

LSNReviews

From: Aladar Csontos
Sent: Friday, July 08, 2005 4:18 PM
To: ddunn@cnwra.swri.edu; Xihua He
Subject: Localized Corrosion Experimental Matrix
Attachments: LC Experiments.xls; Center LC Data.ppt; Center LC Corrosion Data.pdf

Hi guys,

Sorry for being late with this, but, I had to put out some fires with the TPA code and the Mechfail module yesterday and today. Anyway, here's my matrix with the solutions to be compared with the Center data that I've also included. Let's plan to meet on Monday if at all possible.

Thanks,
Al

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From: Aladar Csontos <aac@nrc.gov>

Subject: Localized Corrosion Experimental Matrix

To: ddunn@cnwra.swri.edu, xhe@cnwra.swri.edu

Message-id: <s2cea76e.075@NRNWMS05.NRC.GOV>

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X-Mailer: Novell GroupWise Internet Agent 6.0.4

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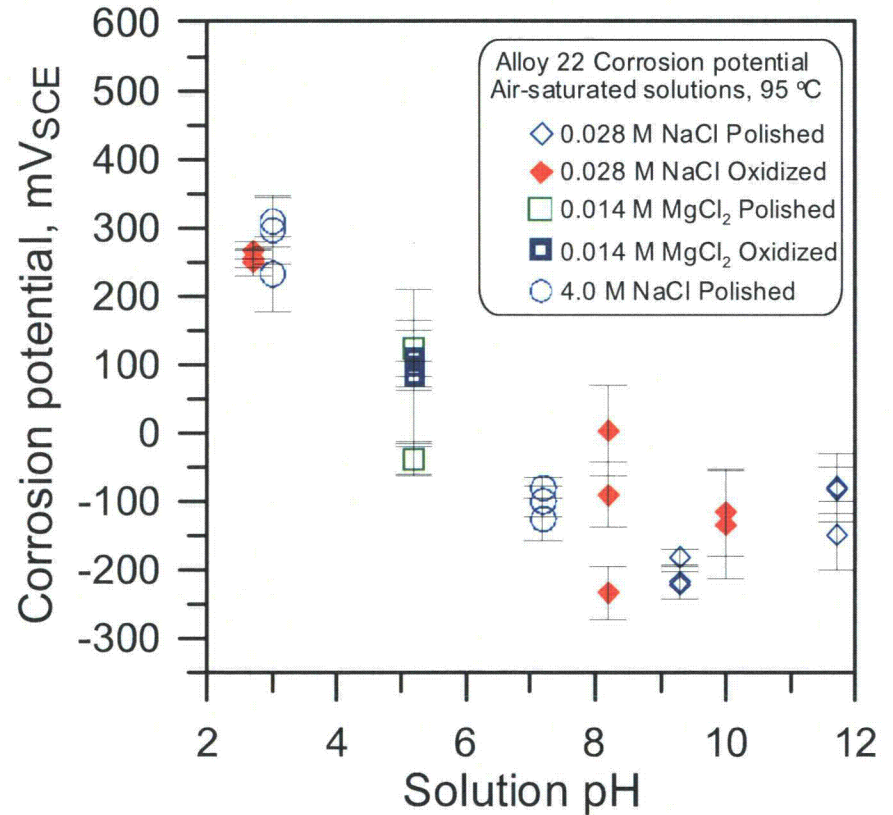
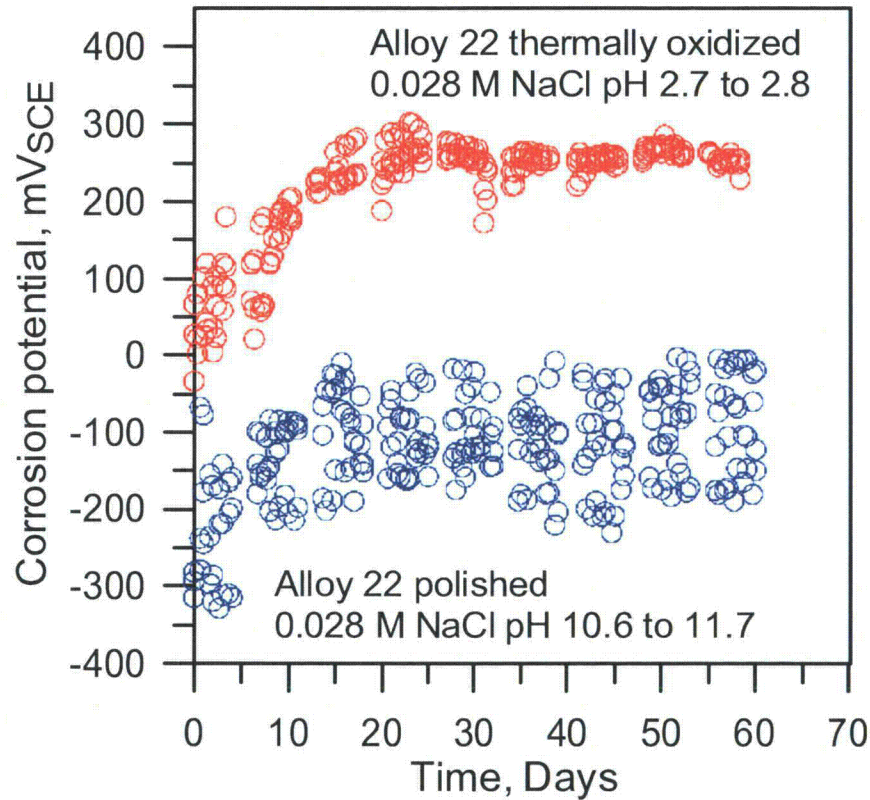
Localized Corrosion Experiments

Cathode	Anode	Area Ratio	Measure	Solution
Base Alloy 22	Base Alloy 22	5/1 or 10/1	E_{corr} / E_{repass}	See attached images
Base Alloy 22	Welded Alloy 22	5/1 or 10/1	E_{corr} / E_{repass}	See attached images
Ti Grade 7	Base Alloy 22	5/1 or 10/1	E_{corr} / E_{repass}	See attached images
Ti Grade 7	Welded Alloy 22	5/1 or 10/1	E_{corr} / E_{repass}	See attached images
Base Alloy 22	Base Alloy 22	5/1 or 10/1	Penetration Rate	See attached images
Base Alloy 22	Welded Alloy 22	5/1 or 10/1	Penetration Rate	See attached images
Ti Grade 7	Base Alloy 22	5/1 or 10/1	Penetration Rate	See attached images
Ti Grade 7	Welded Alloy 22	5/1 or 10/1	Penetration Rate	See attached images

As a function of:

- Torque
- Solution
- Area
- Dissimilar Metals

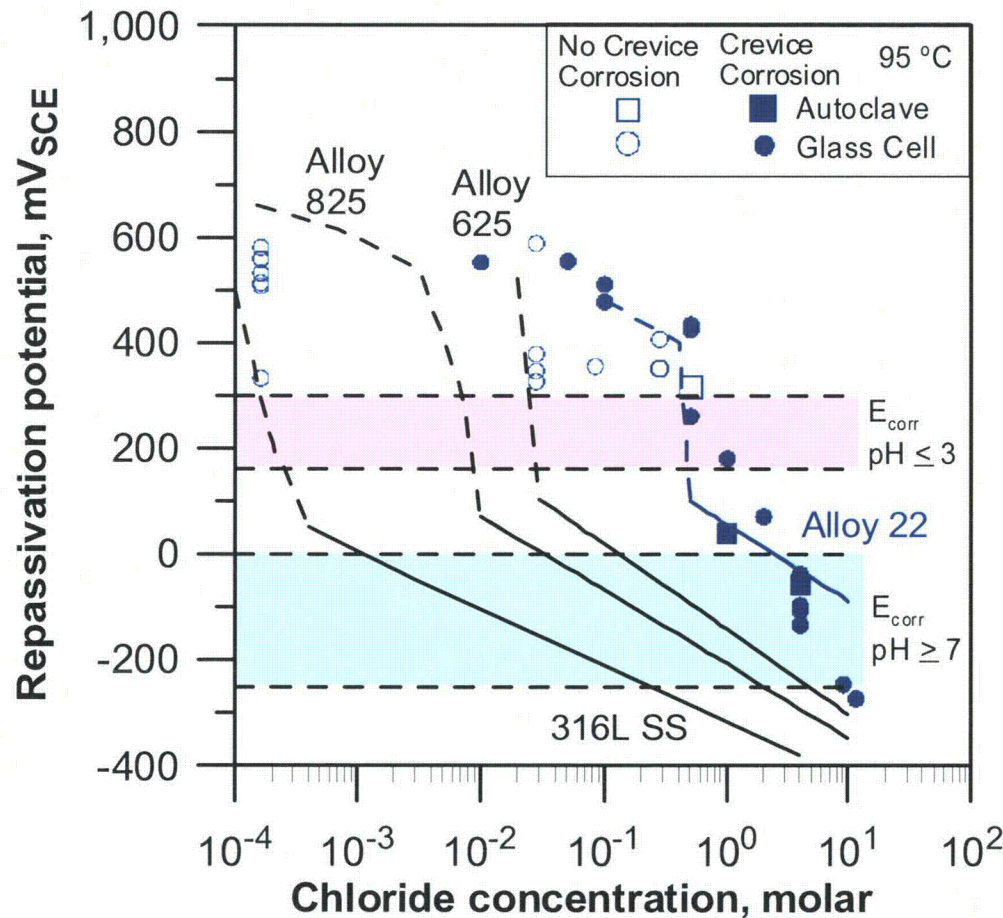
Corrosion Potential



- Thermally oxidized specimens: 200 °C for 30 days

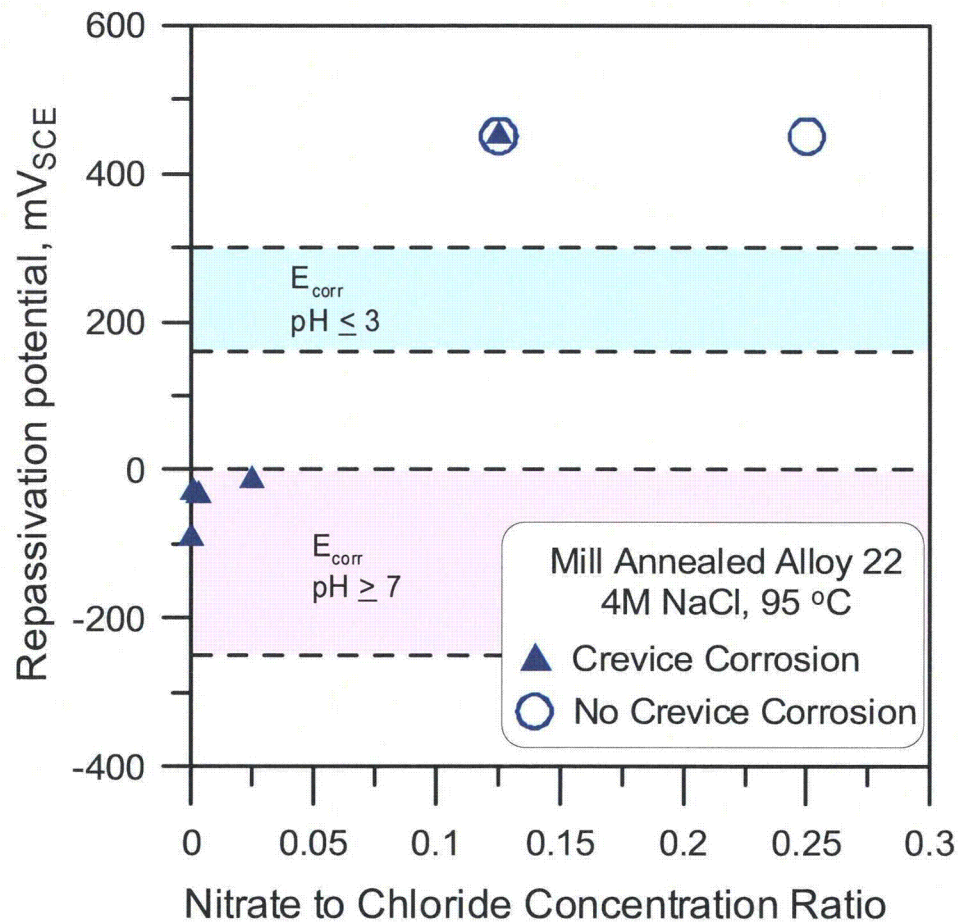
Localized Corrosion Susceptibility

Mill Annealed Alloy 22



- Crevice corrosion repassivation potential used as a critical potential for the long-term initiation of localized corrosion
- Alloy 22 in the mill annealed condition is quite resistant to localized corrosion in chloride solutions
- Increased resistance with respect to other Ni-Cr-Mo alloys is due to the high Mo (and W) content of Alloy 22

Localized Corrosion Susceptibility Mill Annealed Alloy 22



- Inhibition of localized corrosion observed when nitrate-to-chloride concentration ratio exceeds 0.12
- Critical nitrate to chloride ratio likely dependent on chloride concentration and temperature

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Table I. Composition of Alloy 22 (in weight percent)												
Material	Ni*	Cr	Mo	W	Fe	Co	Si	Mn	V	P	S	C
Alloy 22 Heat 2277-8-3175 12.7-mm	57.8	21.40	13.60	3.00	3.80	0.09	0.030	0.12	0.15	0.008	0.002	0.004
Alloy 22 Heat 059902LL2 38.1-mm	Bal	20.35	13.85	2.63	2.85	0.01	0.05	0.16	0.17	0.007	0.0002	0.005
Alloy 22 Heat 2277-3-3266 12.7-mm	Bal	21.40	13.30	2.81	3.75	1.19	0.03	0.23	0.14	0.008	0.004	0.005

*Ni—nickel, Cr—chromium, Mo—molybdenum, W—tungsten, Fe—iron, Co—cobalt, Si—silicon, Mn—manganese, V—vanadium, P—phosphorus, S—sulfur, C—carbon

Table II. Coefficients for the Localized Corrosion Regression Equations for Mill-Annealed and Thermally Altered Alloy 22							
Metallurgical Condition	A ₁ (mV _{SCE})	A ₂ (mV/°C)	B ₁ (mV)	B ₂ (mV/°C)	r _n	r _s	r _c
Mill-annealed (as-received)	940	-9.4	-752	5.2	0.1	0.5	0.2
Thermally altered 5 minutes at 870 °C [1,598 °F] water quench	800	-10.0	-584.2	3.7	0.3	0.5	0.2

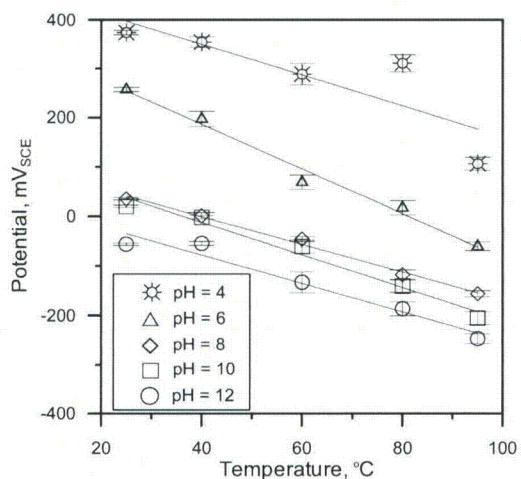


Figure 1. Corrosion potentials of Alloy 22 as a function of temperature. Potentials were measured in 4 M NaCl solution maintained at constant pH values.

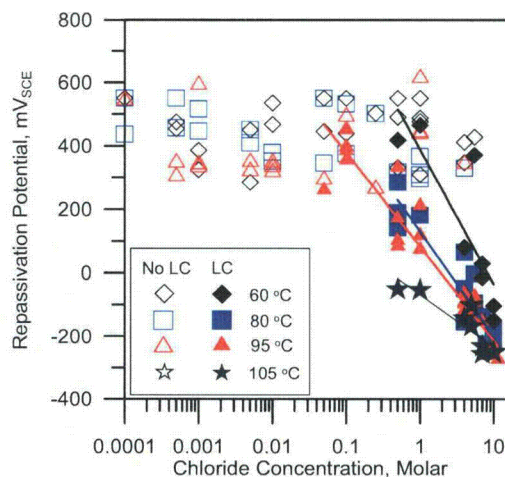


Figure 2. Crevice corrosion repassivation potentials for mill-annealed Alloy 22.

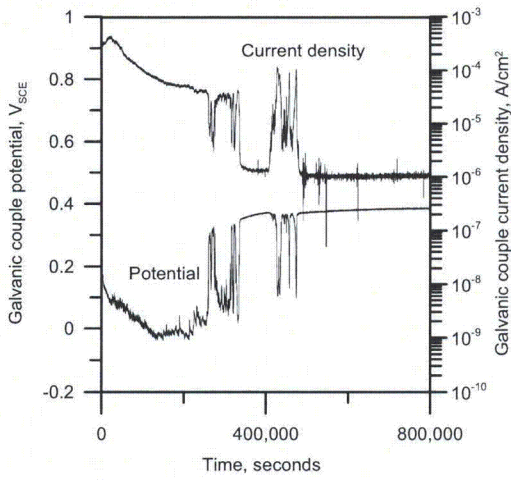


Figure 3. Current and potential transient for an Alloy 22 crevice corrosion test in 5 M NaCl with CuCl_2 at 95 °C [203 °F].

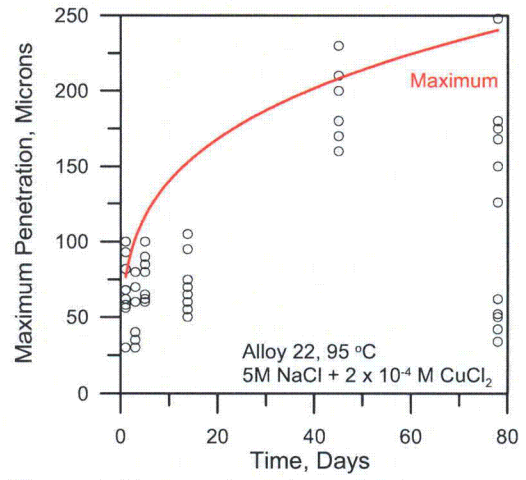


Figure 4. Measured crevice corrosion penetration depths for Alloy 22. Tests conducted at 95 °C [203 °F].