Inputs:
    AI:3  Load  Cell 1
Outputs:
    CH1   Load 1              MT3   Load 1                   LO1   SSRTSS09.DAT

Name:                         CA4   LVDT 1
Function:                     aX + bY
X input:                      AI:4  LVDT 1
Y input:                      0.0
"a" constant:                 0.0498
"b" constant:                 1.0
```

```
"c" constant:                 0.0
Inputs:
    AI:4  LVDT 1
Outputs:
    MT4   Extension 1         LO1   SSRTSS09.DAT

Name:                         CA5   Potential 2
Function:                     aX + bY
X input:                      AI:5  Potential 2
Y input:                      0.0
"a" constant:                 -1.0
"b" constant:                 0.0
"c" constant:                 0.0
Inputs:
    AI:5  Potential 2
Outputs:
    MT5   Potential 2         LO2   SSRTSS10.DAT

Name:                         CA6   Current 2
Function:                     aX + bY
X input:                      AI:6  Current 2
Y input:                      0.0
"a" constant:                 -0.1
"b" constant:                 0.0
"c" constant:                 0.0
Inputs:
    AI:6  Current 2
Outputs:
    MT6   Current 2           LO2   SSRTSS10.DAT

Name:                         CA7   Load 2
Function:                     aX / bY
X input:                      AI:7  Load Cell 2
Y input:                      1.0
"a" constant:                 294.32
"b" constant:                 1.0
"c" constant:                 0.0
Inputs:
    AI:7  Load Cell 2
Outputs:
    CH2   Load 2              MT7   Load 2            LO2   SSRTSS10.DAT

Name:                         CA8   LVDT 2
Function:                     aX + bY
X input:                      AI:8  LVDT 2
Y input:                      0.0
"a" constant:                 0.0587
"b" constant:                 1.0
"c" constant:                 0.0
Inputs:
    AI:8  LVDT 2
Outputs:
    MT8   Extension 2         LO2   SSRTSS10.DAT

Name:                         CA9   Set Potential 1
Function:                     X + Y
X input:                      0.05
Y input:                      0.0
"a" constant:                 0.0
"b" constant:                 0.0
```

```
"c" constant:                 0.0
Inputs:
    < None >
Outputs:
    AO:1  Potential 1

Name:                         CA10  Set Potential 2
Function:                     X + Y
X input:                      0.1
Y input:                      0.0
"a" constant:                 0.0
"b" constant:                 0.0
"c" constant:                 0.0
Inputs:
    < None >
Outputs:
    AO:2  Potential 2

Type: Log____________________________________________________________________

Name:                         LO1   SSRTSS09.DAT
Log Status:                   < disabled >
Sample Rate:                  30.0   Minutes
Gate:                         < None >
Data Format:
Heading:                      SSRT 316LSS, Tensile specimen, 1000 ppm Cl,  . 95C
,  0.050 Vsce
File Path:                    C:\WB\CLIPBRD
File Name:                    SSRTSS09.DAT
Date Stamp:                   enabled
Time Stamp:                   enabled
Inputs:
    TI1   Timer               CA3   Load 1              CA4   LVDT 1
    CA1   Potential 1         CA2   Current 1
Outputs:
    < None >

Name:                         LO2   SSRTSS10.DAT
Log Status:                   < disabled >
Sample Rate:                  30.0   Minutes
Gate:                         < None >
Data Format:
Heading:                      SSRTSS10, 316LSS, Tensile specimen, 1000 ppm Cl, 9
5C, 0.100  Vsce
File Path:                    C:\WB\CLIPBRD
File Name:                    SSRTSS10.DAT
Date Stamp:                   enabled
Time Stamp:                   enabled
Inputs:
    TI2   Timer               CA7   Load 2              CA8   LVDT 2
    CA5   Potential 2         CA6   Current 2
Outputs:
    < None >

Type: Meter__________________________________________________________________

Name:                         MT1   Potential 1
Output Type:                  Fixed Point
Units:                        Volts
Integer:                      6
```

```
Decimal:                        3
Inputs:
    CA1   Potential 1
Outputs:
    < None >

Name:                           MT2   Current 1
Output Type:                    Exponential
Units:                          Amps
Integer:                        7
Decimal:                        2
Inputs:
    CA2   Current 1
Outputs:
    < None >

Name:                           MT3   Load 1
Output Type:                    Fixed Point
Units:                          Pounds
Integer:                        8
Decimal:                        1
Inputs:
    CA3   Load 1
Outputs:
    < None >

Name:                           MT4   Extension 1
Output Type:                    Fixed Point
Units:                          Inches
Integer:                        6
Decimal:                        3
Inputs:
    CA4   LVDT 1
Outputs:
    < None >

Name:                           MT5   Potential 2
Output Type:                    Fixed Point
Units:                          Volts
Integer:                        6
Decimal:                        3
Inputs:
    CA5   Potential 2
Outputs:
    < None >

Name:                           MT6   Current 2
Output Type:                    Exponential
Units:                          Amps
Integer:                        7
Decimal:                        2
Inputs:
    CA6   Current 2
Outputs:
    < None >

Name:                           MT7   Load 2
Output Type:                    Fixed Point
Units:                          Pounds
Integer:                        8
```

Decimal: 1
Inputs:
CA7 Load 2
Outputs:
< None >

Name: MT8 Extension 2
Output Type: Fixed Point
Units: Inches
Integer: 6
Decimal: 3
Inputs:
CA8 LVDT 2
Outputs:
< None >

Type: Chart

Name: CH1 Load 1
Chart Color: White
X Axis Label: Hours
X Axis Min: 0.0
X Axis Max: 180.0
Y Axis Label: Load, lbs
Y Axis Min: 0.0
Y Axis Max: 1000.0
Inputs:
CA3 Load 1
Outputs:
< None >

Name: CH2 Load 2
Chart Color: White
X Axis Label: Hours
X Axis Min: 0.0
X Axis Max: 180.0
Y Axis Label: Load, lbs
Y Axis Min: 0.0
Y Axis Max: 1000.0
Inputs:
CA7 Load 2
Outputs:
< None >

Type: Analog Output

Name: AO:1 Potential 1
Card Type: STI ACAO-12
Channel Number: 1
Range: +|- 5 Volts
Resolution: 0.024%
Inputs:
CA9 Set Potential 1
Outputs:
< None >

Name: AO:2 Potential 2
Card Type: STI ACAO-12
Channel Number: 2
Range: +|- 5 Volts

Resolution:	0.024%
Inputs:	
CA10 Set Potential 2	
Outputs:	
< None >	

Type: System

Name:	SY1 Data 1
Enabled:	Yes
Run Commands:	
Copy File ...	C:\WB\CLIPBRD\SSRTSS09.DAT
To ...	B:\SSRTSS09.DAT
Inputs:	
PL2 Pulse	
Outputs:	
< None >	

Name:	SY2 Data 2
Enabled:	Yes
Run Commands:	
Copy File ...	C:\WB\CLIPBRD\SSRTSS10.DAT
To ...	B:\SSRTSS10.DAT
Inputs:	
PL4 Pulse	
Outputs:	
< None >	

1992

1

Standard Used: Morehouse Proving Ring 1 Kip Serial No: 5616

Calibration of: 2 Kip Load Cell Serial No: 275744

Amplifier: Schaevitz ATA101D Serial No: 14

Digital Voltmeter: HP3465B Serial No: 1530A08815

Frame No. N/A By: [illegible] Campbell Tens. or Comp.: Tension Only

Date: 8-12-92 Temp: 75°F Cal. Volts A: +4.439 B:

Defl.	lbs	Run #1	Run #2	Run #3	Avg.	Error lbs
+6						
100	98.201	.327	.330	.326	.3277	.7988
200	196.909	.650	.656	.653	.6530	.0764
300	296.204	.983	.981	.982	.9820	-.1185
400	396.096	1.314	1.315	1.313	1.3140	-.0067
500	496.596	1.644	1.640	1.648	1.6440	-1.1054
600	597.716	1.982	1980	1.983	1.9817	-.5047
700	699.468	2.322	2.319	2.324	2.3217	.1567
800	801.862	2.660	2.661	2.661	2.6607	-.1250
900	904.912	3.005	3.006	3.003	3.0047	.4434
990	998.227	3.316	3.309	3.318	3.3143	.3849

Y intercept : -9.6706×10^{-4} R fit of slope:

Slope : 3.31988×10^{-3} V/# $301.2157\ \#/V \times 4.439V$ volt * = (1337.1 # Cal sw)

Poly. Fit Coeff. a0 : a1 : a2 : a3 :

$$y = a_0 + a_1 * X + a_2 * X^2 + a_3 * X^3$$

Standard Used: Morehouse Proving Ring 10 Kip Serial No: 3668C-709 1972 (1)

Calibration of: 2 Kip LC Serial No: 275744

Amplifier: Schaevitz ATA101D Serial No: 14

Digital Voltmeter: HP 3465B Serial No: 1530A08815

Frame No. N/A By: J Campbell Tens. or Comp.: Tension ONLY

Date: 8-12-92 Temp: 75°F Cal. Volts A: 4.434 V B: ______

Div	lbs	Run #1	Run #2	Run #3	Avg.	ERROR lbs
+1	0					
60	706.5	+2.347	+2.355	+2.354	+2.352	+1.22 #
70	824.7	+2.743	+2.748	+2.745	+2.7453	+.476 #
80	942.9	+3.137	+3.142	+3.144	+3.1410	+.449
90	1061.2	+3.537	+3.533	+3.534	+3.5347	-.275
100	1179.6	+3.925	+3.930	+3.928	+3.9277	-1.3086
110	1298.0	+4.321	4.325	+4.327	+4.3243	-1.267
120	1416.5	+4.726	+4.724	+4.724	+4.7247	-.1903
130	1535.0	+5.120	+5.123	+5.121	+5.1213	-.2486
140	1653.6	+5.515	+5.520	+5.518	+5.5177	-.466
150	1772.2	+5.923	+5.913	+5.915	+5.9170	+.1815
160	1890.9	+6.311	+6.316	+6.312	+6.3130	-.256
170	2009.7	+6.719	+6.719	+6.714	+6.7173	+1.685

Y intercept : -1.7787×10^{-2} R fit of slope: .999998

Slope : 3.34848×10^{-3} V/# volt * $(298.643 \text{ \#/V}) * 4.434$ = (1324.18 lbs Cal SW)

Poly. Fit Coeff. a_0: ______ a_1: ______ a_2: ______ a_3: ______

$$y = a_0 + a_1*X + a_2*X^2 + a_3*X^3$$

1992 (2)

Standard Used: Morehouse Proving Ring 1 KIP Serial No: 5616

Calibration of: 2 Kip Load Cell Serial No: 275743

Amplifier: Schaevitz ATA101D Serial No: 45

Digital Voltmeter: HP3465B Serial No: 1530A08815

Frame No. N/A By: J Campbell Tens. or Comp.: Tension ONLY

Date: 8-13-92 Temp: 75 °F Cal. Volts A: 4.427 B:

Defl	Load #	Run #1	Run #2	Run #3	Avg.	Error #
+6						
100	98.201	.333	.334	.335	.3340	.500
200	196.909	.667	.667	.673	.6690	.3892
300	296.204	1.001	1.006	1.007	1.0047	-.1026
400	396.096	1.341	1.340	1.344	1.3417	-.809
500	496.596	1.686	1.686	1.688	1.6867	.2316
600	597.716	2.024	2.028	2.030	2.0273	-.643
700	699.468	2.373	2.375	2.376	2.3747	-.1482
800	801.862	2.721	2.726	2.720	2.7223	-.237
900	904.912	3.072	3.076	3.075	3.0743	.3140
990	998.227	3.392	3.391	3.390	3.3910	.2102

Y intercept : -1.3526×10^{-3} R fit of slope: .99999

Slope : 3.39766×10^{-3} V/# volt * 294.32 #/V * 4.427V = (1302.96 # Cal Switch)

Poly. Fit Coeff. a_0:____ a_1:____ a_2:____ a_3:____

$y = a_0 + a_1 * X + a_2 * X^2 + a_3 * X^3$

1992 (2)

Standard Used: Morehouse Proving Ring 10 Kip Serial No: 3668C-709

Calibration of: 2 Kip Load Cell Serial No: 275743

Amplifier: Schaevitz ATA101D Serial No: 45

Digital Voltmeter: HP 3465B Serial No: 1530A08815

Frame No. N/A By: [signature] Campbell Tens. or Comp.: Tension Only

Date: 8-13-92 Temp: 75 °F Cal. Volts A: 4.427 V B: —

Div	lbs	Run #1	Run #2	Run #3	Avg.	Error lbs
+1	0					
60	706.5	2.406	2.407	2.412	2.4083	.2977
70	824.7	2.818	2.806	2.813	2.8123	.5842
80	942.9	3.219	3.214	3.221	3.2180	1.3692
90	1061.2	3.612	3.614	3.616	3.6140	-.7905
100	1179.6	4.013	4.016	4.020	4.0163	-1.2026
110	1298.0	4.419	4.423	4.424	4.4220	-.6175
120	1416.5	4.819	4.835	4.831	4.8283	.0435
130	1535.0	5.228	5.234	5.234	5.2320	-.0580
140	1653.6	5.630	5.639	5.636	5.6350	-.4648
150	1772.2	6.034	6.039	6.039	6.0373	-1.0768
160	1890.9	6.447	6.450	6.446	6.4477	.5867
170	2009.7	6.850	6.862	6.854	6.8553	1.329

Y intercept : -1.6476×10^{-3} R fit of slope: .999998

Slope : 3.40967×10^{-3} V/# 293.283 #/V volt * 4.427 V = (1298.37 # Cal Switch)

Poly. Fit Coeff. a0:____ a1:____ a2:____ a3:____

$$y = a_0 + a_1 * X + a_2 * X^2 + a_3 * X^3$$

1992 ①

Standard Used: Drum Micrometer Serial No: 2-1

Calibration of: Schaevitz LVDT (GCA-121-250) Serial No: 6235

Amplifier: Schaevitz ATA101 Serial No: 1385

Digital Voltmeter: HP3465B Serial No: 1530A08815

Frame No. N/A By: LS Campbell Tens. or Comp.: N/A

Date: 8-6-92 Temp: 75 °F Cal. Volts A: N/A B: N/A

Micrometer INCHES		Run #1	Run #2	Run #3	Avg.	Error (in)
-.250		-4.996	-4.996	-4.995	-4.9957	+.00011
-.225		-4.500	-4.501	-4.500	-4.5003	+.0004
-.200		-4.001	-4.002	-4.002	-4.0017	+.00025
-.175		-3.502	-3.503	-3.503	-3.5027	+.00011
-.150		-3.002	-3.003	-3.003	-3.0027	+.00003
-.125		-2.504	-2.504	-2.504	-2.5040	-.00011
-.100		-2.005	-2.006	-2.006	-2.0057	-.00028
-.075		-1.506	-1.507	-1.507	-1.5067	-.00041
-.050		-1.007	-1.008	-1.007	1.0073	-.00052
-.025		-.506	-.507	-.507	-.5067	-.00058
0		-.003	-.004	-.004	-.0037	-.0005
+.025		+.501	+.500	+.500	.5003	-.00039
+.050		+1.007	+1.006	+1.006	1.0063	-.00017
+.075		+1.513	+1.512	+1.511	1.5120	+.00003
+.100		+2.018	+2.017	+2.016	2.0170	+.0002
+.125		+2.521	+2.520	+2.520	2.5203	+.0003
+.150		+3.022	+3.021	+3.021	3.0213	+.0002
+.175		+3.523	+3.522	+3.522	3.5223	+.0002
+.200		+4.024	+4.023	+4.023	4.0233	+.0002
+.225		+4.525	+4.523	+4.523	4.5237	+.0001
+.250		+5.028	+5.026	+5.026	5.0267	+.0002

Y intercept : .006476 v R fit of slope: .999998

Slope : 20.065538 v/in volt * ________ = ________

Poly. Fit Coeff. a_0: ________ a_1: ________ a_2: ________ a_3: ________

$$y = a_0 + a_1 * X + a_2 * X^2 + a_3 * X^3$$

1992 (2)

Standard Used: Drum Micrometer Serial No: 2-1

Calibration of: Schaevitz LVDT (GCA 121-250 Serial No: 6221

Amplifier: Schaevitz ATA101 Serial No: 1438

Digital Voltmeter: HP3465B Serial No: 1530A08815

Frame No. N/A By: J Campbell Tens. or Comp.: N/A

Date: 8-4-92 Temp: 75 °F Cal. Volts A: N/A B: N/A

		Run #1	Run #2	Run #3	Avg.	Error (in)
-.250		-4.287	-4.287	-4.287	-4.287	-.00108
-.225		-3.851	-3.851	-3.851	-3.851	-.00047
-.200		-3.418	-3.418	-3.419	-3.4183	-.000016
-.175		-2.989	-2.989	-2.990	-2.9893	+.00014
-.150		-2.562	-2.563	-2.562	-2.5623	+.00023
-.125		-2.137	-2.137	-2.137	-2.137	+.00021
-.100		-1.712	-1.712	-1.712	-1.712	+.00017
-.075		-1.287	-1.287	-1.287	-1.287	+.00014
-.050		-.861	-.861	-.861	-.861	+.00016
-.025		-.434	-.434	-.434	-.434	+.00024
0		-.007	-.007	-.007	-.007	+.00033
+.025		+.420	+.420	+.420	+.420	+.00041
+.050		+.847	+.847	+.847	+.847	+.00049
+.075		+1.272	+1.272	+1.272	+1.272	+.00045
+.100		+1.696	+1.696	+1.696	+1.696	+.00036
+.125		+2.118	+2.118	+2.117	+2.1177	+.00013
+.150		+2.539	+2.539	+2.539	+2.539	-.00012
+.175		+2.961	+2.960	+2.960	+2.9603	-.00037
+.200		+3.384	+3.384	+3.383	+3.3837	-.00050
+.225		+3.809	+3.809	+3.809	+3.809	-.00052
+.250		+4.238	+4.238	+4.238	+4.238	-.00032

Y intercept : -.012533 R fit of slope: .999997

Slope : 17.024078 v/in volt * ______ = ______

Poly. Fit Coeff. a0:______ a1:______ a2:______ a3:______

$y = a_0 + a_1 * X + a_2 * X^2 + a_3 * X^3$

Test SSRTSS09: 10/20/92

Tensile specimen cleaned and degreased as described before, after being polished in the longitudinal direction with 600 grit SiC paper.

Specimen dimensions:

Gauge length : 0.928 in

Gauge diameter: 0.124 in

9/1/94

TEST CONDUCTED IN 1000 PPM Cl^-, 85 PPM HCO_3^-, 20 PPM $SO_4^=$, 10 PPM NO_3^-, 2 PPM F^-. SOLUTION WAS DEAERATED WITH CO_2. TEST CONDUCTED ON MACHINE #1 DATA STORED IN SSRTSS09.DAT

STRAINING STARTED ~~ON~~ DD 10/21/92 AT 09:30

INITIAL LOAD 33.1 POUNDS

E_c -514 mV SCE KEITHLEY 614

E_{APP} = 0.050 V SCE TILL 17:00 THEN 0.0 V SCE

CURRENT 3.12×10^{-4} AMP @ 0.050 V, -3.5×10^{-6} AMP AT 0.0 V

MEASURED WITH KEITHLEY 485

ADDED ≈ 165 ml H_2O FROM 10/23 – 10/28 DUE TO SOLUTION EVAPORATION DD

MAXIMUM LOAD: 910.2 LBS

TIME TO FAILURE: 705600 SEC (196 hr)

ELONGATION (LVDT): 0.340

SOLUTION PH (END OF TEST) 5.363

10/30/92

Starting on 10/20/92 DARRELL DUNN was the main responsable of conducting the tests 9/1/94

TEST SSRTSS10 10/20/92

Tensile specimen cleaned and degreased as described before. Polished with 600 grit SiC paper.

Specimen dimension

Gauge length : 0.930 in

Gauge diameter: 0.124 in

Grace [illegible] 9/1/94

TEST CONDUCTED ON MACHINE # 2 IN SAME SOLUTION AS SSRTSS09 (PAGE 47) DATA STORED IN SSRTSS10.DAT

STRAINING STARTED AT 10/21/92 09:30

INITIAL LOAD : 9.50 LBS

E_c = −523 mV SCE KEITHLEY 614

EAPP 0.100 V vs SCE "

CURRENT 1.6×10^{-4} AMP − 8.0×10^{-4} AMP KEITHLEY 485

ADDED 65 ml H_2O FROM 10/23 − 10/25

MAXIMUM LOAD : 816.80 LBS.

TIME TO FAILURE : 473,350 (131.49 hr)

ELONGATION (LVDT) : 0.231"

SOLUTION PH (END OF TEST) 5.385

[signature]

10/30/92

TEST SSRTSS11 11/4/92

TENSILE SPECIMEN CLEANED AND DEGREASED AS DESCRIBED ON PAGE # 33 AND POLISHED WITH 600 GRIT SiC PAPER HEAT # 80746

SPECIMEN ~~DIMENSIONS~~ DIMENSIONS.

GAUGE LENGTH (SHOLDER TO SHOLDER) 0.925"

GAUGE DIAMETER 0.124"

TEST CONDUCTED ON MACHINE # 2 IN 10,000 PPM Cl^-, 85 PPM HCO_3, 20 PPM SO_4, 10 PPM NO_3, 2 PPM F^- AT 95 °C CO_2 BUBBLED INTO SOLUTION. DATA STORED IN SSRTSS11.DAT

STRAINING STARTED AT. 11/5/92 : 10:30 AM

INITIAL LOAD : 28 lbs.

E_c = −260 mV SCE KEITHLEY 614

EAPP −100 mV SCE "

CURRENT 10^{-4} − 10^{-5} KEITHLEY 485

ADDED 90 ml H_2O BETWEEN 11/5 − 11/11

MAXIMUM LOAD: ≈ 900 LBS

TIME TO FAILURE: ≈ 155 HOURS.

ELONGATION (LVDT): ≈ 0.275"

SOLUTION (PH) 5.345

DATA NOT RECORDED ON DISC DUE TO KEYBOARD LOCKUP.

[signature]

11/11/92

SSRTSS 12 12/8/92

316 L TENSILE SPECIMEN CLEANED AS ON P 33 AND POLISHED WITH 600 GRIT SiC PAPER
SPECIMEN DIMENSIONS.
l BETWEEN SHOULDERS 0.924
ϕ = 0.124

TEST CONDUCTED IN MACHINE #1 IN 10000 ~~PPM~~ DD PPM Cl^- 85 PPM HCO_3^-, 20 PPM SO_4^{2-}, 10 PPM NO_3^- 2 PPM F^- AT 95°C CO_2 BUBBLED INTO SOLUTION DATA STORED AS SSRTSS12.DAT

E_c: -260 mV SCE KEITHLEY 614
E_{Pt}: -127 mV SCE "
INITIAL LOAD: 310 LBS 10:15 AM
STRAINING STARTED 12/8/92 4:04 pm -100 mV SCE
E_{APP}: -0.050 V SCE

95 ml H_2O ADDED BETWEEN 12/10/92 - 12/12/92

SOLUTION pH (END OF TEST) 5.538

MAXIMUM LOAD 773.4 LBS
TIME TO FAILURE 321,800 SEC
ELONGATION (LVDT) 0.219"

12/14/92

SSRT SS13 12/8/92

316 L TENSILE SPECIMEN CLEANED AS ON PAGE 33 AND POLISHED TO 600 GRIT FINISH WITH SiC PAPER
SPECIMEN DIMENSIONS
l BETWEEN SHOULDERS 0.924"
ϕ 0.125"

TEST CONDUCTED IN MACHINE #2 IN 10000 PPM Cl^- 85 PPM HCO_3^-, 20 PPM $SO_4^{=}$, 10 PPM NO_3^- 2 PPM F^- AT 95°C CO_2 BUBBLED INTO SOLUTION
DATA STORED AS SSRT SS13.DAT

E_c -311 mV SCE KEITHLEY 614
E_{Pt} NOT RECORDED
INITIAL LOAD 100 LBS AT 10:38 AM
STRAINING STARTED 10:38 AM 12/9/92
E_{APP}: -0.050 V SCE KEITHLEY 614

235 ml H_2O ADDED BETWEEN 12/9/92 - 12/13/92

SOLUTION pH (END OF TEST) 6.379

DD 7/25/94
MAXIMUM LOAD ~~773.4~~ 728.1 LBS
DD 7/25/94
TIME TO FAILURE ~~321,800 SEC~~ 488,150 SEC
ELONGATION (LVDT) ~~0.219~~ DD 7/25/94 0.207"

LUGGIN PROBE LOST VICOR TIP IN TEST SOLN'

12/14/92

12/16/92 SSRT SS14

316 L TENSILE SPECIMEN CLEANED AS BEFORE (PAGE 33) AND POLISHED WITH 600 GRIT SIC PAPER SPECIMEN DIMENSIONS

l BETWEEN SHOULDERS 0.926"

ø = 0.125"

TEST CONDUCTED IN MACHINE #1 IN 10000 PPM Cl^-, 85 PPM HCO_3^-, 20 PPM SO_4^{2-}, 10 PPM NO_3^-, 2 PPM F^- AT 95°C USING DYNA-SENSE 2158-40 CONTROLLER. DP 7/25/94 SOLUTION WAS BUBBLED WITH CO_2

DATA STORED AS SSRTSS14.DAT

pH OF SOLUTION 7.940 PRIOR TO HEAT & CO_2

DP 7/25/94

SPECIMEN ~~GAGUE~~ GAUGE LENGTH WAS COVERED WITH TEFLON TAPE 1/4" WIDE IN CENTER OF 0.5" SECTION

E_c: -332 mV SCE KEITHLEY 614

E_{pt}: -64 mV SCE "

INITIAL LOAD: 33.6 LBS

STRAINING STARTED: 12/16/92 11:40AM

E_{APP}: -100mV SCE KEITHLEY 614

I: $5\times10^{-4} - 1\times10^{-3}$ A 12/16/92 AT START KEITHLEY 485

185 ml H_2O ADDED BETWEEN 12/16/92 – 12/22/92

SOLUTION pH AT END OF TEST: 5.440

MAXIMUM LOAD 910.3

TIME TO FAILURE 586,700 SEC

ELONGATION (LVDT) 0.289"

[signature]

12/23/93

12/16/92 SSRT SS15

316 L TENSILE SPECIMEN CLEANED AS ON PAGE 33 AND POLISHED TO 600 GRIT USING SiC PAPER. SPECIMEN DIMENSIONS.

l = 0.927"

ø = 0.124"

TEST CONDUCTED IN MACHINE #2 IN 10000 PPM Cl^- 85 PPM HCO_3^- 20 PPM SO_4^{2-} 10 PPM NO_3^- 2 PPM F^- AT 95°C USING DYNA SENSE 2158-40 SOLUTION WAS BUBBLED WITH CO_2 DATA STORED AS SSRTSS15.DAT

pH OF SOLUTION 7.940 PRIOR TO HEAT & CO_2

SPECIMEN GAUGE LENGTH WAS COVERED WITH TEFLON TAPE 1/4" WIDE IN THE CENTER OF 0.5" SECTION

E_c: -414 mV SCE KEITHLEY 614

E_{pt}: -89 mV SCE "

INITIAL LOAD: 34.0 LBS

STRAINING STARTED: 12/16/92 11:40Am 7/26/94

E_{APP}: -125 mV SCE KEITHLEY ~~485~~ DP 614

I: $5\times10^{-6} - 1\times10^{-5}$ A 12/16/92 AT START. KEITHLEY 485

180 ml H_2O ADDED BETWEEN 12/16/92 – 12/22/92

SOLUTION pH AT END OF TEST 5.627

MAXIMUM LOAD 924.4 LBS.

TIME TO FAILURE 680260 SEC

ELONGATION (LVDT) 0.343"

[signature]

12/23/92

1/11/93 SSRTSS16 12/30/92

SPECIMEN

7/25/94 DD 316L NOTCHED SPECIMEN CLEANED IN ~~DI~~ ULTRASONIC BATH, ACETONE RINSED IN DI WATER. HEAT # P80746 NO O-RING

TEST CONDUCTED IN MACHINE #2 IN
1000 PPM Cl^- (1.6480 g NaCl LOT 922649A)
85 PPM HCO_3 (0.11572 g $NaHCO_3$ LOT 897784)
20 PPM $SO_4^=$ (20 ml/1000 PPM STOCK SOLUTION USING 1.4787 g Na_2SO_4 LOT 901213 /1000 ml)
10 PPM NO_3^- (10 ml/1000 PPM STOCK SOLUTION USING 1.3767 g $NaNO_3$ LOT 897183 /1000 ml
2 PPM F^- (2 ml/1000 PPM STOCK SOLUTION USING 2.2100 g NaF LOT 896405 /1000 ml)
SOLUTION AT 95°C Hg THERMO 123800Z
PURGED WITH CO_2

SOLUTION IN NEW TEFLON/GLASS CELL FROM SPECIALITY GLASS
ECORR -253mV KEITHLEY 614
EPT -109mV " "
REFERENCE SCE FISHER 13-620-~~051~~ -51 DD 7/25/94 SN 8211163
APPLIED POTENTIAL +100 mV SCE
CURRENT 5×10^{-3}A KEITHLEY 485
END pH 5.537 (1/4/93)

MAXIMUM LOAD 1325.8 LBS
TIME TO FAILURE 212,350 SEC
ELONGATION (LVDT) 0.095"

[signature]
1/2/93

1/11/93 SSRTSS17 1/11/93

SPECIMEN: 316 L NOTCHED CLEANED IN ULTRASONIC BATH FOR 5 min RINSED IN DI WATER, ACETONE, DI WATER. HEAT # P80746
O-RING OVER NOTCH PRIOR TO SOLUTION
TEST CONDUCTED IN MACHINE #2 IN
1000 PPM Cl^- 85 PPM HCO_3 20 PPM $SO_4^=$ 10 PPM NO_3^-
2 PPM F^-. 1 LITER OF SOLUTION MADE AS FOLLOWS
1.65107 g NaCl LOT 922649A FISHER
0.11498 g $NaHCO_3$ LOT 897784 FISHER
10 ml/1000 PPM NO_3 STOCK SOLUTION NO_3 - 1/93
1.37258 g $NaNO_3$ LOT 897183 /1000 PPM
20 ml/1000 PPM $SO_4^=$ STOCK SOLUTION SO_4 - 1/93
1.48040 g Na_2SO_4 LOT ~~9~~01213 DD 7/25/94 /1000 ml
2 ml/1000 PPM F^- STOCK SOLUTION F - 1/93
2.20977 g NaF LOT 896405 /1000 ml
+ DI H_2O TO 1000 ml SOLUTION AT 95°C
Hg THERMO 123800Z PURGED WITH CO_2
START pH (25°C BEFORE CO_2) =
SOLUTION IN TEFLON/GLASS CELL
ECORR -250 mV SCE KEITHLEY 614 SN 467374 CALDUE 1/24/93
EPT -174 mV SCE " " " "
REFERENCE SCE 13-620 ~~051~~ -51 DD 7/25/94 SN 8211163
APPLIED POTENTIAL 0.075V SCE KEITHLEY 614
CURRENT $10^{-4}-10^{-3}$A KEITHLEY 485
END pH = 5.189
INITIAL LOAD 38 LBS 6:10 PM 1/11/93
MAXIMUM LOAD 1327.4 LBS
TIME TO FAILURE 163,710 SEC
ELONGATION (LVDT) 0.083"

DATA SAVED AS SSRTSS17.DAT IN WORKBENCH

[signature]
1/14/93

1/21/93 SSRTSS18 316L NOTCHED

SPECIMEN 316L NOTCHED HT# P80746 CLEANED IN ULTRASONIC BATH DI WATER, ACETONE AND DI WATER RINSE. O-RING PLACED OVER NOTCH AFTER THE ADDITION OF SOLUTION AND REMOVAL OF BUBBLES.

TEST CONDUCTED IN MACHINE #2 IN:
10000 PPM Cl^- 85 PPM HCO_3 20 PPM $SO_4^=$
10 PPM NO_3^-, 2 PPM F^- 1 l MADE AS FOLLOWS:
16.48093 g NaCl LOT 922649A
0.11791 g $NaHCO_3$ LOT 897789
20 ml STOCK SOLUTION SO_4-1/93
10 ml STOCK SOLUTION NO_3-1/93
2 ml STOCK SOLUTION F-1/93 + DI H_2O TO 1000 ml
T = 95°C PURGED WITH CO_2 N_2 THERMO #1238002 FOR TEMP CHECK
START pH: 7.888
END pH: 5.605
SOLUTION IN TEFLON/GLASS CELL ≈ 350 ml

POTENTIOSTAT ESC 440-3 CHANNEL #2
DATA SAVED ON WORKBENCH AS WB|DATA|SSRTSS18.DAT,
USING SSRTSET3.WBB
E_{CORR} - -247.3 mV KEITHLEY 614
E_{PT} - -120.0 mV " "
$E_{APPLIED}$: -100 mV SCE KEITHLEY 614
CURRENT: $3. \times 10^{-4}$ A KEITHLEY 485
REFERENCE SCE FISHER 13-620-51 SN 8211163
INITIAL LOAD 29.8 LBS 1/22/93 3:00PM
MAXIMUM LOAD 1336.5 LBS
TIME TO FAILURE 259150 SEC
ELONGATION (LVDT) 0.086"
STRAINING STARTED 1/22/93 300PM 88,600 SEC
AFTER APPLYING -100 mV POTENTIAL

[signature]
1/25/93

2/12/93 SSRTSS 19 TENSILE $MgCl_2$

SPECIMEN 316L TENSILE HT P80746 CLEANED IN ULTRASONIC BATH RINSED IN DI WATER & ACETONE AND DRIED
l = 0.925" d = 0.125"
SPECIMEN POLISHED WITH 600 SiC PAPER PRIOR TO CLEANING.

TEST CONDUCTED IN MACHINE #1 IN
40% $MgCl_2$ 1000 ml MADE AS FOLLOWS
7/25/94 ~~855.5 g $MgCl_2 \cdot 6H_2O$ LOT 930283~~
7/25/94 ~~ADDED TO WATER TO 1000 ml~~
START pH ~~4.55~~ INSOLUBLE BELOW ~~ABOVE~~ 100°C 7/25/94
END pH
T = 120°C N_2 THERMO 0323003
PURGED WITH N_2
SOLUTION IN TEFLON/GLASS CELL ≈ 350 ml

POTENTIOSTAT ESC 440-3 CHANNEL #1
DATA SAVED AS WB|DATA|SSRTSS19.DAT
USING SSRTSET3.WBB
REFERENCE SCE FISHER 13-620-51 SN 2134032
E_{CORR} 7/25/94 ~~-38~~ -311 mV KEITHLEY 614 CAL DUE 1/28/94
E_{PT} +147.4 mV " " "
E_{APP} OPEN CIRCUIT
CURRENT —
INITIAL LOAD 43.7 LBS
MAXIMUM LOAD 366.6 LBS
ELONGATION LVDT 0.037
STRAINING STARTED: 6:43 PM 2/12/93
TIME TO FAILURE 8.276×10^4 SEC
SOLUTION PREPARED BY ADDITION OF 1100 g $MgCl_2 \cdot 6H_2O$ + DI H_2O TO 900 ml SOLUTION WAS BOILED AND DILUTED WITH WATER UNTIL BOILING TEMP OF 138°C WAS OBTAINED (ASTM G36)
FAILURE BY SCC

[signature]
2/15/93

2/12/93 SSRT SS20 TENSILE $MgCl_2$

SPECIMEN 316L TENSILE HT# P80746 600 SIC
FINISH CLEANED IN ULTRASONIC BATH
RINSED IN DI WATER, ACETONE & DRIED
$l = 0.923"$ $d = 0.124"$
TEST CONDUCTED IN MACHINE #2 IN 40% $MgCl_2$
SAME SOLUTION AS SSRT SS19 P 57
START pH ~~4.55~~ DD 7/25/94 INSOLUBLE BELOW 100°C
END pH "
T = 120 ± 3°C Hg THERMO 0323002
PURGED WITH N_2
SOLUTION IN TEFLON/GLASS CELL ≈ 350 ml
POTENTIOSTAT ESC 440-3 CHANNEL #2 DATA
SAVED AS WB\DATA\SSRTSS20.DAT USING
SSRTSET3.WBB
REFERENCE SCE FISHER 13-620-51 SN 9214083
E_{CORR} −280 mV KEITHLEY 617 CAL DUE 12/21/93
E_{PT} +174.1 mV " " "
E_{APP} −260 mV − −275 mV KEITHLEY 617
CURRENT $10^{-5} \rightarrow 10^{-3}$ A KEITHLEY 617
INITIAL LOAD 44.5 LBS
MAXIMUM LOAD 309.0 LBS
LVDT ELONGATION 0.023"
STRAINING STARTED 6:50 PM 2/12/93
TIME TO FAILURE 4.4987×10^4 SEC
FAILURE BY SCC
[signature] 2/15/93

[signature] 8/31/94

2/17/93 SSRT SS21 TENSILE $MgCl_2$ 30%

SPECIMEN 316L P80746 600 SIC CLEANED
AS BEFORE P 57
$l = 0.926"$ $d = 0.124"$
TEST CONDUCTED IN MACHINE #1 IN
30% $MgCl_2$ AS $MgCl_2 \cdot 6H_2O$
CONCENTRATION MEASURED USING BOILING
POINT OF 117°C ACCORDING TO ASTM G36
T = 110°C ± 3°C Hg THERMO 0323003
PURGED WITH N_2 DD 7/25/94
SOLUTION IN TEFLON/GLASS CELL ≈ 350 ml
START pH 4.95
END pH 5.94 CHANNEL #1 DD 7/25/94
POTENTIOSTAT ESC 440-3 1 DATA SAVED
AS SSRTSS21.DAT USING WORKBENCH
SSRTSET3
REFERENCE SCE FISHER 13-620-51 SN 0165415
E_{CORR} −326 mV KEITHLEY 617 SN 537418
E_{PT} +69 mV "
E_{APP} E_{CORR} + 20 mV −310 mV −340 mV
CURRENT −310 mV ≈ 10^{-3} A −340 mV ≈ 10^{-5} A
INITIAL LOAD 43.3 LBS
MAXIMUM LOAD 465.8 LBS
STRAINING STARTED 6:10 PM 2/17/93
ELONGATION LVDT 0.076"
TIME TO FAILURE 1.610×10^5 SEC
SOME PITS FAILURE BY SCC
[signature] 2/17/93

[signature] 8/31/94

2/17/93 SSRT SS22 TENSILE 30% $MgCl_2$

SPECIMEN 316L P80746 600SIC TENSILE
CLEANED AS BEFORE P57
l = 0.925 d = 0.125
TEST CONDUCTED IN MACHINE #2 IN 30%
$MgCl_2$ SAME SOLUTION AS SSRTSS21 P59
T = 110 ± 3°C N_2 THERMO 0323002
PURGED W/ N_2
SOLUTION IN TEFLON GLASS CELL
START PH 4.95
END PH 5.983
POTENTIOSTAT ESC 440-3 CHANNEL #2
DATA SAVED AS SSRTSS22.DAT USING
WORKBENCH SSRTSET3
REFERENCE SCE FISHER 13-620-51 SN 2134032
E_{CORR} -331 mV KEITHLEY 617 SN 537418
E_{PT} +190 "
E_{APP} OPEN CIRCUIT
CURRENT —
DD 7/25/94
INITIAL LOAD 43.7
MAXIMUM LOAD 903.7
ELONGATION LVDT 0.247
STRAINING STARTED: 6:10 PM 2/17/93
TIME TO FAILURE 4.9975 x10⁵ SEC

[signature] 2/17/93

3/3/93 SSRTSS23 TENSILE 5.5 m NaCl

SPECIMEN 316L P80746 TENSILE CLEANED
AS BEFORE P57
l = 0.925 d = 0.125
TEST CONDUCTED IN MACHINE #1 IN 5.5 m NaCl
(16.2% Cl BY WEIGHT) ρ = 1.20 g/ml
BOILING POINT 107°C NaCl FROM
FISHER LOT 922649A 321.4 g NaCl
DISSOLVED IN DI WATER ADJUSTED TO
A PH OF 3.5 USING HCl 0.032 g
OF HCl ADDED TO ≈ 1000 ml H_2O T = 95-100°C
START PH 2.695
END PH NOT RECORDED
POTENTIOSTAT ESC 440-3 CHANNEL #1 DATA
SAVED AS SSRTSS23.DAT USING WORKBENCH
SSRTSET3.WBB
REFERENCE SCE FISHER 13-620-51 SN 0165415
E_{CORR} -361 mV KEITHLEY 617 SN 537418
E_{PT} +186 mV "
E_{APP} OPEN CIRCUIT
CURRENT —
INITIAL LOAD 39.7 LBS
MAXIMUM LOAD 906.2 LBS
ELONGATION LVDT 0.320"
STRAINING STARTED 3/3/93 1:43 PM
TIME TO FAILURE 6.408 x10⁵ SEC

[signature]
3/16/93

3/3/93 SSRTSS24.DAT TENSILE 316L 5.5 m NaCl

SPECIMEN 316L P80746 TENSILE CLEANED
AS BEFORE P57
l= 0.923 d= 0.123
SOLUTION SAME AS SSRTSS23 P 61
START pH 2.695
END pH 7.046
POTENTIOSTAT ESC 440-3 CHANNEL #2 DATA
SAVED AS SSRTSS24.DAT USING WORKBENCH
SSRTSET3.WBB
REFERENCE SCE FISHER 13-620-51 SN 2134032
E_{CORR} -363 mV KEITHLEY 614
E_{PT} +179 mV " "
E_{APP} 3/3/93 -345mV TO -370 mV KEITHLEY 614
CURRENT 10^{-6} - 10^{-3} AMPS KEITHLEY 485
INITIAL LOAD 40.2 LBS
MAXIMUM LOAD 732.2 LBS
ELONGATION LVDT 0.144"
STRAINING STARTED: 3/3/93 1:49 Pm
TEST CONDUCTED IN MACHINE #2
TIME TO FAILURE: 2.8889 $\times 10^5$ SEC
SPECIMEN HAD LARGE PITS 2 LARGE
PITS AT SITE OF FRACTURE

3/16/93

8/31/94

4/14/93 SSRTSS25.DAT TENSILE 316L 10.5 m LiCl

SPECIMEN 316L P80746 TENSILE CLEANED
AS BEFORE P57.
l= 0.824 d= 0.125"
SOLUTION 10.5 m LiCl LOT 926474
445g LiCl DISSOLVED IN WATER (HIGH PURITY)
TO WHICH 0.013 g/l HCl WAS ADDED.
TOTAL CHLORIDE CONCENTRATION 372 g/l Cl^-
BASED ON 445 g LiCl AND 800 ml ACIDIFIED
WATER. T= 120°C N_2 PURGED
POTENTIOSTAT ESC440-3 CHANNEL #1 DATA SAVED
AS SSRTSS25.DAT USING SSRTSET3.WBB
REFERENCE SCE 13-620-51 SN 0165415
PLACED IN SATURATED NaCl SOLUTION
LUGGIN FROM CELL PLACED IN 10.5m LiCl
IN TEST TUBE JUMPER LUGGIN FROM LiCl TUBE
TO REFERENCE TUBE ALSO TEFLON/COTTON WICK}
PROCEDURE SCC ~~EC~~ DD 7/25/94 CELL ASSEMBLED 4/12/93
E_{CORR} MONITORED FROM 4/13/93
E_{CORR} = -353 mV KEITHLEY 617 4/14/93 11:15 AM
E_{PT} +153 mV " " " 11:20 AM
E_{APP} -322 mV
CURRENT 10^{-6} A TO 4.7×10^{-4} A KEITHLEY 617
INITIAL LOAD 45 LBS
MAXIMUM LOAD 156.6 LBS.
ELONGATION 0.013"
STRAINING STARTED 3:34 pm 4/14/93
TIME TO FAILURE: 26,100 SEC
SOLUTION pH START : 1.6
SOLUTION pH END : 2.0

E_{PT} READINGS UNSTABLE & DEPENDANT ON OTHER CONNECTIONS
FROM ESC 440-3 TO CELL i.e. WORKING ELECTRODE & REFERENCE
ELECTRODE. E_{PT} VALUE LISTED IS USING ONLY KEITHLEY 617
WITHOUT ESC 440-3 CONNECTED TO CELL
SPECIMEN FRACTURE NEAR RADIUS 4/22/93

4/14/93

SSRTSS26.DAT 10.5 m LiCl TENSILE 316L

SPECIMEN 316L P80746 PREPARED AS BEFORE P 57.
$l = 0.824$ $d = 0.125$

SOLUTION 10.5 m LiCl PREPARATION ON PAGE 63
T = 120 °C N_2 PURGED
pH START : 1.6
pH END : 1.40

POTENTIOSTAT ESC 440-3 CHANNEL #2 DATA SAVED AS SSRTSS26.DAT USING SSRTSET3.WBB

REFERENCE SCE FISHER 13-620-51 SN 2134032
LUGGIN SETUP SAME AS P 63

PROCEDURE SETUP ON 4/12/93 MONITOR Ecorr FROM 4/13/93 AT 120°C WITH N_2 PURGE.

E_{CORR} -356 mV KEITHLEY 617 4/14/93 11:15AM
E_{PT} +173 mV " " 4/14/93 11:20AM
E_{APP} OPEN CIRCUIT
CURRENT –
INITIAL LOAD 47 LBS
MAXIMUM LOAD 553.3 LBS
ELONGATION 0.078
STRAINING STARTED 3:34 pm 4/14/93
TIME TO FAILURE 159,300 SEC

E_{PT} READINGS UNSTABLE SEE NOTE P63

SPECIMEN FRACTURE NEAR RADIUS

David D 4/22/93

David D 8/31/94

4/22/93 SSRTSS27.DAT 320 g/l LiCl 9.10 moles Cl/kg WATER

SPECIMEN 316L P80746 600 SiC SPECIMEN OBSERVED UNDER STEREOSCOPE TO ENSURE REMOVAL OF ALL MACHINING MARKS ON SPECIMEN GAGE LENGTH AN RADIUS SECTIONS. SPECIMEN ULTRASONICALLY CLEANED RINSED IN DI WATER DEGREASED IN ACETONE AND DRIED. $l = 0.824"$ DD 7/25/94 $d = 0.125"$

SOLUTION 326 g LiCl LOT 926474 PLUS 830 ml DI WATER ACIDIFIED TO pH 3.5 BY THE ADDITION OF 0.011 g HCl. FINAL VOLUME AT ROOM TEMP = 1000 ml (9.10 moles Cl/kg H_2O)
T = 110°C NITROGEN PURGED
START pH = 2.103
END pH = 5.98 DD 7/25/94

POTENTIOSTAT ESC 440 - 3 CHANNEL #1 DATA SAVED AS SSRTSS27.DAT USING WORKBENCH SSRTSET3.WBB

REFERENCE SCE. FISHER 13-620-51 SN 0165415
LUGGIN PROBE SETUP SAME AS PAGE 63

PROCEDURE SETUP 4/21/93 MONITOR Ecorr AT 110°C WITH N_2 DEAERATION.

E_{CORR} -343 mV KEITHLEY 617
E_{PT} +145 mV " "
E_{APP} -320 TO -340 mV CURRENT : 10^{-4} A KEITHLEY 617
INITIAL LOAD 43.3 LBS
MAXIMUM LOAD 406.0 LBS
ELONGATION 0.066
STRAINING STARTED 5:42 Pm 4/22/93 87,300 SEC
TIME TO FAILURE 137700 SEC

David D 4/30/93

4/22/93 SSRTSS28.DAT 320 g/l LiCl

SPECIMEN 316L P80746 600 SiC PREPARED THE SAME AS SSRTSS27.DAT PAGE 65.

$l = 0.824''$ $d = 0.124''$

SOLUTION 320 g/l LiCl SAME AS PAGE 65.

START pH: 2.103

END pH: 6.102

POTENTIOSTAT ESC 440-3 CHANNEL #2 DATA SAVED AS SSRTSS28.DAT USING SSRTSET3.WBB

REFERENCE SCE FISHER 13620-51 SN 2134032

LUGGIN PROBE SETUP SAME AS PAGE 63

PROCEDURE SETUP 4/21/93 MONITOR E_{corr} AT 110°C WITH N_2 DEAERATION.

E_{corr} −353 mV KEITHLEY 617

E_{PT} +104 mV " "

E_{app} OPEN CIRCUIT

INITIAL LOAD 39.8 LBS

MAXIMUM LOAD 752.6

ELONGATION 0.147"

STRAINING STARTED 5:42 PM 4/22/93 87,300 SEC

TIME TO FAILURE 285,360 SEC

[signature] 4/30/93

[signature] 8/31/94

5/4/93 MODIFICATIONS TO EXPERIMENTAL SETUP - GEAR CHANGE

SPUR GEARS ON DRIVE SHAFT OF MOTOR AND ON INPUT SHAFT OF 1600:1 GEAR BOX CHANGED:

ORIGINAL GEARS:

MOTOR 20 TEETH

1600:1 BOX 80 TEETH

NEW GEARS:

MOTOR 18 TEETH OR 11 TEETH

1600:1 BOX 200 TEETH.

AT SAME OUTPUT SHAFT SPEED YIELDING 5.0×10^{-7} IN/SEC WITH 20/80 GEARS; EXTENSION RATE WITH 18/200 GEARS SHOULD BE 1.8×10^{-7} IN/SEC

1 ROTATION OF BIG GEAR (200 TEETH) SHOULD TAKE 144 SEC. 11/200 GEARS = 1.1×10^{-7} IN/SEC.

ALL OTHER COMPONENTS IN SETUP REMAIN UNCHANGED.

[signature] 5/4/93

[signature] 8/31/94

5/4/93 SSRTSS29 316L TENSILE

SPECIMEN 316L P80746 600 SiC FINISH
PREPARED SAME AS SSRTSS27 P 65
l= 0.827 d= 0.124 TENSILE
SOLUTION 5.2 MOLES LiCl LOT
IN 830ml H_2O AT PH 3.5 BY
THE ADDITION OF 0.01 g/l HCl
(6.2 MOLES Cl/Kg WATER) T= 95°C
START PH 2.492
END PH 7.956
POTENTIOSTAT ESC 440 #3 CHANNEL #1 DATA
SAVED AS SSRTSS29.DAT USING SSRTSET3.WBB
REFERENCE SCE FISHER 13-620-51 SN 0165415
PROCEDURE SET UP ON 5/4/93 MONITOR E_{CORR}
LUGGINS REMOVED ON 5/5/93 COTTON STRING
PLACED DOWN TO VICOR TIP TO ELIMINATE
BUBBLES
E_{CORR} -340 mV KEITHLEY 617
E_{PT} +260 mV " "
E_{APP} -348 → -320mV CURRENT ~ 10^{-3}A KEITHLEY 617
INITIAL LOAD 46.4
MAXIMUM LOAD 420.9 LBS
STRAINING STARTED 5:45 pm 65,500 SEC 5/5/93
TIME TO FAILURE 325,100 SEC
ELONGATION 0.054"
1.8×10^{-7} IN/SEC

[signature] 5/10/93

5/4/93 SSRTSS30 316L TENSILE

SPECIMEN 316L P80746 600 SiC FINISH
TENSILE SPECIMEN PREPARED SAME
AS SSRTSS27 P 65
l= 0.825 d= 0.124
SOLUTION 5.2 MOLES NaCl LOT 922649A
IN 830 ml H_2O AT PH 3.5 BY
THE ADDITION OF 0.01 g/l HCl
(6.2 MOLES Cl/Kg WATER) T= 95°C
START PH 2.780
END PH 8.363
POTENTIOSTAT ESC 440 #3 CHANNEL #2 DATA
SAVED ~~AS~~ ~~SSRTSET 3~~ DD 7/25/94 SSRTSS30.DAT USING
SSRTSET3.WBB.
PROCEDURE SAME AS SSRTSS29 P68.
E_{CORR} -356 mV KEITHLEY 617
E_{PT} +230 mV " "
E_{APP} -380 TO -340 I ~ 10^{-3}A KEITHLEY 617
INITIAL LOAD 45.8 LBS
MAXIMUM LOAD 410.5 LBS
STRAINING STARTED 5/5/93 5:45 pm 65,500 SEC
TIME TO FAILURE. 375,500 SEC
REFERENCE SCE FISHER 13-620-51 SN 8211163
ELONGATION 0.066"
1.8×10^{-7} IN/SEC

[signature] 5/10/93

5/14/93 SSRTSS31

SPECIMEN 316L P80746 TENSILE 600 SiC
PREPARED SAME AS SSRTSS27 P65
l= 0.824" d= 0.124"
SOLUTION 5.2 MOLES LiCl (220.42 g) LOT 926474 ADDED TO 830 ml DI WATER AT pH 4.0 BY THE ADDITION OF 0.00183 g HCl Cl CONCENTRATION 6.2 MOLES / kg WATER T=95°C N_2 PURGED
START pH 2.553
END pH 5.671
POTENTIOSTAT ESC 440-3 CHANNEL #1 DATA SAVED AS SSRTSS31.DAT USING SSRTSET 3.WBB
REFERENCE SCE FISHER 13-620-51 SN 2134032
PROCEDURE SETUP 5/13/93 MONITOR E_{CORR} TILL START OF TEST
E_{CORR} -347mV KEITHLEY 617 SN 537418
E_{PT} -63mV "
E_{APP} -680 mV - 340 mV "
CURRENT 10^{-7} - 10^{-3} A KEITHLEY 485 SN 509163
INITIAL LOAD 43.2 LBS
MAXIMUM LOAD 895 LBS
STRAINING STARTED 4:10 PM 76,500 SEC 5/14/93
TIME TO FAILURE 1,566,500 SEC
ELONGATION 0.280"
1.8×10^{-7} IN/SEC

8/31/94

5/14/93 SSRTSS32

SPECIMEN 316L P80746 TENSILE 600 SiC
PREPARED SAME AS SSRTSS27 P65
l= 0.822 d= 0.124
SOLUTION 5.2 MOLES NaCl (303.88 g) LOT 922649A ADDED TO 830 ml DI WATER AT pH 4.0 BY ~~TO~~ DD 7/25/94 THE ADDITION OF 0.00183 g HCl Cl CONCENTRATION 6.2 MOLES / kg WATER T=95°C N_2 PURGED
START pH 2.749
END pH 6.772
POTENTIOSTAT ESC 440-3 CHANNEL #2 DATA SAVED AS SSRTSS32.DAT USING SSRTSET3.WBB
REFERENCE SCE FISHER 13-620-~~5D~~ -51 DD 7/25/94 SN 0165403
PROCEDURE : SAME AS SSRTSS31 p 70
E_{CORR} -359 mV KEITHLEY 617 SN 537418
E_{PT} -154 mV "
E_{APP} -380 mV - 360 mV "
CURRENT 10^{-7} - 10^{-4} A KEITHLEY 485 SN 509163
INITIAL LOAD 45.2 LBS.
MAXIMUM LOAD 792.1
STRAINING STARTED 4:10 PM 5/14/93 76,500 SEC
TIME TO FAILURE 962,100
ELONGATION 0.178"
1.8×10^{-7} IN/SEC

8/31/94

6/10/93 SSRTSS33

SPECIMEN 316L P80746 TENSILE 600 S.C
PREPARED SAME AS SSRTSS27. P65
l = 0.823" d = 0.123"
SOLUTION 5.2 MOLES LiCl (220 g) LOT 926474
ADDED TO 830 ml DI WATER
ADJUSTED TO PH 4.00 BY THE
ADDITION TO 0.41 ml OF 0.02 g/ml
HCl TO 2500 ml H_2O Cl CONCENTRATION
6.2 MOLES / kg WATER. T = 95°C
DEAERATED WITH N_2 Hg THERMO 0323002
START pH 3.68
END pH 3.93
POTENTIOSTAT ESC 440 #3 CHANNEL #1 DATA
SAVED AS SSRTSS33.DAT USING SSRTSET3.WBB
REFERENCE SCE FISHER 13-620-51 SN 3106337
PROCEDURE SETUP 6/9/93 AND MONITOR
ECORR TILL START OF TEST.
E_{CORR} -342 mV KEITHLEY 614 SN 467374
E_{PT} +87 mV " "
E_{APP} -660 mV to -330 mV "
CURRENT 10^{-6} A KEITHLEY 614
INITIAL LOAD 43.6 LBS
MAXIMUM LOAD 785.9 LBS
STRAINING STARTED 6:33 PM 6/10/93 85,650 SEC
TIME TO FAILURE 1,525,400 SEC 7/1/93 3:26 AM
ELONGATION. 0.182"

STRAINING STOPPED 6/11/93 5:28 PM 0.006" ELONGATION
COMPUTER TURNED OFF.
RESTART 6/12/93 E_{PT} = -195 mV E_{CORR} -341 mV
E_{APP} = -340 mV I = 1.7 μA WORKBENCH CURRENT INCORRECT
STRAINING RESTARTED 6/12/93 1:40 PM t = 1800 SEC
1.1×10^{-7} IN/SEC

[signature] 7/3/93

6/10/93 SSRTSS34
7/25/94
~~SSRT~~ SPECIMEN 316L P80746 TENSILE 600 S.C
PREPARED SAME AS SSRTSS27 P65
l = 0.823 d = 0.123
SOLUTION 5.2 MOLES NaCl (303 g) LOT 922649A
ADDED TO 830 ml DI H_2O ADJUSTED
TO PH 4.00. PROCEDURE P72.
Cl CONCENTRATION 6.2 MOLES / kg WATER
T = 95°C Hg THERMO 0323003
DEAERATED WITH N_2
START PH 3.29
END PH 5.87
POTENTIOSTAT ESC 440 #3 CHANNEL #2 DATA
SAVED AS SSRTSS34.DAT USING SSRTSET3.WBB
REFERENCE SCE FISHER 13-620-51 SN 3106321
PROCEDURE SAME AS SSRTSS33 P72.
E_{CORR} -362 mV KEITHLEY 614 SN 467374
E_{PT} -76 mV "
E_{APP} -391 mV to -355 mV KEITHLEY 614
CURRENT 10^{-6} A KEITHLEY 614
INITIAL LOAD 42.4 LBS.
MAXIMUM LOAD 711 LBS
STRAINING STARTED 6:33 PM 6/10/93 85,650 SEC
TIME TO FAILURE 6/28/93 3:56 AM
ELONGATION. 0.153"

STRAINING STOPPED 6/11/93 5:28 PM 0.007" ELONGATION
COMPUTER TURNED OFF
RESTART 6/12/93 E_{PT} = +56 mV E_{CORR} -352 mV
E_{APP} = -345 mV I = ± 2 μA WORKBENCH CURRENT INCORRECT.
STRAINING RESTARTED 1:40 PM t = 1800 SEC
1.1×10^{-7} IN/SEC

[signature] 7/3/93

7/15/93 SSRTSS35

SPECIMEN 316L P80746 TENSILE 600 S.C
PREPARED SAME AS SSRTSS27 P65
$l = 0.823$ $d = 0.121''$
SOLUTION 1000 PPM Cl^- 85 PPM HCO_3^- 20 PPM SO_4^{2-}
10 PPM NO_3^- 2 PPM F^- 10^{-3} MOLE/LITER $Na_2S_2O_3$
OR 112 PPM $S_2O_3^{2-}$ 1000 ml AS FOLLOWS
1.64968 g NaCl LOT 926368A
0.11881 g $NaHCO_3$ LOT 897789
0.15835 g $Na_2S_2O_3$ LOT 923931A
20 ml SO_4 - 7/93 STOCK SOLUTION
10 ml NO_3 - 7/93 "
2 ml F - 7/93 "
T = 95°C Hg THERMO #
STOCK SOLUTIONS P 76 BUBBLED WITH CO_2
START pH 8.294
END pH 6.521
POTENTIOSTAT ESC 440 #3 CHANNEL #1 DATA
SAVED AS SSRTSS35.DAT USING SSRTSET 4.WBB
SSRTSET 4.WBB ICON LIST P 304
REFERENCE SCE FISHER 13-620-51 SN 2134032
E_{CORR} -232 KEITHLEY 614 SN 467374
E_{PT} +180 " DD 7/25/94
E_{APP} -175 mV TO ~~+0.046~~ +46 mV KEITHLEY 614
CURRENT $10^{-6} - 10^{-5}$ A KEITHLEY 614
INITIAL LOAD 40 LBS
MAXIMUM LOAD 874 LBS
STRAINING STARTED 11:30 AM 7/16/93 214200 SEC
TIME TO FAILURE 633,600 SEC
ELONGATION 0.302"
7/25/94 DD ~~STRAI~~ MACHINE #1 5×10^{-7} IN/SEC

[signature] 7/23/93

7/15/93 SSRTSS36

SPECIMEN 316L P80746 TENSILE 800 S.C
PREPARED SAME AS SSRTSS27.DAT P 65
$l = 0.823$ $d = 0.123$
SOLUTION SAME AS SSRTSS35 P 74
START pH 8.294
END pH 6.478
T = 95°C Hg THERMO #
BUBBLED WITH CO_2
START pH ~~8.924~~ DD 7/25/94 8.294
END pH 6.478
POTENTIOSTAT ESC 440 #3 CHANNEL #2 DATA
SAVED AS SSRTSS36.DAT USING SSRTSET 4.WBB
REFERENCE SCE FISHER 13-620-51 SN 3106337
E_{CORR} -186 KEITHLEY 614 SN 467374
E_{PT} -125 mV "
E_{APP} OPEN CIRCUIT
CURRENT -
INITIAL LOAD 43 LBS
MAXIMUM LOAD 889 LBS
STRAINING STARTED 11:30 AM 7/16/93 214200 SEC
TIME TO FAILURE 644,400 SEC
ELONGATION 0.321"
MACHINE #2 5×10^{-7} IN/SEC

[signature] 7/25/93

STOCK SOLUTIONS. MADE 7/7/93

SO_4 - 7/93
1000 ppm $SO_4^=$ AS Na_2SO_4
1.48346 g Na_2SO_4 + DI WATER TO 1000ml
EXP 8/7/93 Na_2SO_4 LOT # 901213

NO_3 - 7/93
1000 ppm NO_3 AS $NaNO_3$
1.37207 g $NaNO_3$ LOT 897183 + DI WATER
TO 1000 ml EXP 8/7/93

F- 7/93 DD 7/25/94
1000 ppm ~~NaF~~ AS NaF
2.21219 g NaF LOT 896405 + DI WATER
TO 1000 ml EXP 8/7/93

7/25/94

SSRTSS37

SPECIMEN 316L NOTCHED P80746
CLEANED IN ULTRASONIC BATH
RINSED IN DI WATER ACETONE
AND DRIED
SOLUTION 1000 PPM Cl^- 85 PPM HCO_3 112 PPM S_2O_3
20 PPM $SO_4^=$ 10 PPM NO_3^- 2 PPM F^- 1000 ml
PREPARED AS FOLLOWS
1.64835 g NaCl LOT 926368A
0.11963 g $NaHCO_3$ LOT 897789
0.15744 g $Na_2S_2O_3$ LOT 923931A
20ml SO_4 - 7/93 STOCK SOLUTION
10ml NO_3 - 7/93 "
2ml F - 7/93 "
+ DI WATER TO 1000 ml STOCK SOLUTIONS P76
T = 95°C NG THERMO 9243196
CAL ~~DO~~ DD 7/25/94 DUE 9 APR 94 BUBBLED WITH CO_2
START PH 7.700
END PH 5.293
POTENTIOSTAT ESC 440 #3 CHANNEL #3 DATA
SAVED AS SSRTSS37.DAT USING SSRTSET4.WBB
REFERENCE SCE FISHER 13-620-51 SN 3106337
E_{CORR} -200mV
E_{PT} -0.116 V
E_{APP} -200mV
CURRENT 10^{-6}
INITIAL LOAD 40 LBS
MAXIMUM LOAD 1219 LBS
STRAINING STARTED 11:30 AM 7/16/93 150 500 SEC
TIME TO FAILURE 9:54 AM 8/28/93
ELONGATION 0.099"
SYSTEM REBOOTED 8/18/93 DUE TO RUNTIME OVERLAY
ERROR. 5:45 PM

9/1/93

8/17/93

SSRTSS 38

SPECIMEN 316L P80746 TENSILE CLEANED
AND PREPARED SAME AS SSRTSS 27 P65
$l = 0.822"$ $d = 0.123"$

SOLUTION 1000 PPM Cl^- 85PPM HCO_3 20 PPM SO_4^{2}
10 PPM NO_3^- 2PPM F^- 10^{-2} MOLE/LITER $S_2O_3^{2}$
1000 ml PREPARED AS FOLLOWS
1.64897 g NaCl LOT 926368A
0.11887 g $NaHCO_3$ LOT 897789
1.58481 g $Na_2S_2O_3$ LOT 923931A
20 ml SO_4 - 8/93 STOCK SOLUTION
10 ml NO_3 - 8/93 "
2 ml F - 8/93 "
+ DI WATER TO 1000 ml STOCK SOLUTIONS
P 80 T = 95°C N_7 THERMO #
PURGED WITH CO_2

START pH 7.800
END pH 5.118
POTENTIOSTAT ESC 440 # 3 CHANNEL #1 DATA
SAVED AS SSRTSS38.DAT USING SSRTSET4.WBB
REFERENCE SCE FISHER 13-620-51 SN 2134032
E_{CORR} ~~X~~ DD 7/25/94 -209 mV KEITHLEY 617
E_{PT} ~~X~~ DD 7/25/94 -199 mV "
E_{APP} -183mV to +20mV KEITHLEY 617
CURRENT 10^{-6} - 9×10^{-5} A KEITHLEY 617
INITIAL LOAD 46.4 LBS
MAXIMUM LOAD 737 LBS
STRAINING STARTED 6:03 PM 8/18/93 t=0
TIME TO FAILURE 1,312,000 SEC 9/2/93 21:11
ELONGATION 0.142"

[signature] 9/4/93

8/17/93

SSRTSS39

SPECIMEN 316L P80746 TENSILE CLEANED
AND PREPARED SAME AS SSRTSS27 P65
$l = 0.821"$ $d = 0.122"$
SOLUTION: SAME AS SSRTSS 38 P 78
T = 95°C N_7 THERMO #
PURGED WITH CO_2
START pH 7.800
END pH NOT RECORDED DD 7/25/94
POTENTIOSTAT ESC 440 ~~#3~~ #3 CHANNEL # 2
DATA SAVED AS SSRTSS39.DAT USING SSRTSET4.WBB
REFERENCE SCE FISHER 13-620-51 SN 3106321
E_{CORR} -237 mV KEITHLEY 617
E_{PT} DD 7/25/94 ~~X~~ -196 mV " -196 mV = E_{PT}
E_{APP} O.C.
CURRENT —
INITIAL LOAD 46.2 LBS
MAXIMUM LOAD 853 LBS
STRAINING STARTED 6:03 PM t = 0 8/18/93
TIME TO FAILURE NO FAILURE
ELONGATION. 0.186"

TEST INTERRUPTED 9/7/93 AT 1,715,400 SEC

[signature] 9/7/93

[signature] 8/31/94

8/17/93

STOCK SOLUTIONS 8/93

SO_4-8/93 1000 PPM $SO_4^=$ AS Na_2SO_4
1.48535 g Na_2SO_4 LOT 901213
+ DI WATER TO 1000 ml EXP 9/7/93

~~SO_4~~ DD 7/25/94
NO_3 - 8/93 1000 PPM NO_3 AS $NaNO_3$
1.37530 g $NaNO_3$ LOT 897183
+ DI WATER TO 1000 ml EXP 9/7/93

F- 8/93 1000 PPM F^- AS NaF
2.21045 g NaF LOT 896405
+ DI WATER TO 1000 ml EXP 9/7/93

[signature] 8/17/93

[signature] 8/31/94

8/19/93 UBEND 316L 5.5 moles/l NaCl + 10^{-2} m/l $Na_2S_2O_3$

SPECIMEN #1 316L FROM METAL SAMPLES
SPECIMEN # ~~01~~ 03 DD 7/25/94 LEFT AT O.C.
SPECIMEN #2 SAME AS ABOVE BUT METAL SAMPLES
SPECIMEN # ~~04~~ 02 DD 7/25/94 HELD ANODICALLY
SPECIMENS WERE BENT IN UBEND JIG AROUND
1/2" DIAMETER MANDREL AND HELD IN
PLACE USING HAST C-276 BOLTS WITH
ZIRCONIA SPACERS. SPECIMENS WERE
PLACED IN TEFLON HOLDERS AND SUSPENDED
IN SOLUTION WITH A GLASS ROD. SS 302/304
WIRES WERE SPOT WELDED NEAR BOLT EYES
FOR ELECTRICAL CONTACT. 3/64" HEAT SHRINK
USED TO SEPERATE WIRES PASSING THROUGH
GLASS TUBE. SEE CLEANING BOTTOM OF THIS PAGE.
SOLUTION 5.2 MOLES NaCl LOT 926368A ADDED
TO 830 ml DI WATER ADJUSTED TO PH 4 BY
THE ADDITION OF 0.050 ml 0.02 g/ml HCl
+ 1.5813 g $Na_2S_2O_3$ LOT 923931A
t = 95°C H_1 THERMO 0323007 (303.4g NaCl)
POTENTIOSTAT ESC 440 #1 CHANNEL ~~#3~~ #4 DD 7/25/94
DATA SAVED AS ~~UB316L #1~~ DD 7/25/94 UB316L2.DAT USING
LONGTM.WBB REFERENCE: 13-620-51 SN 3106321 SCE

METAL SAMPLES # ~~1~~ 03 DD 7/25/94
E_{CORR} -345 mV
E_{PT} +352 mV
E_{APP} OC
I —

METAL SAMPLES # ~~4~~ 02 DD 7/25/94
E_{CORR} = -349 mV
E_{PT} = +352 mV
E_{APP} = -340 mV
I = 10^{-6} - 10^{-5} A
5:30 pm 8/18/93 t = 82800 sec

CLEANING, PRIOR TO CELL ASSEMBLY BENT SPECIMENS
WERE ULTRASONICALLY CLEANED IN ACETONE FOR
30 min. RINSED IN DI WATER CLEANED IN
30% HNO_3 FOR 60 min AND RINSED
TEST ENDED 8/30/93

[signature] 8/30/93

8/19/93 UBEND UB316L2.DAT 5.5 MOLES/LITER NaCl
DD 7/25/94

SPECIMEN #1 METAL SAMPLES 316L # ~~03~~ DD 01
SPECIMEN #2 METAL SAMPLES 316L # ~~02~~ 04 7/25/94
SPECIMENS WERE BENT AS UB316L1.DAT P81
AND ASSEMBLY WAS IDENTICAL
SOLUTION 5.2 MOLES NaCl (303.6 g) ADDED
TO 830 ml DI WATER ADJUSTED TO pH 4
BY THE ADDITION OF 0.050 ml 0.02 g/ml HCl
NaCl LOT # 926368A FINAL VOLUME ≈ 950 ml
t=95°C Hg THERMO 0323005 DD 7/25/94
POTENTIOSTAT ESC 440 # 1 CHANNEL # ~~1~~ 3
DD 7/25/94 ~~DATA SAVED AS UB316L2.DAT USING LONGTM.WBB~~
REFERENCE FISHER SCE 13-620-51 SN 0169033
METAL SAMPLES # ~~3~~ 01
E_{CORR} -390 mV DD 7/25/94
E_{PT} -97 mV
E_{APP} OC
I —
METAL SAMPLES # ~~2~~ 04
E_{CORR} -392 mV DD 7/25/94
E_{PT} -97 mV
E_{APP} -340 mV 5:30 8/19/93 t= 82800 sec
I 10^{-6} - 10^{-4} A
DATA SAVED AS UB316L1.DAT USING LONGTM.WBB
METAL SAMPLES # 04 VARIED FROM -480 mV to -340 mV
TEST ENDED 8/30/93

[signature] 8/30/93

8/19/93 UBEND UB316L3.DAT 7.5 moles/l LiCl

SPECIMEN #1 METAL SAMPLES 316L # 8
SPECIMEN #2 METAL SAMPLES 316L # 5
SPECIMENS WERE BENT AS UB316L.DAT P81
AND ASSEMBLY WAS IDENTICAL
SOLUTION 7.5 MOLES LiCl ADDED TO 830 ml
DI WATER ADJUSTED TO pH 4 BY THE ADDITION
OF 0.050 ml 0.02 g/ml HCl LiCl = 317.46 g
LOT 926474 FINAL VOLUME =
t=95°C Hg THERMO DD 7/25/94 ~~123800T~~ 183306
CAL DUE 2 JAN 94
POTENTIOSTAT ESC 440 #1 CHANNEL #5
DATA SAVED AS UB316L3.DAT USING LONGTM.WBB
REFERENCE FISHER SCE 13-620-51 SN 0165415
METAL SAMPLES # 8
E_{CORR} DD 7/25/94 ~~+350 mV~~ -350 mV KEITHLEY 617 SN 537418
E_{PT} DD 7/25/94 ~~+240 mV~~ -240 mV "
E_{APP} OC
I
METAL SAMPLES # 5
E_{CORR} DD 7/25/94 ~~+349 mV~~ -349 mV KEITHLEY 617 SN 537418
E_{PT} DD 7/25/94 ~~+240 mV~~ -240 mV "
E_{APP} -320 mV 530 pm 8/18/93 t= 82800 sec
I 10^{-6} - 10^{-4} A KEITHLEY 617
E_{APP} VARIED FROM -400 mV TO -320 mV
TEST ENDED 8/30/93

[signature] 8/30/93

8/19/93 UBEND UB316L4.DAT 1000 PPM Cl⁻ 10^{-2} moles/l $Na_2S_2O_3$

SPECIMEN #1 METAL SAMPLES #7 316L
SPECIMEN #2 METAL SAMPLES #6 316L
SPECIMENS WERE BENT AS UB316L1.DAT P81
AND CELL ASSEMBLY WAS IDENTICAL
SOLUTION 1000 PPM Cl⁻ 1.65008 g NaCl LOT
926368A + 1.58967 g $Na_2S_2O_3$ LOT 923431A
+ DI WATER TO 1000 ml DI WATER ADJUSTED
TO pH 4 BY THE ADDITION OF 6×10^{-5} ml 0.02 g/ml
HCl PER ml OF WATER
t = 95°C N_2 THERMO 183302 CAL DUE 2 JAN 94
POTENTIOSTAT ESC 440 #1 CHANNEL #6
DATA SAVED AS UB316L4.DAT USING LONGTM.WBB
REFERENCE FISHER 13-620-51 SN 3106340
METAL SAMPLES #7
E_{CORR} −127 mV KEITHLEY 617 SN 537418
E_{PT} +409 mV "
E_{APP} OC.
I —
METAL SAMPLES #6
E_{CORR} ~~+130 mV~~ −130 mV DD 7/25/94
E_{PT} +409 mV
E_{APP} −20 mV −110 mV
I 10^{-6} – 10^{-5} A
WORKBENCH NOT RECORDING CORRECT APPLIED
POTENTIAL
TEST ENDED 8/30/93

[signature] 8/30/93

9/9/93 U BEND UB316L5.DAT 5.2 moles/l NaCl

SPECIMEN #1 METAL SAMPLES #9 316L
SPECIMEN #2 METAL SAMPLES #10 316L
SPECIMENS WERE PREPARED SAME AS UB316L1
P81 CELL ASSEMBLY WAS IDENTICAL WITH
THE ADDITION OF A BUBBLER
SOLUTION 304 g NaCl LOT 926368A ADDED
TO 875 ml DI WATER ADJUSTED TO pH 4.0
BY THE ADDITION OF 0.00175 g HCl ρ = 1.186 g/ml
T = 95°C N_2 THERMO 183306 BUBBLED
WITH ZERO AIR 79% N_2 / 21% O_2
POTENTIOSTAT ESC 440 #1 CHANNEL #3
DATA SAVED AS UB316L5.DAT USING LONGTM.WBB
REFERENCE FISHER 13-620-51 SN 0169033
CELL ASSEMBLED AND PURGED WITH ZERO AIR
FOR 38 HOURS. E_{CORR} WAS THEN MEASURED AND
ANODIC POTENTIAL APPLIED TO METAL SAMPLES #10
METAL SAMPLES #9
E_{CORR} −342 mV AT START KEITHLEY 617 SN 537418
E_{PT} +281 mV
E_{APP} O.C
METAL SAMPLES #10
E_{CORR} −352 mV
E_{PT} +281 mV
E_{APP} −304 mV 140,000 SEC 9:45 AM 9/9/93
−338 mV FROM −350 mV TO END OF TEST
AT 2055000 SEC I = 10^{-5} A
E_{CORR} METAL SAMPLES #9 AT ~~2055000~~ SEC = −348 mV
10/1/93 DD 7/25/94 2055000

[signature] 10/1/93

9/9/93 UBEND UB316L6.DAT 5.2 mol/l LiCl

SPECIMEN #1 METAL SAMPLES #11 316L
SPECIMEN #2 METAL SAMPLES #12 316L
SPECIMENS WERE PREPARED SAME AS UB316L1
P81 CELL ASSEMBLY WAS IDENTICAL WITH THE ADDITION OF A GLASS FRIT BUBBLER
SOLUTION 220.4 g LiCl LOT 926474 ADDED TO 900 ml DI WATER ADJUSTED TO pH 4.0 BY THE ADDITION OF 0.00175 g HCl ρ= 1.108 g/ml
T=95 °C Hg THERMO 032300S BUBBLED WITH ZERO AIR.
POTENTIOSTAT ESC 440 #1 CHANNEL #4
DATA SAVED AS UB316L5.DAT USING LONGTM.WBB
REFERENCE FISHER 13-620-51 SN 3106321
CELL ASSEMBLED AND PURGED WITH ZERO AIR FOR 38 HOURS E_{CORR} WAS RECORDED AND ANODIC POTENTIAL APPLIED TO METAL SAMPLES #12
METAL SAMPLES #11
E_{CORR} -341 mV AT START OF TEST KEITHLEY #537418 (617)
E_{PT} +292 mV KEITHLEY 617 SN 537418
E_{APP} O.C
METAL SAMPLES #12
E_{CORR} -343 mV
E_{PT} +292 mV
E_{APP} -292 mV 140,000 sec 9:45 am 9/9/93
CONTACT LOST WITH METAL SAMPLES #2 ON 9/12/93
E_{CORR} UNKNOWN
E_{CORR} METAL SAMPLES #11 AT 2055060 sec -203 mV
10/1/93

[signature] 10/1/93

9/9/93 UBEND UB316L7.DAT 1000 ppm Cl⁻

SPECIMEN #1 METAL SAMPLES #13 316L
SPECIMEN #2 METAL SAMPLES #14 316L
SPECIMENS WERE PREPARED SAME AS UB316L1.DAT
P81 CELL ASSEMBLY WAS IDENTICAL WITH THE ADDITION OF A GLASS FRIT BUBBLER
SOLUTION 1.65084 g NaCl LOT 926368A ADDED TO APPROXIMATELY 1000 ml DI WATER ADJUSTED TO pH 4.0 BY THE ADDITION OF 0.002 g HCl FINAL VOLUME = 1000 ml ρ= 1.0 g/ml
T= 95 °C Hg THERMO 183302 BUBBLED WITH ZERO AIR.
POTENTIOSTAT ESC 440 #1 CHANNEL #5
DATA SAVED AS UB316L8.DAT USING LONGTM.WBB
REFERENCE FISHER 13-620-51 SN 0165415
CELL ASSEMBLED AND PURGED WITH ZERO AIR FOR 38 HOURS. E_{CORR} WAS RECORDED AND ANODIC POTENTIAL APPLIED TO METAL SAMPLES #14 METAL SAMPLES #13 LEFT AT OPEN CIRCUIT
METAL SAMPLES #13
E_{CORR} -134 mV KEITHLEY 617 SN 537418
E_{PT} +383 mV "
E_{APP} O.C
METAL SAMPLES #14
E_{CORR} -184 mV
E_{PT} +383 mV
E_{APP} -138 mV 140,000 sec 9/9/93
E_{APP} RANGE -140 mV TO -100 mV
E_{CORR} METAL SAMPLES #14 AT 2055000 sec -231 mV
10/1/93
BRIEF INTURRUPTION OF ANODIC POTENTIAL OF #14 ON 9/14/93 DUE TO ELECTRODE PROBLEMS

[signature] 10/1/93

9/9/93 UBEND UB316L8.DAT 1000 PPM Cl^- 10^{-2} mol/l S_2O_3

SPECIMEN #1 METAL SAMPLES # 15 316L
SPECIMEN #2 METAL SAMPLES # 16 316L
SPECIMENS PREPARED SAME AS UB316L1 P81
CELL ASSEMBLY WAS IDENTICAL WITH THE ADDITION OF A GLASS FRIT BUBBLER.
SOLUTION 1000 PPM Cl^- 10^{-2} mol/l S_2O_3
PREPARED BY ADDING 1.65101 g NaCl LOT 926368A AND 1.58777 g $Na_2S_2O_3$ LOT 923931A TO DI WATER ADJUSTED TO pH 4.0 BY THE ADDITION OF 0.002 g/l HCl FINAL VOLUME = 1000 ml
T = 95°C Hg THERMO 0323007 BUBBLED WITH ZERO AIR.
POTENTIOSTAT ESC 440 #1 CHANNEL #6
DATA SAVED AS UB316L8.DAT USING LONGTM.WBB
REFERENCE FISHER 13-620-51 SN 2314032
CELL ASSEMBLED AND PURGED WITH ZERO AIR FOR 38 HOURS. E_{CORR} WAS THEN RECORDED AND ANODIC POTENTIAL WAS APPLIED TO METAL SAMPLES # 16
METAL SAMPLES # 15
E_{CORR} -270 mV KEITHLEY 617 SN 537418
E_{PT} -48 mV
E_{APP} O.C.
METAL SAMPLES # 16
E_{CORR} -272 mV
E_{PT} -48 mV
$E_{APP.}$ -222 mV 140,000 sec 9:45 am 9/9/93
$I \approx 10^{-6}$ A WORK BENCH INCORRECTLY READING POTENTIAL
E_{CORR} METAL SAMPLES #15 AT 2055008 sec -200 mV
10/1/93

[signature] 10/1/93

9/9/93 SSRTSS40

SPECIMEN 316L P80746 TENSILE CLEANED AND PREPARED SAME AS SSRTSS27 P65
l = 0.824" d = 0.122"
SOLUTION 303.8 g NaCl LOT 926368A ADDED TO 890 ml DI WATER ADJUSTED TO pH 4.0 BY THE ADDITION OF 0.00178 g HCl.
1.58206 g $Na_2S_2O_3$ ADDED TO SOLUTION
FINAL VOLUME = 1000 ml $Na_2S_2O_3$ LOT 923931A
T = 95°C Hg THERMO 0323002 BUBBLED WITH CO_2 THROUGH TEFLON TUBE
POTENTIOSTAT ESC 440 #3 CHANNEL #1 DATA SAVED AS SSRTSS40.DAT USING SSRTSET4.WBB
REFERENCE SCE 13-620-51 SN 3106337
E_{CORR} -391 mV KEITHLEY 614 SN 467374
E_{PT} -131 mV "
E_{APP} -395 mV AT START OF TEST. -420 mV TO -391 mV
CURRENT -10^{-6} A TO 5×10^{-5} A KEITHLEY 485 SN 509163
INITIAL LOAD 31.6 LBS
MAXIMUM LOAD 629 LBS
STRAINING STARTED 4:30 pm ~~9/10/9~~ DD 7/25/94 9/10/93
TIME TO FAILURE 867600 sec
ELONGATION 0.090"

TIMER RESET TO ZERO AT 6:30 pm 9/11/93

EXAMINATION AT COMPLETION OF TEST SHOWED FAILURE BY SCC

[signature] 9/29/93

9/9/93 SSRT SS41

SPECIMEN 316L P80746 TENSILE CLEANED
AND PREPARED SAME AS SSRTSS27 P 65
$l = 0.823$ $d = 0.124$
SOLUTION SAME AS SSRT SS 40 P 89
$T = 95°C$ N_2 THERMO # 0323003 BUBBLED
WITH CO_2 THROUGH TEFLON TUBE
POTENTIOSTAT ESC 440 #3 CHANNEL # 2 DATA
SAVED AS SSRT SS41.DAT USING SSRT SET 4.WBB
REFERENCE SCE FISHER 13-620-51 SN 0165403
E_{CORR} -393 KEITHLEY 614 SN 467374
E_{PT} -146mV "
E_{APP} O.C.
CURRENT —
INITIAL LOAD 33.6 LBS
MAXIMUM LOAD 543 LBS
STRAINING STARTED 4:30 pm 9/10/93
TIME TO FAILURE 559750 SEC
ELONGATION 0.061"

FAILURE BY SCC

9/29/93

8/31/94

9/29/93 SSRT NI 1

SPECIMEN ALLOY 825 HH4371FG TENSILE CLEANED
AND PREPARED SAME AS SSRTSS27 P65
$l = 0.927"$ $d = 0.122"$
SOLUTION 455.17752 g NaCl LOT 926368 A
AND 2.37711 g $Na_2S_2O_3$ LOT 923931 A ADDED
TO 1335 ml DI WATER ADJUSTED TO pH 4.0
BY THE ADDITION OF 0.00267 g HCl
FINAL VOLUME = 1500 ml Cl CONCENTRATION = 5.2 mol/L
S_2O_3 CONCENTRATION = 10^{-2} mol/L ρ = 1.18 g/ml
START pH = 3.4
END pH = 6.12
$T = 95°C$ N_2 THERMO 0323003 BUBBLED
WITH CO_2 THROUGH TEFLON TUBE.
POTENTIOSTAT ESC 440 # 3 CHANNEL #1
DATA SAVED AS SSRT NI 1.DAT USING SSRTSET4.WBB
REFERENCE SCE FISHER 13-620-51 SN 3106337
E_{CORR} -333 mV KEITHLEY 617
E_{PT} -168 mV "
E_{APP} -320 mV AT START OF TEST KEITHLEY 617
CURRENT 10^{-6} - 10^{-5} AMPS AT START OF TEST. KEITHLEY 617
INITIAL LOAD 40 LBS
MAXIMUM LOAD 635.5 LBS
STRAINING STARTED 2:40 pm 10/1/93 t=0
TIME TO FAILURE NO FAILURE.
ELONGATION 0.087" WHEN STOPPED
TEST CONDUCTED IN TEFLON/GLASS CELL IN MACHINE
#1 WITH 350 ml SOLUTION USING AN APPROXIMATE
EXTENSION RATE OF 1.1×10^{-7} IN/SEC
IN AM OF 10/8/93 POTENTIAL CONTROL WAS
~~LOTS~~ DD 1/25/94 LOST. POTENTIAL INCREASED TO -0.015V
I 10^{-1} AMPS SOLUTION VERY CLOUDY AND LOAD
DECREASED TO 170 LBS POTENTIAL WAS TURNED OFF.
TEST INTERRUPTED 10/11/93 LOAD = 206 LBS
EXT = 0.087"

10/11/93

10/1/93 SSRTNI2

SPECIMEN ALLOY 825 HN4371FG TENSILE
CLEANED AND PREPARED SAME AS SSRTSS27 P65
l = 0.929" d = 0.123" DD 7/25/94
SOLUTION SAME AS ~~SSRTN~~ SSRTNI1 P91
T = 95°C BUBBLED WITH CO_2 THROUGH TEFLON
TUBE Hg THERMO 0323002
START pH 3.4
END pH 3.8
POTENTIOSTAT ESC 440 #3 CHANNEL #2
DATA SAVED AS SSRTNI2.DAT USING SSRTSET4.WBB
REFERENCE SCE FISHER 13-620-51 SN 0165403
E_{CORR} -336 mV KEITHLEY 617
E_{PT} -154 mV "
E_{APP} O.C.
CURRENT —
INITIAL LOAD 40 LBS
MAXIMUM LOAD 1047.5 LBS
STRAINING STARTED 240 pm 10/1/93 t=0
TIME TO FAILURE 2,208,600 SEC
ELONGATION 0.238"
TEST CONDUCTED IN TEFLON/GLASS CELL IN
MACHINE # 2 WITH 350 ml SOLUTION
USING AN EXTENSION RATE OF 1.1×10^{-7} IN/SEC

FAILURE BY LOCALIZED CORROSION AND
DUCTILE FAILURE NO SIGN OF SCC

[signature] 11/16/93

[signature] 8/31/94

10/1/93 SSRTNI3

SPECIMEN ALLOY 825 HN4371FG NOTCHED CLEANED
IN ULTRASONIC BATH RINSED IN DI WATER
ACETONE AND DRIED IN AIR
SOLUTION SAME AS SSRTNI1. P91
T = 95°C BUBBLED WITH CO_2 THROUGH TEFLON TUBE
Hg THERMO # 9243186
START pH 3.4
END pH 4.6
POTENTIOSTAT ESC 440 #3 CHANNEL #3
DATA SAVED AS SSRTNI3.DAT USING SSRTSET4.WBB
REFERENCE SCE FISHER 13-620-51 SN 3106340
E_{CORR} -330 mV KEITHLEY 617
E_{PT} -145 mV "
E_{APP} O.C. UNTIL 10/29/93 THEN -330 mV to -300 mV
CURRENT 10^{-8} TO 5×10^{-4} A KEITHLEY 617
INITIAL LOAD 40 LBS
STRAINING STARTED 2:40 pm 10/1/93 t=0
TIME TO FAILURE NO FAILURE
MAXIMUM LOAD 1791. LBS
ELONGATION 0.103 WHEN STOPPED
TEST CONDUCTED IN TEFLON/GLASS CELL
IN CORTEST MACHINE WITH 350 ml SOLUTION
USING AN EXTENSION RATE OF 2.8×10^{-8} IN/SEC

TEST INTERRUPTED 2:11 pm 11/16/93
3976400 SEC LOAD = 1783.1 LBS
ELONGATION = 0.103" NO SCC BUT
LARGE AREA OF LOCALIZED CORROSION
AT WATERLINE

[signature] 11/16/93

10/8/93

U BEND UB 825 N1 ALLOY 825

SPECIMEN #1 METAL SAMPLES I 825 01
ALLOY 825 HEAT # J 208
SPECIMEN #2 METAL SAMPLES I 825 02
ALLOY 825 HEAT # J 208
SPECIMENS WERE BENT AROUND 1/2" MANDRELL AND HELD USING C-276 BOLTS WITH ZIRCONIA WASHERS
SPECIMENS WERE CLEANED IN 10% HNO_3 FOR 60min AFTER BENDING, 0.042" ALLOY 825 WIRE WAS SPOT WELDED TO END OF SPECIMEN PRIOR TO BENDING. WIRES WERE COATED WITH HEAT SHRINK AND PASSED THROUGH GLASS TUBE. SPECIMENS HELD IN TEFLON JIG AS BEFORE.
SOLUTION 5.2 mol/L NaCl 303.8 g NaCl LOT 926448A ADDED TO 880 ml WATER ADJUSTED TO pH 4.0 BY THE ADDITION OF 0.00176 g HCl
START pH = 3.8
END pH = NOT RECORDED
T = 95°C N_2 THERMO # 0323605 SOLUTION PURGED WITH ZERO AIR, 79% N_2 + 21% O_2
POTENTIOSTAT ESC 440 #1 CHANNEL #3 DATA SAVED AS UB825N1.DAT USING LONGTM.WBB
REFERENCE SCE
METAL SAMPLES I 825 01
E_{corr} -168 mV KEITHLEY 617
E_{pt} +248 "
E_{app} O.C
I —
METAL SAMPLES I 825 02
E_{corr} -161 mV KEITHLEY 617
E_{pt} +248 "
E_{app} -165 mV -194 mV "
I 10^{-5} - 10^{-4} A/cm² "
TEST STARTED 10/8/93 4:30 pm t=0
TEST STOPPED 10/29/93 4:30 pm t = 1,814,400
[signature] 11/8/93

10/8/93

U BEND UB825N2 ALLOY 825

SPECIMEN #1 METAL SAMPLES I 825 03
ALLOY 825 HEAT # J 208
SPECIMEN #2 METAL SAMPLES I 825 04
ALLOY 825 HEAT # J 208
SPECIMENS WERE PREPARED SAME AS UB825N1 P94
SOLUTION 5.2 mol/L LiCl 220.4 g LiCl LOT 926474 ADDED TO 900 ml DI WATER ADJUSTED TO pH 4.0 BY THE ADDITION OF 0.00180 g HCl
T = 95°C Hg THERMO # 183306 SOLUTION PURGED WITH ZERO AIR.
pH AT START = 3.4
pH AT END NOT RECORDED
POTENTIOSTAT ESC 440 #1 CHANNEL #4 DATA SAVED AS UB825N2.DAT USING LONGTM.WBB
REFERENCE SCE
METAL SAMPLES I 825 03
E_{corr} -261 KEITHLEY 617
E_{pt} +282 "
E_{app} O.C
I —
METAL SAMPLES I 825 04
E_{corr} -224 mV KEITHLEY 617
E_{pt} +282 "
E_{app} -220 - 240 mV "
I 10^{-6} - 10^{-4} "
TEST STARTED 10/8/93 4:30 pm t=0
TEST STOPPED 10/29/93 4:30 pm t = 1,814,400
[signature] 11/8/93

[signature] 8/31/94

10/8/93 UBEND ~~UB316L10.DAT~~ 9 DD 7/25/94 316L

SPECIMEN #1 METAL SAMPLES 316L 17
316L HEAT # H980
SPECIMEN #2 METAL SAMPLES 316L 18
316L HEAT # H980
SPECIMENS WERE BENT AROUND 1/2" MANDREL AND HELD IN PLACE WITH C-276 BOLTS WITH ZIRCONIA SPACERS. SPECIMENS WERE CLEANED IN 10% HNO_3 FOR 60 MIN AFTER BENDING. SPECIMENS WERE THEN RINSED IN DI WATER AND DRIED. ELECTRICAL CONTACT MADE WITH 1/16" 316L WELDING WIRE SPOT WELDED TO END OF SPECIMEN WIRE WAS COATED WITH HEAT SRINK AND PASSED THROUGH GLASS TUBE. BENT SPECIMENS HELD IN TEFLON JIG.
SOLUTION 1000 ppm Cl^-. 1.65415 g NaCl LOT 926448 A ADDED TO ≈ 1000 ml SOLUTION CONTAINING DI WATER ADJUSTED TO pH 4.0 BY THE ADDITION OF 0.00200 g HCl
START pH 4.378
END pH
T = 95°C N_2 THERMO 183302 PURGED WITH ZERO AIR
METAL SAMPLES 316L 17
7/25/94 DD ~~ST~~ E_{CORR} −70 KEITHLEY 617
E_{PT} +318 "
E_{APP} −55 mV TO −5 mV "
I $10^{-7} - 10^{-6}$ A/cm² "
METAL SAMPLES 316L 18
E_{CORR} −114 KEITHLEY 617
E_{PT} +318 "
E_{APP} O.C
I —
POTENTIOSTAT ESC 440 #1 CHANNEL #5 DATA SAVED AS ~~UB316L10.DAT~~ 9 DD 7/25/94 USING LONGTM.WBB
TEST STARTED 10/8/93 4:30 PM t=0 sec
TEST STOPPED 10/29/93 t= 1,814,400 sec
[signature] 11/8/93

10/8/93 UBEND UB316L10 316L

SPECIMEN #1 METAL SAMPLES 316L #19
316L HEAT # H980
SPECIMEN #2 METAL SAMPLES 316L 20
316L HEAT # H980
SPECIMENS WERE PREPARED SAME AS UB316L10 p 98
SOLUTION 1000 ppm Cl^- 10^{-2} mol/L ~~$S_2O_3^-$~~ DD 7/25/94 $Na_2S_2O_3$
1.64889 g NaCl LOT 926448 AND 1.59100 g $Na_2S_2O_3$ LOT 923931A ADDED TO DI WATER ADJUSTED TO pH 4.0 BY THE ADDITION OF 0.002 g HCl. T=95°C N_2 THERMO # PURGED WITH ZERO AIR
START pH 4.922
END pH
POTENTIOSTAT ESC 440 #1 CHANNEL #6 DATA SAVED AS UB316L10.DAT USING LONGTM.WBB
METAL SAMPLES 316L 19
E_{CORR} −205 KEITHLEY 617
E_{PT} +23 "
E_{APP} −150 mV TO 0 mV KEITHLEY 617
I $10^{-7} - 10^{-6}$ KEITHLEY 617
METAL SAMPLES 316L 20
E_{CORR} −242 KEITHLEY 617
E_{PT} +23 "
E_{APP} O.C "
I —
TEST STARTED 10/8/93 4:30 pm t=0
TEST STOPPED 10/29/93 4:30 pm t=1,814,400 sec
[signature] 11/8/93

10/13/93 SSRT NI 4 ALLOY 825

SPECIMEN ALLOY 825 NN4371FG TENSILE
CLEANED AND PREPARED SAME AS SSRTSS27
$l = 0.941"$ $d = 0.123"$
SOLUTION SAME AS SSRT NI 1 P91
START PH = 3.4
END PH ~ 3.8
T = 95 °C Hg THERMO # 0323003 BUBBLED
WITH CO_2 THROUGH TEFLON TUBE.
POTENTIOSTAT ESC 440 #3 CHANNEL # 1
DATA SAVED AS SSRTNI4.DAT USING SSRTSET4.WBB
REFERENCE SCE FISHER 13-620-51 SN
E_{CORR} -339 mV KEITHLEY 617
E_{PT} -165 mV
E_{APP} -325 mV AT START TO -336 mV KEITHLEY 617
CURRENT 1×10^{-5} TO 5×10^{-5} A KEITHLEY 617
INITIAL LOAD 39.7 LBS
MAXIMUM LOAD 911.5 LBS
STRAINING STARTED 5:00 pm 10/13/93
TIME TO FAILURE 1,555,000 SEC
ELONGATION. 0.173"

FAILURE IS DUCTILE AND HAS SOME
AREA OF CORROSION NO SIGN OF SCC.

11/18/93

8/31/94

11/10/93 UBEND 825N3 UB825N3.DAT

SPECIMEN #1 METAL SAMPLES # I 825 01
ALLOY 825 HEAT # J208
SPECIMEN #2 METAL SAMPLES # I 825 05
ALLOY 825 HEAT # J208
SPECIMENS BENT AND PREPARED SAME AS
UB825N1 P.94 SPECIMEN I 825 01 CARRY
OVER FROM UB825N1 TEST P94. SPECIMENS
MOUNTED IN TEFLON JIG SUCH THAT I 825 05
IS IMMERSED IN SOLUTION AND I 825 01 IS
COMPLETELY ABOVE SOLUTION LEVEL
SOLUTION 5.2 MOL NaCl + 880 ml WATER AT
PH 4.0 . 303.83134 g NaCl LOT 926448A
+ 0.00106 g HCl AND 880 ml DI WATER.
START PH 3.93
END PH 2.97
T = 95 °C Hg THERMO 0323007 PURGED WITH
ZERO AIR.
POTENTIOSTAT ESC 440 #1 CHANNEL #3 DATA
SAVED AS UB825N3.DAT USING LONG TM.WBB
REFERENCE SCE FISHER 13-620-51 SN 0165415
I 825 01
E_{CORR} - ABOVE SOLN E_{PT} +258 mV E_{APP} O.C
KEITHLEY 617 SN 537418
I 825 05
E_{CORR} -273 mV E_{PT} +258 mV E_{APP} -260 mV
KEITHLEY 617 SN 537418
TEST STARTED 5:50 pm 11/10/93 11/10/93
12/8/93 ~~12/7/93~~ 1/25/94 TEST STOPPED 5:50 pm 12/8/93 12/7/93
12/10/93 I 825 01 VERY CLEAN SOME MINOR CORROSION
PRODUCTS AROUND WELD TO ~~ST~~ 1/25/94 825 WIRE
I 825 05 CORROSION SCALE ON LEG OF SPECIMEN
ABOVE SOLUTION / VAPOR INTERFACE APPEARS TO
HAVE CREVICE CORROSION UNDER WASHER NO SIGN
OF SCC 12/10/93

11/10/93 UBEND ALLOY 825 UB825N4.DAT

SPECIMEN #1 METAL SAMPLES I 825 03
ALLOY 825 HEAT # J 208
SPECIMEN #2 METAL SAMPLES I 825 06
ALLOY 825 HEAT # J 208
SPECIMENS BENT AND PREPARED SAME AS
UB825N1 p94 SPECIMEN I 825 03 IS
A CARRY OVER FROM UB825N2 p95
I 825 03 ABOVE SOLUTION, I 825 06 IMMERSED
IN SOLUTION
SOLUTION 5.2 MOL LiCl IN 880 ml WATER
AT pH 4.0 220.34g LiCl LOT 926474
+ 0.00106 g HCl + 880 ml DI WATER
START pH 3.86
END pH 3.00
T=95°C Hg THERMO 0323005 PURGED
WITH ZERO AIR
POTENTIOSTAT ESC 440 #1 CHANNEL #4 DATA SAVED
AS UB825N4.DAT USING LONGTM.WBB
REFERENCE SCE 13-620-51 SN 0169033
I 825 03
E_{corr} ABOVE SOLN E_{pt} +266 E_{app} O.C.
KEITHLEY 617 SN S37418
I 825 06
E_{corr} -260mV E_{pt} +266 E_{app} -250mV
KEITHLEY 617 SN S37418 DD 7/25/94
TEST STARTED ~~11/50~~ 11/10/93 5:50PM
11/10/93
12/8/93 DD ~~12/8/?~~ 7/25/94 TEST STOPPED 12/8/93 5:50pm 12/8/93
12/10/93 I82503 CORROSION PRODUCTS ON LEG
PITS ON LEG AND AROUND WELD NO SCC
I825 06 CORROSION PRODUCTS ON LEG ABOVE S/L
INTERFACE PIT ON CORNER ABOVE S/L INTERFACE.
PITS ON INSIDE OF BEND NO PITS ON OUTSIDE.
NO SIGN OF SCC
12/10/93

11/10/93 UBEND 316L UB316L11.DAT

SPECIMEN #1 METAL SAMPLES 316L 17
316L HEAT # H980
SPECIMEN #2 METAL SAMPLES 316L 18
316L HEAT # H980
SPECIMENS SAME AS THOSE USED IN UB316L9
p96
SOLUTION 1000 ppm Cl^- IN pH 4 DI WATER
1.64867 g NaCl + 0.00184 g HCl + 1000ml DI
WATER
START pH 4.134
END pH 5.82
T=95°C Hg THERMO 183302 PURGED WITH
ZERO AIR.
POTENTIOSTAT ESC 440 #1 CHANNEL #5
DATA SAVED AS UB316L11.DAT USING
LONGTM.WBB
REFERENCE SCE FISHER 13-620-51 SN 3106337
~~I 825~~ DD 7/25/94 316L 17
E_{corr} -188mV E_{pt} +377mV E_{app} -100mV
KEITHLEY 617 SN S37418
316L 18
E_{corr} -180mV E_{pt} +377mV E_{app} O.C.
KEITHLEY 617 SN S37418
TEST STARTED 11/10/93 5:50pm
11/10/93
12/8/93 TEST STOPPED 12/8/93 5:50PM 12/8/93
12/10/93 316L-17 PITS ON LEG CORROSION AROUND WELD
AREA ALL CORROSION IN VAPOR PHASE. NO SCC
~~331~~ DD 7/25/94 316L-18 CORROSION IN VAPOR PHASE ONLY
SHALLOW PITS AND CORROSION PRODUCTS NO SCC
12/10/93

11/10/93 UBEND UB316L12.DAT

SPECIMEN #1 METAL SAMPLES 316L 19
316L HEAT # N980
SPECIMEN #2 METAL SAMPLES 316L 20
316L HEAT # N980
SPECIMENS SAME AS THOSE USED IN UB316L10
p 97
SOLUTION 1000 PPM Cl + 10^{-2} MOL/LITER $S_2O_3^{2}$
IN pH 4 DI WATER 1.65110 g NaCl LOT
926448A + 1.58150 g $Na_2S_2O_3$ LOT 923931A
+ 0.00184 g HCl + DI WATER TO 1000 ml
START pH 4.643
END pH 8.37
T = 95°C N.I THERMO 183306 PURGED
WITH ZERO AIR.
POTENTIOSTAT ESC 440 # CHANNEL #6
DATA SAVED AS UB316L12.DAT USING
LONGTM.WBB
REFERENCE SCE FISHER 13-620-51 SN 2134032
316L 19
E_{CORR} -135 mV E_{PT} +75 mV E_{APP} -100 mV
KEITHLEY 617 SN 537418
316L 20
E_{CORR} -247 mV E_{PT} +75 mV E_{APP} O.C
KEITHLEY 617 SN 537418
TEST STARTED 11/10/93 5:50 pm
[signature] 11/10/93
12/8/93 TEST STOPPED 12/8/93 5:50 pm [signature] 12/8/93
12/10/93 316L-19 CORROSION PRODUCTS ON BEND IN SOLUTION
GOLD IN COLOR. BLACK CORROSION PRODUCTS IN VAPOR
PHASE. PITS AND SCC ON LEG IN VAPOR PHASE.

[signature] 8/31/94

11/18/93 SSRT NI5

SPECIMEN ALLOY 825 HH4371FG 600 SiC FINISH
CLEANED AND PREPARED SAME AS SSRTSS27 P.65
l = 0.940" d = 0.122"
SOLUTION 385.74 g LiCl LOT # 926474
ADDED TO 1 LITER OF DI WATER ADJUSTED
TO pH 4.0 BY THE ADDITION OF 0.002 g HCl
FINAL VOLUME = 1200 ml Cl CONCENTRATION =
9.1 MOLES Cl^- / kg WATER. 350 ml OF
ABOVE SOLUTION PLACED IN TEFLON/GLASS
CELL AND HELD AT 95°C Hg THERMO #0323002
BUBBLED WITH CO_2 THROUGH TEFLON TUBE.
START pH 2.0
END pH. 2.4
POTENTIOSTAT ESC 440 #3 CHANNEL #1
DATA SAVED AS SSRTNI5 USING SSRTSET4.WBB
REFERENCE SCE FISHER 13-620-51 SN 3106340
E_{CORR} -297 mV KEITHLEY 617 SN 537418
E_{PT} -124 mV KEITHLEY 617
E_{APP} -292 mV ~~AS~~ 11/23/94 AT START KEITHLEY 617
CURRENT 10^{-6} A AT START KEITHLEY 485 SN 509163
INITIAL LOAD 42.2 LBS
MAXIMUM LOAD 1070.5 LBS
STRAINING STARTED 6:30 pm 11/20/93 [signature]
TIME TO FAILURE 612,000 sec
ELONGATION. 0.303"
SOLUTION BUBBLED WITH CO_2 FROM 11/18/93 5:00pm
TO 11/19/93 3:00 pm. SOLUTION WAS
PURGED WITH N_2 FROM 11/19/93 300 pm TO
END OF TEST
E_{APP} VARIED FROM -272 mV TO -303 mV
CURRENT VARIED FROM 10^{-6} A TO 7×10^{-5} A
PITTING / DUCTILE FAILURE A FEW SECONDARY
PITS VISABLE. SMALL PIT AT SOLUTION/VAPOR
INTERFACE. NO SIGN OF SCC
[signature] 12/2/93

11/19/93 SSRTNI6

SPECIMEN ALLOY 825 HH4371FG 600 S.C
CLEANED AND PREPARED SAME AS SSRTSS27 P65
$l = 0.946''$ $d = 0.122''$
SOLUTION : 350 ml OF STOCK SOLUTION USED
IN SSRTNI5 P 103. T = 95°C
N_2 THERMO # 0323003 BUBBLED WITH
CO_2 THROUGH TEFLON TUBE.
START PH 2.0
END PH 1.8
POTENTIOSTAT ESC 440 #3 CHANNEL #2
DATA SAVED AS SSRTNI6.DAT USING SSRTSET4.WBB
REFERENCE SCE FISHER 13-620-51 SN 3106321
E_{CORR} -254 mV KEITHLEY 617 SN 537418
E_{PT} -6.5 mV KEITHLEY 617
E_{APP} O.C. AT START. E_{CORR} DECREASED TO -317 mV IN TEST
CURRENT O.C.
INITIAL LOAD 43.2 LBS
MAXIMUM LOAD 1077 LBS
STRAINING STARTED 6:30 PM 11/20/93
TIME TO FAILURE 644,410 SEC
ELONGATION. 0.313
SOLUTION WAS BUBBLED WITH CO_2 FROM 11/18/93
5:00 PM TO 11/19/93 3:00 PM. SOLUTION WAS
THEN PURGED WITH N_2 FROM 11/19/93 3:00 PM
TO END OF TEST.
PITTING / DUCTILE FAILURE. A FEW SECONDARY
PITS VISABLE. ONE PIT NEAR SOLUTION / VAPOR
INTERFACE. NO SIGN OF SCC.

12/2/93

11/19/93 SSRTNI7.

SPECIMEN ALLOY 825 HH 4371 FC NOTCHED
ULTRASONICALLY CLEANED IN DETERGENT
RINSED WITH DI WATER AND ACETONE AND
DRIED. NO O-RING USED IN TEST
SOLUTION 350 ml OF STOCK SOLUTION USED
IN SSRTNI5 P 103 T = 95°C FROM 5:00 PM
11/18/93 TO 3:00 PM 11/19/93. TEMP OF SOLUTION
WAS INCREASED TO 110°C FOR DURATION OF
TEST. SOLUTION WAS BUBBLED WITH CO_2
WHILE SOLUTION TEMP WAS 95°C. SOLUTION
WAS THEN PURGED WITH N_2 FROM 3:00 PM
11/19/93 TO END OF TEST. GAS ROUTED
THROUGH TEFLON TUBE. N_2 THERMO # 183308
START PH 2.0
END PH 3.0
POTENTIOSTAT ESC 440 #3 CHANNEL #3
DATA SAVED AS SSRTNI7.DAT USING SSRTSET4.WBB
TEST CONDUCTED IN CORTEST MACHINE.
REFERENCE SCE FISHER 13-620-51 SN 0165403
E_{CORR} -290 mV KEITHLEY 614 # 467374
E_{PT} -180 mV KEITHLEY 614 # 467374
E_{APP} O.C. AT START.
CURRENT —
INITIAL LOAD 40.3 LBS
MAXIMUM LOAD
STRAINING STARTED 6:30 PM 11/20/93
TIME TO FAILURE TEST STOPPED 7/25/94
ELONGATION. 0.077" AT STOP
TEST INTERRUPTED 12/22/93 8:00 AM t = 2727580 SEC
LOAD = 1676.3 LBS EXT = 0.077" SMALL PITS
ON SIDE OF SPECIMEN SOME CORROSION IN
NOTCH AREA NO SIGN OF SCC

12/22/93

12/15/93 SSRT NI8

SPECIMEN ALLOY 825 HH4371FG 600 S:C
TENSILE CLEANED AND PREPARED SAME AS
SSRTSS27 P65 l= 0.864 d= 0.123
SOLUTION 40 % $MgCl_2$ LOT 930588
PREPARED BY HEATING 820 g $MgCl_2 \cdot 6H_2O$
+100 ml DI WATER TO 138 °C AND ADDING
WATER UNTIL SOLUTION BOILS (REF ASTM G36)
YIELD WAS APPROXIMATELY 700 ml SOLUTION
40 % $MgCl_2$ NOT SOLUBLE AT ROOM TEMP
THEREFORE ACTUAL VOLUME, DENSITY AND
pH OF SOLUTION WERE NOT RECORDED
T = 120 °C Hg THERMO 0323002
SOLUTION DEAERATED WITH N_2 THROUGH TEFLON
TUBE. 350 ml SOLUTION USED IN TEST
POTENTIOSTAT ESC 440#3 CHANNEL #1
DATA SAVED AS SSRTNI8.DAT USING SSRTSET4.WBB
REFERENCE SCE FISHER 13-620-51 3106321
E_{CORR} -0.262 V KEITHLEY 617 SN 537418
E_{PT} +200 mV OR +0.200 V KEITHLEY 617 # 537418
E_{APP} -257 mV AT START KEITHLEY 617
CURRENT 10^{-6} to 10^{-4} A KEITHLEY 617
INITIAL LOAD 40.3 LBS
MAXIMUM LOAD 896.1 LBS
STRAINING STARTED 6:30 pm 12/9/93
TIME TO FAILURE 369000 SEC
ELONGATION 0.182
FAILURE APPEARS TO BE DUCTILE IN CENTER
OF SPECIMEN CROSSECTION SCC ON EDGE OF
CROSSECTION MANY SECONDARY CRACKS. CRACKS
ARE SHORT AND WIDE.

[signature] 12/15/93

12/15/93 SSRT NI9

SPECIMEN ALLOY 825 HH4371FG 600 S:C
TENSILE SPECIMEN CLEANED AND PREPARED
SAME AS SSRT SS27 P65 l= 0.876 d= 0.121
SOLUTION 40% $MgCl_2$ LOT 930558 SAME
AS SSRTNI8 P 106 T = 120 °C Hg THERMO# 0323003
SOLUTION DEAERATED WITH N_2 THROUGH TEFLON
TUBE 350 ml SOLUTION USED IN TEST.
POTENTIOSTAT ESC 440 #3 CHANNEL #2
DATA SAVED AS SSRTNI9.DAT USING SSRTSET4.WBB
REFERENCE SCE FISHER 13-620-51 SN 3106340
E_{CORR} -272 mV KEITHLEY ~~617~~ 617 SN 537418 7/25/94
E_{PT} +200 mV KEITHLEY 617 SN 537418
E_{APP} O.C.
CURRENT -
INITIAL LOAD 40.5 LBS
MAXIMUM LOAD 977.7 LBS
STRAINING STARTED 6:30 pm 12/9/93
TIME TO FAILURE ~~600~~ 449800 SEC 12/14/93 11:30 PM
ELONGATION 0.218" 7/25/94
FAILURE APPEARS TO BE DUCTILE IN CENTER
SOME SCC AROUND PERIMETER OF FRACTURE
SURFACE MANY SECONDARY CRACKS ON
TENSILE SECTION CRACKS ARE SHORT AND WIDE

[signature] 12/15/93

[signature] 8/31/94

12/15/93 UBEND ALLOY 825 UB825N5

SPECIMEN #1 METAL SAMPLES I 825 01
ALLOY 825 HEAT # J208
SPECIMEN #2 METAL SAMPLES I 825 05
ALLOY 825 HEAT # J208
SPECIMENS ARE SAME AS THOSE USED IN
UB825N3 P.99
I 825 03 SUSPENDED ABOVE SOLUTION I 825 06
IMMERSED IN SOLUTION.
SOLUTION 304.2 g NaCl LOT 926448A DISSOLVED
IN 830 ml DI WATER TO WHICH 0.00084 g HCl
WAS ADDED WATER PH = 4.0
SOLUTION pH AT START - 5.337
SOLUTION pH AT END = 5.858
T=95°C N_2 THERMO 183306 NO GAS BUBBLED
THROUGH SOLUTION.
POTENTIOSTAT ESC 440 # 1 CHANNEL # 3 DATA
SAVED AS UB825N5.DAT USING LONGTM.WBB
REFERENCE SCE FISHER 13-620-51 SN 9214083
I 825 0~~5~~1 DD 7/25/94 - ABOVE SOLUTION NO E_{CORR} MEASURED
I 825 05 CONDITIONS AT START OF TEST
E_{CORR} = -175 mV E_{PT} = +274 mV E_{APP} = -165 mV AT START
VALUES MEASURED WITH KEITHLEY 614 555368
TEST STARTED 6:00 PM 12/15/93 [signature] 12/15/93
KEITHLEY 614 SN 555368

1/14/94 TEST ENDED 1/12/94 6:00 pm t = 2,419,200 sec
CHARGE PASSED 2661.3 COULOMBS FOR I 825 05
NO SCC OBSERVED ON EITHER SPECIMEN
I825 05 HAS SEVERE ~~XDD~~ 7/25/94 LOCALLIZED ATTACK
AT SOLUTION / VAPOR INTERFACE.
I 825 01 FREE FROM ATTACK

[signature] 1/14/94

12/15/93 UBEND ALLOY 825 UB825N6

SPECIMEN #1 METAL SAMPLES I 825 03
ALLOY 825 HEAT # J 208
SPECIMEN #2 METAL SAMPLES I 825 06
ALLOY 825 HEAT # J 208
SPECIMENS SAME AS THOSE USED IN UB825N4
P100 SPECIMEN UB825 03 SUSPENDED ABOVE
SOLUTION UB825 06 IMMERSED IN SOLUTION
SOLUTION 220 g LiCl LOT 926474 DISSOLVED
IN 900 ml DI WATER TO WHICH ~~0.0086~~ DD 7/25/94 0.00086 g HCl
WAS ADDED WATER pH = 4.0
SOLUTION pH AT START: 5.113
SOLUTION pH AT END: 6.673
T=95°C N_2 THERMO 0323005 NO GAS
BUBBLED THROUGH SOLUTION
POTENTIOSTAT ESC 440 # 1 CHANNEL # 4 DATA
SAVED AS UB825N6.DAT USING LONGTM.WBB
REFERENCE SCE FISHER 13-620-51 SN 016545
I 825 03 ABOVE SOLUTION NO ECORR MEASURED
I 825 06 CONDITIONS AT START OF TEST
E_{CORR} -262 mV E_{PT} +289 mV E_{APP} ~~+250~~ DD 7/25/94 -250 mV
VALUES MEASURED WITH KEITHLEY 614 555368
TEST STARTED 6:00 PM 12/15/93 [signature] 12/15/93

1/14/94 TEST ENDED 1/12/94 600 pm t = 2419200 sec
CHARGE PASSED 32.9 COULOMBS FOR I 825 06
SHALLOW PITS OBSERVED ON BOTH SPECIMENS
PITS OBSERVED ON INSIDE OF BEND ON I 825 03
NO SIGN OF SCC

[signature] 1/14/94

12/15/93 UBEND ALLOY 825 UB825N7

SPECIMEN #1 METAL SAMPLES I825 08
ALLOY 825 HEAT #. J 208
SPECIMEN #2 METAL SAMPLES I825 07
ALLOY 825 HEAT # J 208
SPECIMENS BENT AND PREPARED SAME AS
UB825N1 p94 BOTH SPECIMENS IMMERSED
IN SOLUTION
SOLUTION: 318 g LiCl LOT 926474 DISSOLVED IN
830 ml DI WATER TO WHICH WAS ADDED 0.0008 g HCl
WATER pH = 4.0
SOLUTION pH AT START 4.230
SOLUTION pH AT END 3.341
T = 95°C N_2 THERMO 0323007 ~~PURGED WITH~~ DD 7/25/94
SOLUTION WAS NOT PURGED.
POTENTIOSTAT ESC 440 # 1 CHANNEL #5 DATA
SAVED AS UB825N7.DAT USING LONGTM.WBB
REFERENCE SCE 13-620-51 SN 8211163
I 825 08 CONDITIONS AT START OF TEST
E_{CORR} -296 mV E_{PT} +278 mV E_{APP} O.C.

I 825 07 CONDITIONS AT START OF TEST
E_{CORR} -297 mV E_{PT} +278 mV E_{APP} -285 mV
POTENTIALS MEASURED WITH KEITHLEY 614
TEST STARTED 6:00 PM 12/15/93
[signature] 12/15/93

1/14/94 TEST ENDED 1/12/94 6:00PM t = 2,419,200 SEC
CHARGE PASSED 68.9 COULOMBS ON I825 07
NO SCC. SMALL PITS ABOVE AND BELOW
SOLUTION / VAPOR INTERFACE ON BOTH SPECIMENS

[signature] 1/14/94

12/15/93 UBEND 316L UB316L13.DAT

SPECIMEN #1 METAL SAMPLES # 17 (316L 17)
316L HEAT # H 980
SPECIMEN #2 METAL SAMPLES 316L 18
316L HEAT # H 980
SPECIMENS SAME AS THOSE USED IN UB316L11 p107
BOTH SPECIMENS IMMERSED IN SOLUTION
SOLUTION 1000 ppm Cl^- AS NaCl 1.6426 g NaCl
LOT 926448A ADDED TO APPROXIMATELY 1000 ml
DI WATER AT pH 4.0 BY THE ADDITION OF 0.001 g HCl
SOLUTION pH AT START ~~4.22~~ DD 7/25/94 4.505
SOLUTION pH AT END 8.390
T = 95°C N_2 THERMO 183302 SOLUTION
WAS NOT PURGED
POTENTIOSTAT ESC 440 #1 CHANNEL #6 DATA SAVED
AS UB316L13.DAT USING LONGTM.WBB
REFERENCE SCE FISHER 13-620-51 SN 0169033
~~I 825~~ DD 7/25/94 316L #17 CONDITIONS AT START
E_{CORR} -171 mV E_{PT} +294 mV E_{APP} -100 mV

316L 18 CONDITIONS AT START
E_{CORR} -240 mV E_{PT} +294 mV E_{APP} O.C.
POTENTIALS MEASURED WITH KEITHLEY 614 555368
TEST STARTED 600 PM 12/15/93
[signature] 12/15/93

1/14/94 TEST ENDED 1/12/94 600 PM t = 2,419,200 SEC
CHARGE PASSED 140.1 COULOMBS ON 316L 17
SCC ON 316L 17 ABOVE SOLUTION / VAPOR
INTERFACE

[signature] 1/14/94

1/12/94 SSRTSS42

SPECIMEN 316L SS P80746 CLEANED
AND PREPARED SAME AS SSRTSS27 P65
TENSILE SPECIMEN l= 0.820 d= 0.123
SOLUTION 330 ml OF STOCK SOLUTION
MADE BY ADDING 58.44134 g NaCl
LOT 926448A TO DI WATER 1000 ml
SOLUTION ADJUSTED TO PH 4.0 BY THE
ADDITION OF 0.15 ml 0.02 g/ml HCl
T=95°C Hg THERMO 9243196 CAL DUE 9 APRIL/94
PURGED WITH N_2 THROUGH GLASS FRITT
START PH 3.937
POTENTIOSTAT ESC 440 #3 CHANNEL #1
DATA SAVED AS SSRTSS42.DAT USING SSRTSET4.WBB
REFERENCE SCE FISHER 13-620-51 SN 0165403
E_{CORR} -265 mV KEITHLEY 617 # 537418
E_{PT} -126 mV "
E_{APP} -240 mV "
CURRENT 10^{-6} A KEITHLEY 485 # 509163
INITIAL LOAD 40.4 LBS
STRAINING STARTED 5:50 pm 1/12/94

1/21/94 END PH = 8.030 1/21/94
$E_{APPLIED}$ ~~-260~~ -260 mV TO -210 mV.
POTENTIAL AT END OF TEST -210 mV
CURRENT -10^{-6} TO 2.8×10^{-5} A
CURRENT AT END OF TEST 8×10^{-6}
MAX LOAD 887.5
ELONGATION AT FAILURE 0.316
TIME TO FAILURE 635400 SEC
FAILURE IS DUCTILE SOME SMALL PITS
ON GAGE LENGTH OF SPECIMEN

1/21/94

1/12/94 SSRTSS43

SPECIMEN 316L SS P 80746 CLEANED
AND PREPARED SAME AS SSRTSS27 P65
TENSILE SPECIMEN l= 0.825 d= 0.122
SOLUTION 330 ml STOCK SOLUTION ON PAGE
112 1 m/l NaCl AT PH 4.0
T= 95°C Hg THERMO 92143200 CAL DUE 9 APRIL/94
PURGED WITH N_2 THROUGH GLASS FRITT
START pH = 3.937
POTENTIOSTAT ESC 440 #3 CHANNEL #2
DATA SAVED AS SSRTSS43.DAT USING SSRTSET4.WBB
REFERENCE SCE FISHER 13-620-51 SN 3106340
E_{CORR} -245 mV KEITHLEY 617 537418
E_{PT} -97 mV
E_{APP} O.C.
CURRENT O.C
INITIAL LOAD 40.6 LBS
STRAINING STARTED 550 PM 1/12/94

1/21/94 END PH 8.042
MAX LOAD 871.5 LBS
ELONGATION AT FAILURE 0.302"
TIME TO FAILURE 622800 SEC
E_{CORR} AT FAILURE -0.336 V TO -0.323 V
E_{CORR} DURING TEST -0.219 V TO -0.339 V
FAILURE IS DUCTILE SOME SMALL PITS ON
GAGE LENGTH OF SPECIMEN.

1/21/94

8/31/94

1/12/94 SSRTSS44

SPECIMEN 316L P80746 TENSILE SPECIMEN
CLEANED AND PREPARED SAME AS SSRTSS27 P65
l= 0.824 d= 0.122
SOLUTION 330ml STOCK SOLUTION P 112
1M NaCl AT pH 4.0
T=95°C Hg THERMO 9243197 CAL DUE 9 APRIL/94
PURGED WITH N_2 THROUGH ~~FE~~ DD 7/25/94 GLASS FRITT
START pH 3.937
POTENTIOSTAT ESC 440 #3 CHANNEL #3
DATA SAVED AS SSRTSS44.DAT USING SSRTSET4.WBB
REFERENCE SCE FISHER 13-620-51 SN 3106321
E_{corr} -256 mV KEITHLEY ~~4~~ DD 7/25/94 614 # 437674
E_{PT} -131 mV "
E_{APP} -240 mV "
CURRENT 10^{-6}A
INITIAL LOAD 41.4LBS
STRAINING STARTED 5:50pm ~~1/12/93~~ DD 7/25/94 1/12/94

2/4/94 END pH 7.990
TIME TO FAILURE 1,515,600 SEC
ELONGATION 0.175"
MAX LOAD 743 LBS.
FAILURE IS DUCTILE WITH SOME PITTING
NO SIGN OF SCC.

2/4/94

8/31/94

1/18/94 UBEND ALLOY 825 UB825N8

SPECIMEN #1 METAL SAMPLES ~~#~~ DD 7/25/94 I 825-01
ALLOY 825 HEAT J208
SPECIMEN #2 METAL SAMPLES I 825 09
ALLOY 825 HEAT J208
SPECIMENS BENT AND PREPARED SAME AS
UB825N1 P94. I 825 01 SAME AS
THAT USED IN UB825N5 P108
SPECIMEN I 825 09 HUNG UP SIDE DOWN
SO ~~THAT~~ DD 7/25/94 THAT BEND IS ABOVE SOLUTION
LEVEL I 825 01 IMMERSED IN SOLUTION
JUST BEYOND BEND
SOLUTION 324.16 g NaCl IN 884 ml DI WATER
AT pH 4.0 BY THE ADDITION OF 0.0018 g ~~HCl~~ DD 7/25/94
HCl 6.27 MOLES Cl^- / kg WATER
START pH: 4.43
END pH: 5.80
T= 95°C Hg THERMO 183303 SOLUTION NOT PURGED
POTENTIOSTAT ESC 440 #1 CHANNEL # 3 DATA
SAVED AS UB825N8.DAT USING LONGTM.WBB
REFERENCE SCE FISHER 13-620-51 SN 0169033
I 825 01 CONDITIONS AT START OF TEST
E_{CORR} -93mV E_{PT} +254mV E_{APP} O.C.

I 825 09 CONDITIONS AT START OF TEST
E_{CORR} -306mV E_{PT} +254mV E_{APP} -300 mV
POTENTIALS MEASURED WITH KEITHLEY 614 # 555368
TEST STARTED: 1/18/94 10:00 AM
TEST STOPPED 2/15/94
END pH 5.80
RUNTIME 2437200 SEC
POTENTIAL RANGE -309 mV TO +263mV
FINAL POTENTIAL -285mV
EXAMINATION REVEALED NO LARGE EASILY IDENTIFIABLE
CRACKS 2/22/94

1/18/94 UBEND ALLOY 825 UB825N9

SPECIMEN #1 METAL SAMPLES I 825 03
ALLOY 825 HEAT J208
SPECIMEN #2 METAL SAMPLES I 825 06
ALLOY 825 HEAT J208
SPECIMENS SAME AS THOSE USED IN UB825N6
P 109. I 825 03 SUSPENDED ~~UBOUE~~ DD 7/25/94 ABOVE SOLUTION
LEVEL. I 825 06 IMMERSED IN SOLUTION
SOLUTION 220 g ~~LiCl~~ DD 7/25/94 LiCl LOT 926474
IN 900 ml DI WATER ADJUSTED TO pH 4.0
BY THE ADDITION OF 0.0018 g HCl
START pH 4.90
END pH 5.60
T=95°C Hg THERMO# 183305 SOLUTION NOT PURGED
POTENTIOSTAT ESC 440 #1 CHANNEL #4 DATA
SAVED AS UB825N9.DAT USING LONGTM.WBB
REFERENCE SCE 13-620-51 SN 8211163
I 825 03 CONDITIONS AT START OF TEST
E_{CORR} NOT MEASURED - SPECIMEN ABOVE SOLUTION

I 825 06 CONDITIONS AT START OF TEST
E_{CORR} -260 mV E_{PT} +322 mV E_{APP} -248 mV
POTENTIALS MEASURED WITH KEITHLEY 614 SN 555368
TEST STARTED 1/18/94 10:00 AM [signature]
TEST STOPPED 2/15/94
RUNTIME 2437200 SEC
POTENTIAL RANGE -248 mV TO -290 mV
FINAL POTENTIAL -270 mV
EXAMINATION REVEALED NO CRACKS

[signature] 2/22/94

1/18/94 UBEND ALLOY 825 UB825N10

SPECIMEN #1 METAL SAMPLES I 825 10
ALLOY 825 HEAT J208
SPECIMEN #2 METAL SAMPLES I 825 11
ALLOY 825 HEAT J208
SPECIMENS BENT AND PREPARED SAME AS
UB 825 N1 P 94 BOTH SPECIMENS IMMERSED
IN SOLUTION WITH BEND ABOVE SOLUTION/
VAPOR INTERFACE.
SOLUTION 220 g LiCl LOT 926474 DISSOLVED
IN 900 ml DI WATER TO WHICH 0.0018 g HCl
WAS ADDED
START pH 5.27
END pH 4.39
T=95°C Hg THERMO # 183304 SOLUTION NOT PURGED
POTENTIOSTAT ESC 440 #1 CHANNEL #5 DATA
SAVED AS UB825N10.DAT USING LONGTM.WBB
REFERENCE SCE FISHER 13-620-51 SN 3106337
I 825 10 CONDITIONS AT START OF TEST
E_{CORR} -306 E_{PT} +244 E_{APP} O.C.

I 825 11 CONDITIONS AT START OF TEST
E_{CORR} -305 E_{PT} +244 E_{APP}
POTENTIALS MEASURED WITH KEITHLEY 614 SN 555368
TEST STARTED 1/18/94 10:00 AM [signature]
1/20/94 MEASURED POTENTIAL OF I 825 11 INCORRECT
ANALOG INPUT TO READ POTENTIAL CALCULATION ICON
AND METER REMOVED FROM LONGTM.WBB FOR
CHANNEL #5. [signature] 1/20/94
TEST STOPPED 2/15/94
RUNTIME 2437200 SEC
CORROSION OF CONTACT 825 WIRES TO SPECIMEN
RESULTED IN NO POTENTIOSTATIC CONTROL BEYOND
1/20/94 NO SIGN OF SCC

[signature] 2/22/94

1/18/94 UBEND ALLOY 825 UB825N11

SPECIMEN #1 METAL SAMPLES I825 08
ALLOY 825 HEAT J208
SPECIMEN #2 METAL SAMPLES I 825 07
ALLOY 825 HEAT J208
SPECIMENS SAME AS THOSE USED IN UB825N7
P 110 BOTH SPECIMENS IMMERSED IN SOLUTION
SOLUTION 318 g ~~Na~~ DD 7/25/94 LiCl LOT 926474
IN 830 ml DI WATER AT pH 4.0 BY THE
ADDITION OF 0.0017 g HCl
START pH 4.30
END pH 3.60
T=95 °C N_2 THERMO # 183306 SOLUTION NOT PURGED
POTENTIOSTAT ESC 440 #1 CHANNEL #6 DATA SAVED
AS UB825N11.DAT USING LONGTM.WBB
~~START pH~~ DD 7/25/94
~~END pH~~ DD 7/25/94
REFERENCE SCE 13-620-51 SN 2134032
I 825 08 CONDITIONS AT START OF TEST
E_{CORR} -260 E_{PT} +313 E_{APP} O.C.

I 825 07 CONDITIONS AT START OF TEST
E_{CORR} -287 E_{PT} +313 E_{APP} -275 mV
POTENTIALS MEASURED WITH KEITHLEY 614 # 555368
TEST STARTED: 1/18/94 10:00 AM
TEST STOPPED 2/15/94
RUNTIME 2 437 200 SEC
POTENTIAL RANGE -300 TO -270 mV
FINAL POTENTIAL -270 mV
SOME LOCALIZED CORROSION NO SIGN
OF SCC.

2/22/94

1/28/94 SSRTSS 45

SPECIMEN 316L SS P 80746 TENSILE CLEANED
AND PREPARED SAME AS SSRT SS 27 P65
l= 0.830 d= 0.122
SOLUTION : 350 ml STOCK SOLUTION MADE
BY ADDING 303.97 g NaCl LOT 926448A
TO 830 ml DI WATER ADJUSTED TO pH 4.0
BY THE ADDITION OF 0.17 ml 0.02 g/ml HCl
T= 95 °C N_2 THERMO # 9243200. SOLUTION
PURGED WITH N_2 THROUGH TEFLON TUBE
START pH = 3.21
SPECIMEN PLACED IN 90 mm × 50 mm DISH
WITH SOLUTION COVERING ~~GAGUE~~ DD 7/25/94 GAGE
LENGTH. PFA TUBE AND TEFLON CLAMP
WITH SCREWS PLACED OVER 0.375" OF 0.5"
GAGE LENGTH WHILE IMMERSED IN SOLUTION
TO PRODUCE CREVICE. SPECIMEN WAS
QUICKLY TRANSFERRED TO TEFLON/GLASS SLOW
STRAIN RATE TEST CELL; CELL WAS ASSEMBLED,
PLACED ON LOAD FRAME AND FILLED WITH
SOLUTION. ENTIRE CREVICE AREA AND GAGE
LENGTH IMMERSED IN SOLUTION FOR TEST.
POTENTIOSTAT ESC 440 #3 CHANNEL #1 DATA SAVED
AS SSRTSS45.DAT USING SSRTSET4.WBB
REFERENCE FISHER 13-620-51 SN 3106340
E_{CORR} -352 mV KEITHLEY 614 # 555368
E_{PT} 0 mV "
E_{APP} O.C
CURRENT -
INITIAL LOAD 43.3 LBS 7/25/94
STRAINING STARTED, ~~ST~~ DD 5:23 pm 1/28/94
2/15/94 E_{APP} -350 mV FROM E_{CORR} -330 -380 mV
I= 5×10^{-5} A 3:00 pm AT 5:45 pm I= 0.32 mA E_{SET} TO O.C.
3/7/94 END PH 6.810 MAX LOAD 874 LBS
ELONGATION 0.265" TIME TO FAILURE 2,342,000 SEC
DUCTILE / PITTING FAILURE 3/7/94

1/28/94 SSRTSS46

SPECIMEN 316L P80746 TENSILE CLEANED
AND PREPARED SAME AS SSRTSS27 P65
l= 0.830 d=0.122
SOLUTION 350 ml STOCK SOLUTION SAME AS
SSRTSS45 P119. T=95°C N_2 THERMO # 9243196
PURGED WITH N_2 THROUGH TEFLON TUBE
START pH = 3.21
TEFLON/PFA CREVICE FORMING DEVICE PLACED
OVER GAGE LENGTH METHOD SAME AS
THAT USED IN SSRTSS~~46~~45 p119. SPECIMEN
PLACED IN SLOW STRAIN RATE CELL SO THAT
SOLUTION LEVEL DURING TEST COULD BE MAINTAINED
BELOW GAGE LENGTH AND CREVICE REGION.
35 ml OF SOLUTION EXTRACTED FROM CELL
AFTER T=95°C SO THAT CREVICE AND
GAGE LENGTH ARE IN VAPOR PHASE.
POTENTIOSTAT ESC 440 #~~2~~ 3 7/25/94 CHANNEL #2
DATA SAVED AS SSRTSS46.DAT USING ~~LONGTM~~ 7/25/94
SSRTSET4.WBB
REFERENCE SCE FISHER 13-620-51 SN 0165403
E_{CORR} -332 mV KEITHLEY 614 #555368
E_{PT} +30 mV "
E_{APP} O.C.
CURRENT -
INITIAL LOAD 42.9 LBS
STRAINING STARTED 5:23 PM 1/28/94
2/15/94 E_{APP}= -350mV FROM E_{CORR} -340 -360 mV KEITHLEY 614
I= 10^{-6} A 3:00PM KEITHLEY 614
3/7/94 END pH 7.36
ELONGATION 0.317"
MAX LOAD 929 LBS
TIME TO FAILURE 2,862,000 SEC
DUCTILE FAILURE
3/7/94

2/24/94 UB825N12

SPECIMEN #1 METAL SAMPLES I 825-01
ALLOY 825 HEAT J208
SPECIMEN #2 METAL SAMPLES I 825 09
ALLOY 825 HEAT J208
SPECIMENS BENT AND PREPARED SAME
AS UB825N1 P94. SPECIMENS SAME
AS THOSE USED IN UB825N8 P115
SOLUTION 324 g NaCl LOT 926448A IN 884 ml
DI WATER AT pH 4.0 BY THE ADDITION OF
0.001 g HCl 6.27 moles Cl^-/kg WATER
START pH 5.20
END pH 6.76
T= 95°C N_2 THERMO 183305 SOLUTION NOT DEAERATED
POTENTIOSTAT ESC 440 #1 CHANNEL #3 DATA
SAVED AS UB825N12.DAT USING LONGTM.WBB
REFERENCE SCE FISHER 13-620-51 SN 9214083
I 825 01 CONDITIONS AT START OF TEST
E_{CORR} -96mV E_{PT} +245 mV E_{APP} O.C.

I 825 09 CONDITIONS AT START OF TEST
E_{CORR} -300mV E_{PT} +245mV E_{APP} -295mV
POTENTIALS MEASURED WITH KEITHLEY 614 #467374
TEST STARTED: 10:13 AM 2/24/94
TEST STOPPED 10:20 AM 3/24/94

EXAMINATION OF BOTH SPECIMENS SHOWS
NO DEFINATE SIGN OF SCC BUT SOME
VERY SMALL SURFACE FEATURES RESEMBELING
CRACKS ARE PRESENT ON THE BEND OF
THE SPECIMENS.
3/28/94

2/24/94 UB825N13

SPECIMEN #1 METAL SAMPLES I 825 03
ALLOY 825 HEAT J208
SPECIMEN #2 METAL SAMPLES I 825 06
ALLOY 825 HEAT J208
SPECIMENS SAME AS THOSE USED IN UB825N9
P 116 I 825 03 ABOVE SOLUTION, I 825 06
IMMERSED IN SOLUTION.
SOLUTION 220 g LiCl LOT 926474 IN 900 ml
DI WATER AT pH 4.0 BY THE ADDITION
OF 0.001 g HCl
START pH 5.20
END pH 6.528
T = 95°C Hg THERMO 183306 SOLUTION NOT DEAERATED
POTENTIOSTAT ESC 440 # 1 CHANNEL #4
DATA SAVED AS UB825N13.DAT USING LONGTM.WBB
REFERENCE SCE 13-620-51 SN 0765415
I 825 03 CONDITIONS AT START OF TEST
ABOVE SOLUTION IN VAPOR PHASE

I 825 06 CONDITIONS AT START OF TEST
E_{CORR} -229 mV E_{PT} +329 mV E_{APP} -220 mV
POTENTIALS MEASURED WITH KEITHLEY 614 # 467374
TEST STARTED. 10:15 AM ~~2/24/93~~ 2/24/94
TEST STOPPED 10:20 AM 3/24/94 7/25/94

EXAMINATION AT 70x ~~SHOWES~~ 7/25/94 SHOWS
NO OBVIOUS SCC BUT SOME SMALL
FEATURES WHICH APPEAR TO BE SURFACE CRACKS
ARE PRESENT.

3/28/94

2/24/94 UB825N14

SPECIMEN #1 METAL SAMPLES I 825 10
ALLOY 825 HEAT J208
SPECIMEN #2 METAL SAMPLES I 825 11
ALLOY 825 HEAT J208
SPECIMENS BENT AND PREPARED SAME AS
UB825N1 P94. BOTH SPECIMENS SAME AS
THOSE USED IN UB825N10 P117. ALLOY
825 WIRE RE WELDED TO SPECIMEN. SPECIMENS
INVERTED SO THAT BEND IS ABOVE SOLUTION LEVEL.
SOLUTION. 220 g LiCl LOT 926474 IN 900 ml
DI WATER ADJUSTED TO pH 4.0 BY THE
ADDITION OF 0.001 g HCl
START pH 5.20
END pH 5.655
T = 95°C Hg THERMO 183304 SOLUTION NOT ~~PDD~~ 7/25/94 DEAERATED
POTENTIOSTAT ESC 440 #1 CHANNEL #5 DATA
SAVED AS UB825N14.DAT USING LONGTM.WBB
REFERENCE SCE FISHER 13-620-51 SN 8211163
I 825 10 CONDITIONS AT START OF TEST
E_{CORR} -298 mV E_{PT} +263 mV E_{APP} O.C.

I 825 11 CONDITIONS AT START OF TEST
E_{CORR} -304 mV E_{PT} +263 mV E_{APP} 299 mV
POTENTIALS MEASURED WITH KEITHLEY 614 # 467374
TEST STARTED: 2/24/94 10:15 AM
TEST STOPPED 3/24/94 10:20 AM

EXAMINATION AT 70X SHOWS NO OBVIOUS CRACKS
BUT SMALL FEATURES WHICH APPEAR TO BE
FINE SURFACE CRACKS ARE PRESENT.

3/28/94

2/24/94 UB825N15

SPECIMEN #1 METAL SAMPLES I825 08
ALLOY 825 HEAT J208
SPECIMEN #2 METAL SAMPLES I 825 07
ALLOY 825 HEAT J208
SPECIMENS SAME AS THOSE USED IN UB825N11
P118 BOTH SPECIMENS IMMERSED IN SOLUTION.
SOLUTION 318 g LiCl LOT 926474 IN 830 ml
DI WATER AT PH 4.0 BY THE ADDITION OF
0.001 g HCl.
START pH 4.05
END pH 3.77
T=95°C N_2 THERMO 183303 SOLUTION NOT DEAERATED
POTENTIOSTAT ESC 440 #1 CHANNEL #6 DATA
SAVED AS UB825N15.DAT USING LONGTM.WBB
REFERENCE SCE FISHER 13-620-51 SN 3106345
I825 08 CONDITIONS AT START OF TEST
E_{CORR} -276mV E_{PT} +337 mV E_{APP} O.C.

I 82507 CONDITIONS AT START OF TEST
E_{CORR} -292mV E_{PT} +337 mV E_{APP} -285mV
POTENTIALS MEASURED WITH KEITHLEY 614 #467374
TEST STARTED 2/24/94 10:22 AM
TEST STOPPED 3/24/94 10:25 AM

EXAMINATION AT 70x SHOWS NO OBVIOUS
SIGNS OF SCC, SOME SMALL SURFACE
CRACKS APPEAR TO BE PRESENT.

3/28/94

3/16/94 SSRTSS47

SPECIMEN 316L P80746 TENSILE
CLEANED AND PREPARED SAME AS
SSRTSS27 P65 l= 0.823 d= 0.123
SOLUTION 303.47 g NaCl LOT 926448A
ADDED TO 830 ml DI WATER ADJUSTED
TO pH 4.0 BY THE ADDITION OF 0.09ml
0.02 g/ml HCl. 350 ml STOCK SOLUTION
USED IN TEST T=95°C N_2 THERMO 9243200
SOLUTION PURGED THROUGH TEFLON TUBE WITH
N_2
START pH 4.416
CREVICE ATTACHED TO GAGE LENGTH OF
SPECIMEN AS DESCRIBED IN SSRTSS45
P119. GAGE LENGTH AND CREVICE IMMERSED
IN SOLUTION. TEST CONDUCTED UNDER
GALVANOSTATIC CONTROL BY CONNECTING 1000 Ω
RESISTOR BETWEEN WORKING AND REFERENCE LEADS
OF ESC 440 #3. POTENTIAL OF SPECIMEN MEASURED
WITH KEITHLEY 614 # 555368 AND INPUT INTO
DATA ACQUISITION SYSTEM. CURRENT MEASURED
WITH KEITHLEY 485 PICOAMMETER. TEST CONDUCTED
IN MACHINE #1
DATA SAVED AS SSRTSS47.DAT USING SSRTSET4.WBB
REFERENCE SCE FISHER 13-620-51 SN 3106340
E_{CORR} = -347mV E_{pt} +67mV
I_{SET} 20 MICRO AMPS 1:35 PM 3/17/94 TIMER = 0 SEC
INITIAL LOAD 42 LBS
STRAINING STARTED 3/18/94 11:35 AM TIMER = 79200 SEC
I= 20 μA V= -352 mV_{SCE} 3/18/94

5/10/94 MAXIMUM LOAD 843 LBS
TIME TO FAILURE 1996000 SEC OR 554.4 HOURS
ELONGATION 0.212"
PITTING AND DUCTILE FAILURE. 5/10/94

3/16/94 SSRTSS48

SPECIMEN 316L P80746 TENSILE. CLEANED AND PREPARED SAME AS SSRTSS27 P65
$l = 0.823"$ $d = 0.122"$
SOLUTION 350 ml SOLUTION 6.2 MOLAL Cl^- AS NaCl DESCRIBED ON PAGE 125 T = 95°C
Hg THERMO 9243197. SOLUTION PURGED WITH N_2 THROUGH TEFLON TUBE.
START pH 4.416
CREVICE ATTACHED TO GAGE LENGTH OF SPECIMEN AS ~~DES~~ DD 7/25/94 DESCRIBED IN SSRT SS45 PAGE 119
GAGE LENGTH AND CREVICE IMMERSED IN SOLUTION. TEST CONDUCTED UNDER GALVANOSTATIC ~~CONTROL~~ DD 7/25/94 CONTROL BY PLACING A 1000 Ω RESISTOR BETWEEN WORKING AND REFERENCE LEADS OF ESC 440 #3 POTENTIOSTAT. SPECIMEN POTENTIAL MEASURED WITH KEITHLEY 614 # 467374.
TEST CONDUCTED IN MACHINE #2
DATA SAVED AS SSRTSS48.DAT USING SSRTSET4.WBB
REFERENCE SCE FISHER 13-620-51 SN 9214074
E_{CORR} -341 mV E_{PT} ~~+0.11~~ DD 7/25/94 +0.011 V
I_{SET} 40 MICROAMPS 1:35 PM 3/17/94 TIMER = 0 SEC
INITIAL LOAD 40 LBS
STRAINING STARTED: 3/18/94 11:35 AM TIMER = 79200 SEC
I = 40 μA V = -364 mV SCE

3/18/94

4/5/94 END pH 7.45
MAXIMUM LOAD 771 LBS
FAILURE 1535400 SEC (TIMER) 4/4/94
TIME TO FAILURE 1456200 SEC
ELONGATION 0.159"
FAILURE APPEARS TO BE DUCTILE WITH SOME PITTING. SEVERAL PITS ON SPECIMEN. GAGE LENGTH SHOWS SOME CREVICE CORROSION AND SOME SHORT BROAD CRACKS.

4/5/94

3/29/94 UB825N16

SPECIMEN #1 METAL SAMPLES I 825 01
ALLOY 825 HEAT J208
SPECIMEN #2 METAL SAMPLES ~~I 825 02~~ DD 7/25/94
I 825 09 ALLOY 825 HEAT J208
SPECIMENS SAME AS THOSE USED IN UB825N12 p 121
SOLUTION 324 g NaCl LOT 935535 IN 884 ml DI WATER ADJUSTED TO pH 4.0 BY THE ADDITION OF 0.0035 g HCl 6.27 moles Cl^- / kg WATER
START pH 3.394
END pH
T = 95°C Hg THERMO 183304 SOLUTION NOT DEAERATED
POTENTIOSTAT ESC 440 #1 CHANNEL #3 DATA SAVED AS UB825N16.DAT USING LONGTM.WBB
REFERENCE SCE FISHER 13-620-51 SN 9214083
I 825 01 CONDITIONS AT START OF TEST
E_{CORR} -267 mV E_{PT} +250 mV E_{APP} O.C.

I 825 09 CONDITIONS AT START OF TEST
E_{CORR} -265 mV E_{PT} +250 mV E_{APP} -265 mV
POTENTIALS MEASURED WITH KEITHLEY 617 # 537418
TEST STARTED: 4:30 pm 3/29/94
TEST STOPPED: 5:30 pm 4/26/94
END pH 5.142

NO SIGN OF SCC

5/17/94

3/29/94

UB825N17

SPECIMEN # 1 METAL SAMPLES I 825 03

ALLOY 825 HEAT J208

SPECIMEN # 2 METAL SAMPLES I 825 06

ALLOY 825 HEAT J208

SPECIMENS SAME AS THOSE USED IN UB825N13

p122 I 825 03 ABOVE SOLUTION I 825 06

IMMERSED IN SOLUTION.

SOLUTION 220g LiCl LOT 930844 IN 900ml

DI WATER ADJUSTED TO pH 4.0 BY THE ADDITION

OF 0.0036 g HCl.

START pH ≈ 5-6 pH DRIFTS UPWARDS WITH TIME.

END pH 5.5 - 6.5

T = 95°C Hg THERMO 183306 SOLUTION NOT

DE AERATED POTENTIOSTAT ESC 440 # 1 CHANNEL # 4

DATA SAVED AS UB825N17.DAT USING LONGTM.WBB

REFERENCE SCE 13-620-51 SN 0165415

I 825 03 CONDITIONS AT START OF TEST

ABOVE SOLUTION IN VAPOR PHASE

I 825 06 CONDITIONS AT START OF TEST

E_{CORR} -257 mV E_{PT} +254 mV E_{APP} -255 mV

POTENTIALS MEASURED WITH KEITHLEY 617 # 537418

TEST STARTED: 4:30 pm ~~2/2~~ 7/25/94 3/29/94

TEST STOPPED 5:30 Pm ~~4/29~~ 7/25/94 4/26/94

END pH 5.731

NO SIGN OF SCC SOME SMALL PITS

ON 825 WIRE CONTACT AREA I 825 06

5/17/94

3/29/94

UB825N18

SPECIMEN #1 METAL SAMPLES I 825 10

ALLOY 825 HEAT J208

SPECIMEN # 2 METAL. SAMPLES I 825 11

ALLOY 825 HEAT J208

SPECIMENS SAME AS THOSE USED IN UB825N14 p123

BOTH SPECIMENS INVERTED SO THAT BEND IS

ABOVE SOLUTION LEVEL.

SOLUTION 220g LiCl LOT 930844 IN 900ml

DI WATER ADJUSTED TO pH 4.0 BY THE

ADDITION OF 0.0036 g OF HCl

START pH ≈ 5~6 pH DRIFTS UPWARD WITH TIME.

END pH 5.5 - 6.5

T = 95°C Hg THERMO 183303 SOLUTION

NOT DEAERATED. POTENTIOSTAT ESC 440 #1

CHANNEL # 5 DATA SAVED AS UB825N18.DAT USING LONGTM.WBB

REFERENCE SCE 13-620-51 SN 8211163

I 825 10 CONDITIONS AT START OF TEST

E_{CORR} -266 E_{PT} +227 mV E_{APP} O.C

I 825 11 CONDITIONS AT START OF TEST

E_{CORR} -273 mV E_{PT} +227 mV E_{APP} -270 mV

POTENTIALS MEASURED WITH KEITHLEY 617 537418

TEST STARTED: 4:30 Pm 3/29/94

TEST STOPPED 5:30 Pm 4/26/94

NO SIGN OF SCC ALLOY 825 WIRE WELDED

FOR CONTACT IS PITTING

5/17/94

3/29/94 UB825N 19

SPECIMEN #1 METAL SAMPLES I 825 08
ALLOY 825 HEAT J208
SPECIMEN #2 METAL SAMPLES I 825 07
ALLOY 825 HEAT J 208
SPECIMENS SAME AS THOSE USED IN UB825N15
P 124. BOTH SPECIMENS IMMERSED IN SOLUTION
SOLUTION 318g LiCl LOT 930844 IN 830 ml
DI WATER ADJUSTED TO pH 4.0 BY THE ADDITION
OF 0.0033g HCl.
START pH 4.8
END pH 5.5
T = 95°C Hg THERMO 183305 SOLUTION NOT DEAERATED
POTENTIOSTAT ESC 440 #1 CHANNEL #6 DATA
SAVED AS UB825N19.DAT USING LONGTM.WBB
REFERENCE SCE 13-620-S1 SN 3106345
I 825 08 CONDITIONS AT START OF TEST
E_{corr} -275 mV E_{pt} +287 mV E_{app} O.C

I 825 07 CONDITIONS AT START OF TEST
E_{corr} -269 mV E_{pt} +281 mV E_{app} -264
POTENTIALS MEASURED WITH KEITHLEY 617 #537418
TEST STARTED: 4:30 pm 3/29/94
TEST STOPPED 5:30 PM 4/26/94

NO SIGN OF SCC PITS ARE PRESENT
ON BOTH SPECIMENS

[signature] 5/17/94

[signature] 8/31/94

4/15/94 SSRTSS49

SPECIMEN 316L TENSILE P 80746 CLEANED
AND PREPARED SAME AS SSRTSS27 P 65
l = 0.831 d = 0.122
SOLUTION 350 ml STOCK SOLUTION MADE BY
116.88398 g NaCl LOT 935535 AND 0.32 ml
OF 0.02 g/ml HCl + WATER TO 2000 ml
Cl CONCENTRATION = 1 MOLAR T = 95°C Hg THERMO
0323005 PURGED WITH N_2
START pH 4.063
PFA / PTFE CREVICE ATTACHED TO GAGE
LENGTH OF SPECIMEN IN THE SAME MANNER
AS SSRTSS45 P 119. TEST CONDUCTED UNDER
GALVANOSTATIC CONTROL USING A 1000 Ω RESISTOR
BETWEEN WORKING AND REFERENCE LEADS OF
ESC 440 #3 POTENTIOSTAT. SPECIMEN POTENTIAL
MEASURED WITH KEITHLEY 614 # 555368
TEST CONDUCTED IN MACHINE #1
DATA SAVED AS SSRTSS49.DAT USING SSRTSET4.WBB
REFERENCE SCE FISHER 13-620-S1 SN 9214074
E_{corr} -339 mV E_{pt} = -122 mV
I_{set} 10 μA 5:45 pm 4/15/94 [signature]
INITIAL LOAD 42 LBS
E AT START OF STRAINING -0.240 V
STRAINING STARTED 2:45 Pm 4/16/94 t = 75,600 sec
END pH = 7.383
MAXIMUM LOAD NOT RECORDED DUE TO LOG IN ERROR
ELONGATION " l = 1.020"
TIME TO FAILURE. "
PITTING AND DUCTILE FAILURE. 1.1×10^{-7} IN/SEC

[signature] 5/10/94

4/15/94

SSRTSS50

SPECIMEN 316L P80746 TENSILE CLEANED AND PREPARED SAME AS SSRTSS27 P 65
l= 0.826 d= 0.121
SOLUTION 350 ml STOCK SOLUTION 1MOLAR NaCl AT pH 4.065 P 131 T= 95°C Hg THERMO # 0323004
PURGED WITH N_2
START pH = 4.063
PFA/PTFE CREVICE ATTACHED TO GAGE LENGTH OF SPECIMEN IN THE SAME MANNER AS SSRTSS45 p119. TEST CONDUCTED IN MACHINE #2 UNDER GALVANOSTATIC CONTROL USING A 1000 Ω RESISTOR BETWEEN THE WORKING AND REFERENCE LEADS OF ESC 440 #3 CHANNEL #2
SPECIMEN POTENTIAL MEASURED WITH ~~KIE~~ DD 7/25/94 KEITHLEY 614 # 467374
DATA SAVED AS SSRTSS50.DAT USING SSRTSET4.WBB
REFERENCE SCE FISHER 13-620-51 SN 0169033
E_{CORR} -259 mV E_{PT} -141 mV
I_{SET} 50 μA 5:45 pm 4/15/94
INITIAL LOAD 39 LBS
E AT START OF STRAINING -0.242 V
STRAINING STARTED. 4/16/94 2:45 pm t= 75,600 sec
END pH 7.944
MAXIMUM LOAD ELONGATION AND TIME TO FAILURE ~~NOT~~ DD 7/25/94 5/10/94 NOT RECORDED DUE TO LOG IN FAILURE; PITTING AND DUCTILE FAILURE 1.1x10^{-7} IN/SEC l= 0.995"

5/10/94

SSRTSS51

SPECIMEN 316L P80746 CLEANED AND PREPARED SAME AS SSRTSS 27 p65 RADIUS AND GAGE LENGTH AT 600 SiC FINISH PTFE/PFA CREVICE ON GAGE LENGTH 1/4" SPECIMEN SHAFTS COVERED WITH PTFE TAPE EXPOSED AREA = 3.3 cm^2
l= 0.823" d= 0.122"
SOLUTION 58.44127 g NaCl LOT 935535 0.18 ml 0.02 g/ml HCl + DI WATER TO 1000 ml (1molar Cl^-)
START pH 3.945
TEST CONDUCTED IN CORTEST MACHINE UNDER GALVANOSTATIC CONTROL USING A 1000 Ω RESISTOR BETWEEN WORKING AND REFERENCE LEADS OF ESC 440 #3 CHANNEL #3 SPECIMEN POTENTIAL MEASURED WITH KEITHLEY 617 SN 537418
DATA SAVED AS SSRTSS51.DAT USING SSRTSET4.WBB
REFERENCE SCE FISHER 13-620-51 SN 3106340
E_{CORR} -287 mV E_{PT} ~~-184 mV~~ DD 7/25/94 -154 mV
I_{SET} = 33 μA 4/27/94 11:00 am
INITIAL LOAD 7/25/94 38.4 LBS
E ~~AT SAF~~ DD 4/29/94 AT START OF STRAINING -265 mV
STRAINING STARTED 4/29/94 t= 165600 sec
END pH 7.749
TIME TO FAILURE 508 hr OR 1828800 sec
ELONGATION 0.211"
MAX LOAD 908 LBS
PITTING DUCTILE FAILURE CREVICE CORROSION AND SMALL PITS ON GAGE LENGTH CREVICE CORROSION ON SPECIMEN SHAFT UNDER O-RING
TEMPERATURE OF SOLUTION NOT MAINTAINED AT 95°C DUE TO FAILURE OF TEMP CONTROLER

5/24/94

5/4/94 UB825N20

SPECIMEN #1 METAL SAMPLES I825 01 ALLOY 825
HEAT J 208
SPECIMEN #2 METAL SAMPLES I825 09 ALLOY 825
HEAT J 208
SPECIMENS SAME AS THOSE USED IN UB825N16 p127
SOLUTION 324g NaCl LOT 935535 + 0.23ml OF 0.02g/ml
HCl LOT FL-05-1290 IN 884 ml DI WATER
pH AT START 3.441
END pH 6.929
T = 95°C Hg THERMO 183305 SOLUTION NOT DEAERATED
POTENTIOSTAT ESC 440 #1 CHANNEL #3 DATA SAVED
AS UB825N20.DAT USING LONGTM.WBB
REFERENCE FISHER 13-620-51 SN 0165415
I825 01 CONDITIONS AT START OF TEST
E_{corr} -79mV E_{pt} +385mV E_{app} O.C.

I 825 09 CONDITIONS AT START OF TEST
E_{corr} -283mV E_{pt} +385mV E_{app} -277mV
POTENTIALS MEASURED WITH KEITHLEY 614 SN 535 368
TEST STARTED 4:35 pm 5/4/94
TEST STOPPED 5:15 pm 6/1/94
POTENTIAL RANGE -274 mV TO -315mV
CURRENT RANGE 2×10^{-4} MAX -1.9×10^{-5} MIN
PROGRAM CRASH DURING RUN AT ≈771000 SEC 7/25/94
TWO DATA FILES UB825N20.DAT & ~~UB825N20B.DAT~~ 6/15/94
UB825N20B.DAT MERGED DATA FILE SAVED
USING QUATTRO PRO AS UB825N20.WK1 7/25/94
NO SIGN OF SCC ON SPECIMENS NO ~~PIT~~ 6/15/94
PITTING OF SPECIMENS IN THIS TEST SEQUENCE.

6/15/94

5/4/94 UB825N21

SPECIMEN #1 METAL SAMPLES I825 03
ALLOY 825 HEAT J 208
SPECIMEN #2 METAL SAMPLES I 825 06
ALLOY 825 HEAT J 208
SPECIMENS SAME AS THOSE USED IN UB825N17
p128 I 825 03 ABOVE SOLUTION I825 06 IMMERSED
IN SOLUTION.
SOLUTION 220g LiCl LOT 930844 1.30ml OF 0.02g/ml
HCl LOT FL-05-1290 IN 900ml DI WATER
START pH 3.841
END pH 6.794
T = 95°C Hg THERMO # 183303 SOLUTION NOT DEAERATED
POTENTIOSTAT ESC 440 # 1 CHANNEL #4
DATA SAVED AS UB825N21.DAT USING LONGTM.WBB
REFERENCE SCE FISHER 13-620-51 SN 2134032
I825 03 CONDITIONS AT START OF TEST
ABOVE SOLUTION IN VAPOR PHASE
7/25/94
~~I 825~~ 5/4/94 I 825 06 CONDITIONS AT START OF TEST
E_{corr} -256mV E_{pt} +381 mV E_{app} -249mV
POTENTIALS MEASURED WITH KEITHLEY 614 SN535368
TEST STARTED 5/4/94 4:35 pm
TEST STOPPED 6/1/94 5:15 pm
POTENTIAL RANGE -246mV TO -271mV
CURRENT RANGE -5×10^{-6}A TO 9.3×10^{-6}A
CURRENT OF 3×10^{-2} A RECORDED NEAR END OF
TEST CAUSED BY PROBLEMS WITH LUGGIN PROBE
PROGRAM CRASH DURING RUN AT ≈770000 SEC
COMPLETE DATA FILE SAVED AS UB825N21.DAT
MODIFIED DATA FILE WITH CUMULATIVE TIME SAVED
AS UB825N21.WK1 USING QUATTRO PRO
NO SIGN OF SCC OR LOCALIZED CORROSION
DURING THIS TEST.

6/15/94.

5/4/94 UB825 N22

SPECIMEN #1 METAL SAMPLES I 825 10
ALLOY 825 HEAT J 208
SPECIMEN #2 METAL SAMPLES I 825 11
ALLOY 825 HEAT J 208
SPECIMENS SAME AS UB825N18 p129
BOTH SPECIMENS INVERTED SO THAT BEND IS
ABOVE SOLUTION LEVEL
SOLUTION 220g LiCl LOT 930844 + 1.30ml
0.02 g/ml HCl LOT FL-05-1290 IN 900ml
DI WATER
START pH 3.814
END pH 6.077
T= 95°C Hg THERMO 183306 SOLUTION NOT DEAERATED
POTENTIOSTAT ESC 440 #1 CHANNEL #5
DATA SAVED AS UB825N22.DAT USING LONGTM.WBB
REFERENCE SCE FISHER 13-620-51 SN 3106337
I 825 10 CONDITIONS AT START OF TEST
E_{CORR} -258mV E_{PT} +406mV E_{APP} O.C.

I 825 11 CONDITIONS AT START OF TEST
E_{CORR} -265mV E_{PT} +406mV E_{APP} -262
POTENTIALS MEASURED WITH KEITHLEY 614 SN555368
TEST STARTED 5/4/94 4:40 Am
TEST STOPPED 6/1/94 5:15 Pm
POTENTIAL RANGE -262mV TO -322 mV
CURRENT RANGE -1.6×10^{-5} A TO 1.2×10^{-4} A
PROGRAM CRASH DURING RUN AT 771000 SEC
DATA FILE SAVED AS UB825N22.DAT. MODIFIED
DATA FILE SAVED AS UB825N22.WK1 USING
QUATTRO PRO NO SIGN OF SCC ON
SPECIMENS AND NO INDICATION OF FURTHER
LOCALIZED CORROSION DURING THIS TEST

[signature] 6/13/94

5/4/94 UB825 N23

SPECIMEN #1 METAL SAMPLES I 825 08
ALLOY 825 HEAT J 208
SPECIMEN #2 METAL SAMPLES I 825 07
ALLOY 825 HEAT J 208.
SPECIMENS SAME AS THOSE USED IN UB825 N19 p130
SOLUTION 318g LiCl LOT 930844 + 1.25 ml 0.02g/ml
HCl LOT FL-05-1290 IN 830 ml DI WATER
START pH 4.130
END pH 4.533
T= 95°C Hg THERMO # 183304 SOLUTION NOT DEAERATED
POTENTIOSTAT ESC 440 #1 CHANNEL #6
DATA SAVED AS UB825N23.DAT USING LONGTM.WBB
REFERENCE SCE 13-620-51 SN 3106343
I 825 08 CONDITIONS AT START OF TEST
E_{CORR} -260mV E_{PT} +331mV E_{APP} O.C.

I 825 07 CONDITIONS AT START OF TEST
E_{CORR} -255mV E_{PT} +331mV E_{APP}
POTENTIALS MEASURED WITH KEITHLEY 614 SN555368
TEST STARTED 5/4/94 4:40pm
TEST STOPPED 6/1/94 5:15pm
POTENTIAL RANGE -438 mV TO 5.3 V
CURRENT RANGE -0.017 A TO 0.036 A
PROGRAM CRASH DURING RUN AT 771000 SEC
LOSS OF POTENTIOSTATIC CONTROL AT 701999 SEC
ALLOWED POTENTIAL TO INCREASE CURRENT TO
INCREASE AND SAMPLE TO BE SEVERELY ATTACKED
DATA FILE SAVED AS UB825 23B.DAT MODIFIED
DATA FILE SAVED AS UB825N23.WK1 USING
QUATTRO PRO. NO SIGN OF SCC ON SPECIMENS.

[signature] 6/15/94

5/19/94 SSRTSS 52

SPECIMEN 316L P 80746 CLEANED AND
PREPARED SAME AS SSRTSS27 P65
l= 0.831" d= ~~0.131"~~ DD 5/19/94 0.121"
SOLUTION 1000 ppm Cl^- 10^{-2} MOLAR $S_2O_3^{2-}$
AT pH 4.0. 1000 ml PREPARED AS FOLLOWS
1.65210 g NaCl LOT 935535
1.58216 g $Na_2S_2O_3$ LOT 923931A
0.4 ml 0.02 g/ml HCl LOT FL-05-1290
+ DI WATER TO 1000 ml T=95°C Hg THERMO# 9243197
AERATED WITH ZERO AIR FROM LIQUID
CARBONIC TANK # 635216
START pH - 4.116
END pH 4.453
TEST CONDUCTED IN MACHINE #1
POTENTIOSTAT ESC 440-3 CHANNEL #1
DATA SAVED AS SSRT SS 52. DAT USING SSRTSET4.WBB
REFERENCE SCE FISHER 13-620-51 SN 9214074
E_{CORR} -155 mV KEITHLEY 614 #467374
E_{PT} -98 mV "
INITIAL LOAD 40 LBS
STRAINING STARTED 12:00 PM 5/19/94 t=0
SPECIMEN INVERTED SO THAT 1/2 OF GAGE LENGTH
IS ABOVE SOLUTION LEVEL
E_{APP} OPEN C
STRAINING STOPPED 10:32 AM 5/20/94 t= 81000 SEC
LOAD 484.5 LBS
ELONGATION 0.036"
CURRENT -
E_{APP} = O.C. = -104 mV
STRAINING STARTED 8:04 AM 6/8/94 t= 1713600 SEC
STRAINING STOPPED 9:52 PM 6/8/94 t= 1763200 SEC
LOAD= 594 LBS V= O.C. = -108 mV_{SCE} 0.060" ELONG.
TEST STOPPED 6/27/94 8:00 AM t= 3355200 SEC
V_{OC} = -69 mV LOAD = 545 LBS
NO SIGN OF SCC [signature] 7/5/94

5/19/94 SSRTSS 53

SPECIMEN 316L P 80746 CLEANED AND
PREPARED SAME AS SSRTSS27 P65
l= 0.830 d= 0.121"
SOLUTION 1000 ppm Cl^- ~~8~~ DD 5/19/94 10^{-2} MOLAR
$S_2O_3^-$ AT pH 4.0 SAME AS LISTED ON PAGE 138
T=95°C Hg THERMO 9243196
AERATED WITH ZERO AIR FROM LIQUID CARBONIC
TANK # 635216
START pH = 4.116
END pH 7.533
TEST CONDUCTED IN MACHINE #2
POTENTIOSTAT ESC 440 #3 CHANNEL #2
DATA SAVED AS SSRTSS53.DAT USING SSRTSET4.WBB
REFERENCE SCE FISHER 13-620-51 SN 9214080
E_{CORR} -142 mV KEITHLEY 614 #467374
E_{PT} -127 mV "
INITIAL LOAD 40 LBS
STRAINING STARTED 12:00 PM ~~12~~ DD 5/19/94 t=0
SPECIMEN INVERTED SO THAT 1/2 OF GAGE
LENGTH IS ABOVE SOLUTION LEVEL.
E_{APP} -100 mV 12:00 PM 5/19/94
I= 10^{-7} 10^{-6} AMPS 12:00 PM 5/19/94
STRAINING STOPPED 9:10 AM 5/20/94 t= 76,000 SEC
LOAD 489.7 LBS
ELONGATION 0.035"
CURRENT 10^{-7} - 10^{-6} AMPS KEITHLEY 485 509163
E_{APP} -100 mV
STRAINING STARTED 8:04 AM 6/8/94 t= 1713600 SEC
STRAINING STOPPED 9:52 PM 6/8/94 t= 1763200 SEC
LOAD = 600.9 LBS V= -101 mV_{SCE} ELONGATION = 0.060"
TEST STOPPED 6/27/94 8:00 AM t= 3355200 SEC
~~V_{SCE} = 0.173 mV~~ DD 6/27/94 V_{SCE} = -173 mV I = 2×10^{-7} A
LOAD = 387 LBS
NO SIGN OF SCC - SEVERE LOCALIZED CORROSION
[signature] 7/5/94

6/17/94 SSRT NI3 FRACTURE

SPECIMEN SSRT NI3 p93 IWPE 027
OBJECTIVE PULL SPECIMEN TO FAILURE IN AIR AT ROOM TEMPERATURE AND EXAMINE FRACTURE SURFACE FOR SIGNS OF SCC INITIATED DURING TEST ON P93.
MACHINE : CORTEST AT 1400 RPM
= 3.8x10^-7 IN/SEC
SPECIMEN STARTED 6/17/94 AT 5:50 PM
LOAD AND ELONGATION DATA NOT RECORDED

6/17/94

SPECIMEN DID NOT FRACTURE TO TO NECKING IN 0.25" SHAFT DIAMETER AT BASE OF 1/4-28 THREADS

6/28/94

8/31/94

Initial Scientific notebook entry for U-BEND Stress corrosion cracking tests.

Title: Ubend: UB316L(#), UB825N(#).

Tests Preformed by: Darrell S. Dunn and Gustavo A. Cragnolino.

Objectives: Determine the environmental conditions in which stress corrosion cracking is possible for constant deflection specimens.

Equipment: ESC multichannel potentiostat Serial Number 9209138. Strawberry tree data acquisition boards (16 channel, 16 bit A/D and 8 channel, 12 bit D/A) and workbench data acquisition software. Compuadd 586 computer/Austin 386 computer. ASTM G-5 polarization cell with removal top, Teflon/glass reaction vessels or vessel meeting the requirements of TOP-008

Materials: Alloy 825 Heat # J208, 316L Heat # H980, Alloy 825 Heat # HH4371FG, 316L Heat # P80746.

Specimen specifications: As shown in IWPE-027 page 142

Measurement Parameters: Potentials verses saturated calomel electrode.

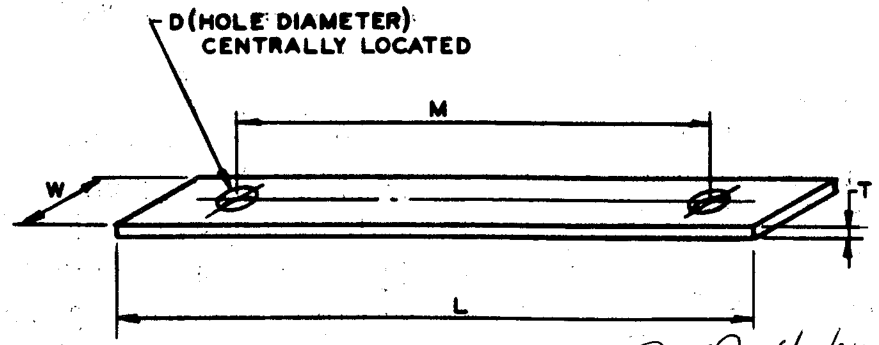
Required level of accuracy: Potentials $\pm$ 5mV

Uncertainty and Sources of Error: Specimens only partially immersed during testing. Actual current density of corroding areas is not determined.

6/28/94

6/28/94

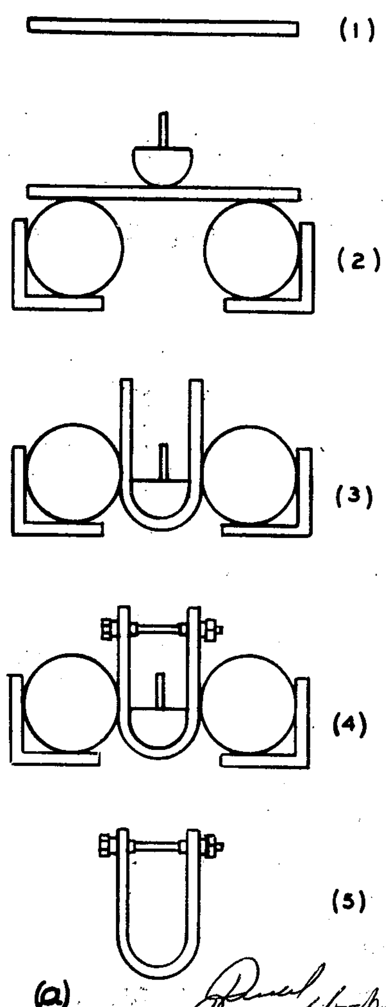
UBEND DIMENSIONS AND FORMING PROCESS



6/28/94

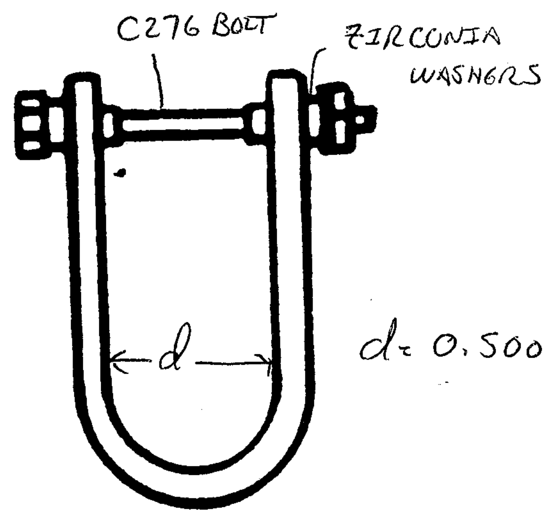
T = 0.115"
W = 0.750"
M = 4.000"
L = 5.000"

FORMING PROCESS



6/28/94

FINAL SPECIMEN



d = 0.500"

6/28/94

ALLOY 825 HEAT J208 316L HEAT H980 VENDOR ANALYSIS

METAL SAMPLES CO.

P.O. BOX 8
RT 1 BOX 152
MUNFORD, AL 36268
(205) 358-4202
FAX (205) 358-4515

MATERIAL TEST REPORT

DATE: 05/13/93
CUSTOMER: SOUTHWEST RESEARCH INSTITUTE
CUST. ORDER: 73293
M.S. ORDER: 932315

DEAR CUSTOMER:
WE CERTIFY THAT THIS MATERIAL TEST REPORT IS CORRECT TO THE BEST OF OUR KNOWLEDGE AND THAT THE MATERIAL SUPPLIED MEETS THE REQUIRED SPECIFICATIONS.
THANK YOU,

QUALITY CONTROL DEPARTMENT

CHEMICAL PROPERTIES

ALLOY	HEAT	AL	C	CR	CU	FE	MN	MO	NI	P	S	SI	TI	OTHERS
825	J208	0.009	0.01	22.07	1.72	29.69	0.40	3.49	41.22		<0.001	0.29	1.02	
316L	H980		0.019	16.30			1.90	2.13	10.18	0.03	0.001	0.50		N-.03

PHYSICAL PROPERTIES

ALLOY	HEAT	TENSILE - KSI	YIELD - KSI	ELONG - %	R / A - %	HARDNESS	COND.	UNS	MILL
825	J208							N08825	INCO ALLOYS
316L	H980	85.5	40	57 (2")		RB 78	CR ANN	S31603	REYNOLDS ALUMINUM

PAGE 1 of

6/28/94

VENDOR ANALYSIS OF U BEND MATERIAL

6/28/94

ALLOY 825 HEAT J208 KAWIN ANALYSIS
316L HEAT H980 KAWIN ANALYSIS

PHONE: 708/865-0400

2671 GARDNER ROAD, BROADVIEW, ILLINOIS 60153

CHARLES C. KAWIN COMPANY
METALLURGICAL LABORATORIES

MAILING ADDRESS / P.O. BOX 310 / MAYWOOD, ILLINOIS 60153

SOUTHWEST RESEARCH INST. 7010
6220 CULEBRA ROAD
P. O. DRAWER 28510
SAN ANTONIO TX 78284
H. GREEN/R. RAMIREZ/H. PRATT

P. O. # 03686

DESCR REL# 095651

REPORT DATE: 06/16/93

LAB NO: 0615-006 / 02

JOB NO: 6/16 #22

316L

CHEMICAL ANALYSIS

Si	.50	Ni	10.74	Cr	16.53
Mo	2.00	Cu	.42	Al	<.01
Ti	<.01	Fe	66.90		

TEST METHODS: ASTM E 663 ; ASTM E 1019 ; ASTM E 354 ;

Q. A. INSPECTOR

PAGE 2 OF 2

6/28/94

316L STAINLESS STEEL HEAT H980

6/28/94

ALLOY 825 HEAT J208 KAWIN ANALYSIS

PHONE: 708/865-0400

2671 GARDNER ROAD, BROADVIEW, ILLINOIS 60153

CHARLES C. KAWIN COMPANY
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6220 CULEBRA ROAD
P. O. DRAWER 28510
SAN ANTONIO TX 78284
H. GREEN/R. RAMIREZ/H. PRATT

P. O. # 03686

DESCR REL# 095651

REPORT DATE: 06/16/93

LAB NO: 0615-006 / 01

JOB NO: 6/16 #21

IN 825

CHEMICAL ANALYSIS

Si	.26	Ni	42.36	Cr	22.35
Mo	3.49	Cu	1.78	Al	.08
Ti	.94	Fe	28.17		

TEST METHODS: ASTM E 663 ; ASTM E 1019 ; ASTM E 354 ;

Q. A. INSPECTOR

PAGE 1 OF 2

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ALLOY 825 HEAT J208

6/28/94

ALLOY 825 UBEND
HEAT J208
ANALYSIS BY EDS

ALLOY 825
HEAT J208

EDS ANALYSIS

SQ: QUANTIFY

20-5704-041 825-9 EDGE 30KV WD=18
Standardless Analysis
30.0 KV 35.7 Degrees

Chi-sqd = 1.24

Element	Rel. K-ratio	Net Counts
Fe-K	0.28012 +/- 0.00307	33175 +/- 364
Ni-K	0.36160 +/- 0.00422	33260 +/- 388
Cr-K	0.23513 +/- 0.00242	34546 +/- 356
Ti-K	0.00976 +/- 0.00100	1700 +/- 175
Cu-K	0.00708 +/- 0.00280	566 +/- 224
Mo-K	0.05694 +/- 0.01917	345 +/- 116
Mo-L	0.01683 +/- 0.00194	2220 +/- 256
Si-K	0.00274 +/- 0.00069	521 +/- 132
Al-K	0.00088 +/- 0.00068	140 +/- 108
Ni-L	0.02893 +/- 0.00325	614 +/- 69

ZAF Correction 30.00 kV 35.67 deg
No.of Iterations = 1

BULK MATERIAL

Element	K-ratio	Z	A	F	Atom%	Wt%
Fe-K	0.273	1.004	1.114	0.933	28.99	28.50
Ni-K	0.353	0.982	1.155	1.000	38.70	40.00
Cr-K	0.229	1.011	1.057	0.909	24.32	22.26
Ti-K	0.010	1.014	1.119	0.915	1.17	0.99
Cu-K	0.007	1.028	1.119	1.000	0.71	0.79
Mo-K	0.056	1.124	1.010	1.000	3.73	6.31
Si-K	0.003	0.923	3.202	0.997	1.59	0.79
Al-K	0.001	0.952	4.572	0.998	0.78	0.37
					Total=	100.00%

6/28/94

< 'SQ

SQ: QUANTIFY

20-5704-041 825-9 BASE 30KV WD=18
Standardless Analysis
30.0 KV 35.7 Degrees

Chi-sqd = 1.01

Element	Rel. K-ratio	Net Counts
Fe-K	0.28793 +/- 0.00309	35299 +/- 379
Ni-K	0.39656 +/- 0.00435	37758 +/- 414
Cr-K	0.19441 +/- 0.00226	29568 +/- 343
Ti-K	0.00490 +/- 0.00094	884 +/- 169
Cu-K	0.01164 +/- 0.00279	965 +/- 231
Mo-K	0.05220 +/- 0.01820	327 +/- 114
Mo-L	0.01888 +/- 0.00196	2578 +/- 268
Si-K	0.00315 +/- 0.00072	621 +/- 142
Al-K	0.00040 +/- 0.00070	66 +/- 115
Ni-L	0.02992 +/- 0.00328	657 +/- 72

MILL FINISHED
SURFACE.

ZAF Correction 30.00 kV 35.67 deg
No.of Iterations = 2

Element	K-ratio	Z	A	F	Atom%	Wt%
Fe-K	0.284	1.005	1.097	0.922	29.48	28.84
Ni-K	0.391	0.983	1.145	1.000	42.77	43.98
Cr-K	0.191	1.012	1.055	0.900	20.22	18.41
Ti-K	0.005	1.016	1.120	0.918	0.60	0.50
Cu-K	0.011	1.029	1.112	1.000	1.18	1.31
Mo-K	0.051	1.125	1.010	1.000	3.48	5.85
Si-K	0.003	0.924	3.262	0.997	1.90	0.93
Al-K	0.000	0.953	4.684	0.998	0.37	0.18
					Total=	100.00%

6/28/94

INITIAL SCIENTIFIC NOTEBOOK ENTRY FOR THE SCANNING ELECTRON MICROSCOPIC ANALYSIS OF SLOW STRAIN RATE SPECIMENS AND U-BEND SPECIMENS

Title: SSRTSS(#), SSRTNI(#), UB316L(#), UB825N(#)

Tests performed by: Darrell S. Dunn and Gustavo A. Cragnolino

Optical microscopy and scanning electron microscopy performed by:
Harold Saldana (Div 6 SwRI # 4642), Ron McInnis (Div 6 SwRI # 4915) and Issiac Rodriguez (Div 6, SwRI # 6059)

Objectives: Document failure mode of specimens.

Equipment: MP4 Polaroid Camera SwRI # 12296, AMRAY Model 1645 Scanning Electron Microscope, Tracor Northern model 5200.

Materials: Alloy 825 Heat # HH4371FG; 316L Heat # P80746; Alloy 825 Heat # J208; 316L Heat # H980.

Specimen specifications: As shown in IWPE-027 page 17 and page 142.

Measurement Parameters: Documentation of failure mode, composition of material.

Required level of accuracy: For EDS analysis $\pm$ 1.0 WT %

Sources of error: Artifacts of optical microscopy and scanning electron microscopy.

6/28/94

6/31/94