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

Properties Page

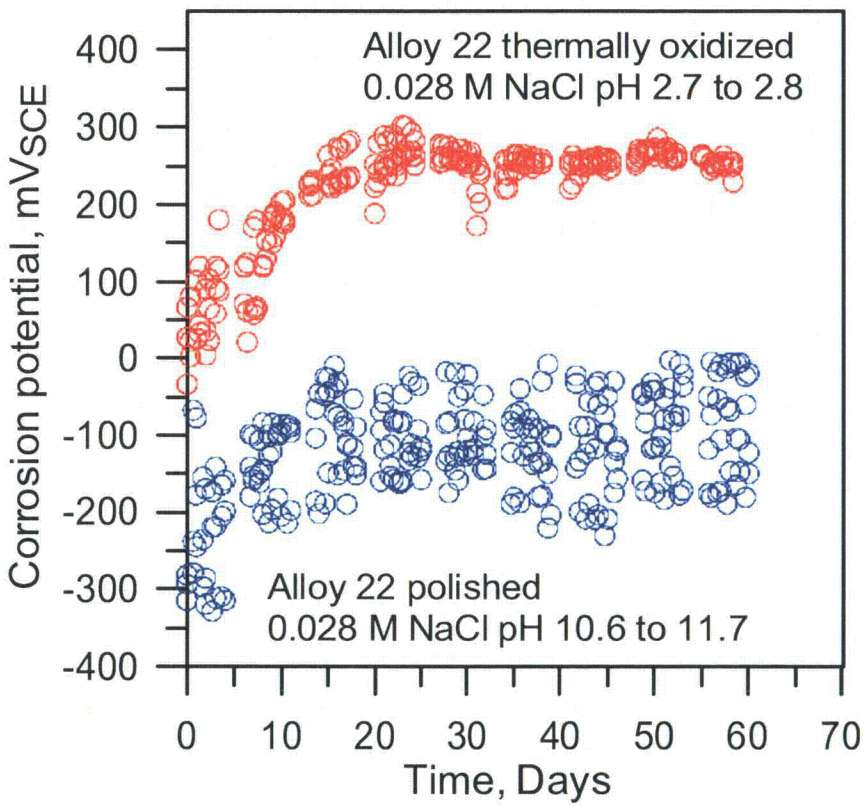
Return-path: <aac@nrc.gov>
Received: from mail.cnwra.swri.edu ([129.162.205.6])
 by rogain.cnwra.swri.edu (Sun ONE Messaging Server 6.0 (built Oct 29 2003))
 with ESMTP id <0IJB00H7FSHM7900@rogain.cnwra.swri.edu>; Fri,
 08 Jul 2005 15:20:10 -0500 (CDT)
Received: from igate2.nrc.gov (igate2.nrc.gov [148.184.176.32])
        by mail.cnwra.swri.edu (Switch-2.2.6/Switch-2.2.6) with SMTP id
j68KKMM27779;
 Fri, 08 Jul 2005 15:20:22 -0500 (CDT)
Received: from NRNWMS05.NRC.GOV (nrnwms05.nrc.gov [148.184.200.215])
 by smtp-gateway ESMTP id j68KHjg5021972; Fri, 08 Jul 2005 16:17:45 -0400 (EDT)
Received: from NRGWDO04-MTA by NRNWMS05.NRC.GOV with
Novell_GroupWise; Fri,
 08 Jul 2005 16:18:54 -0400
Date: Fri, 08 Jul 2005 16:18:29 -0400
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>
MIME-version: 1.0
X-Mailer: Novell GroupWise Internet Agent 6.0.4
Content-type: multipart/mixed; boundary="=_85A604BE.2B4A6BDE"

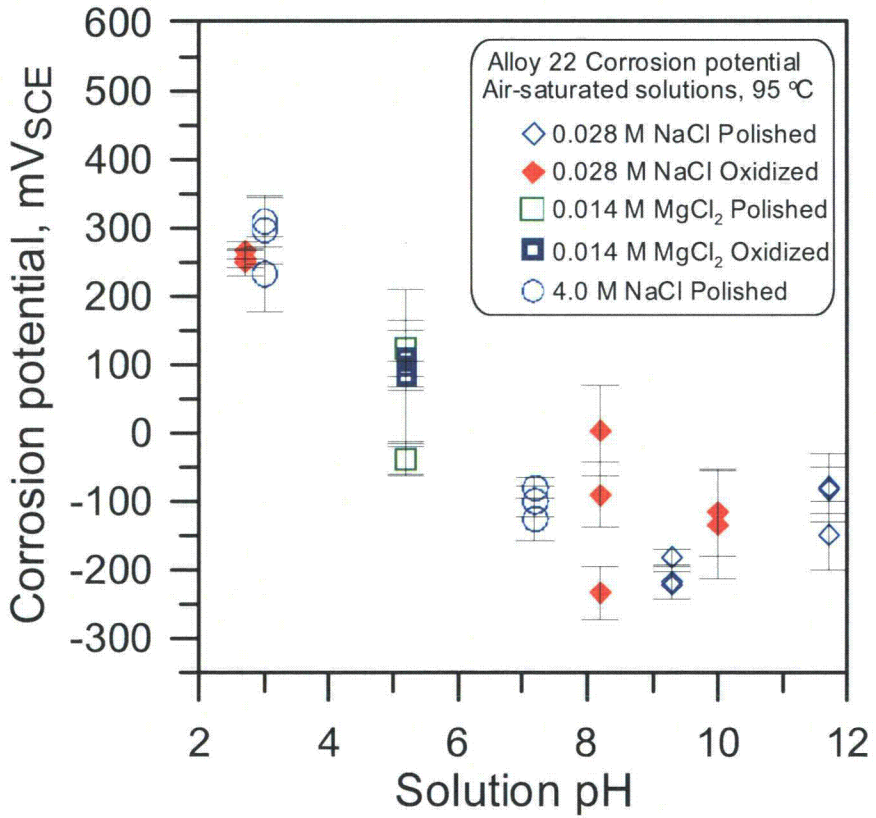
Localized Corrosion Experiments

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

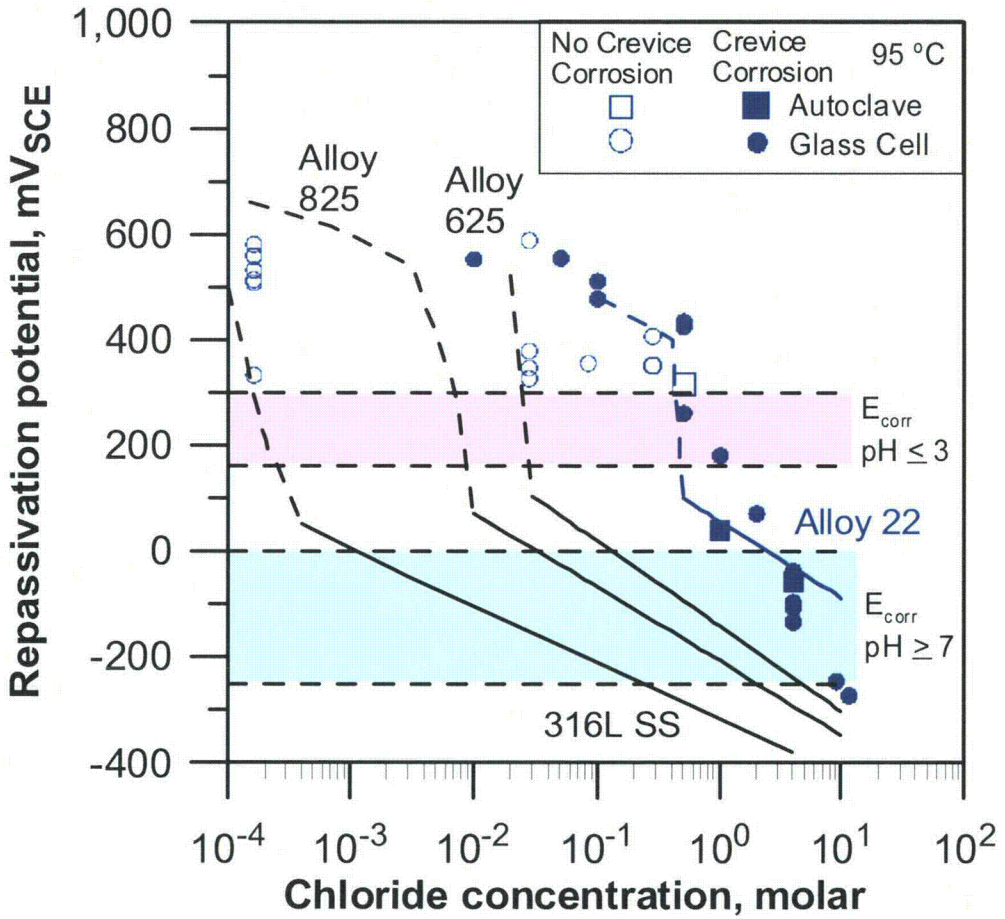
Corrosion Potential





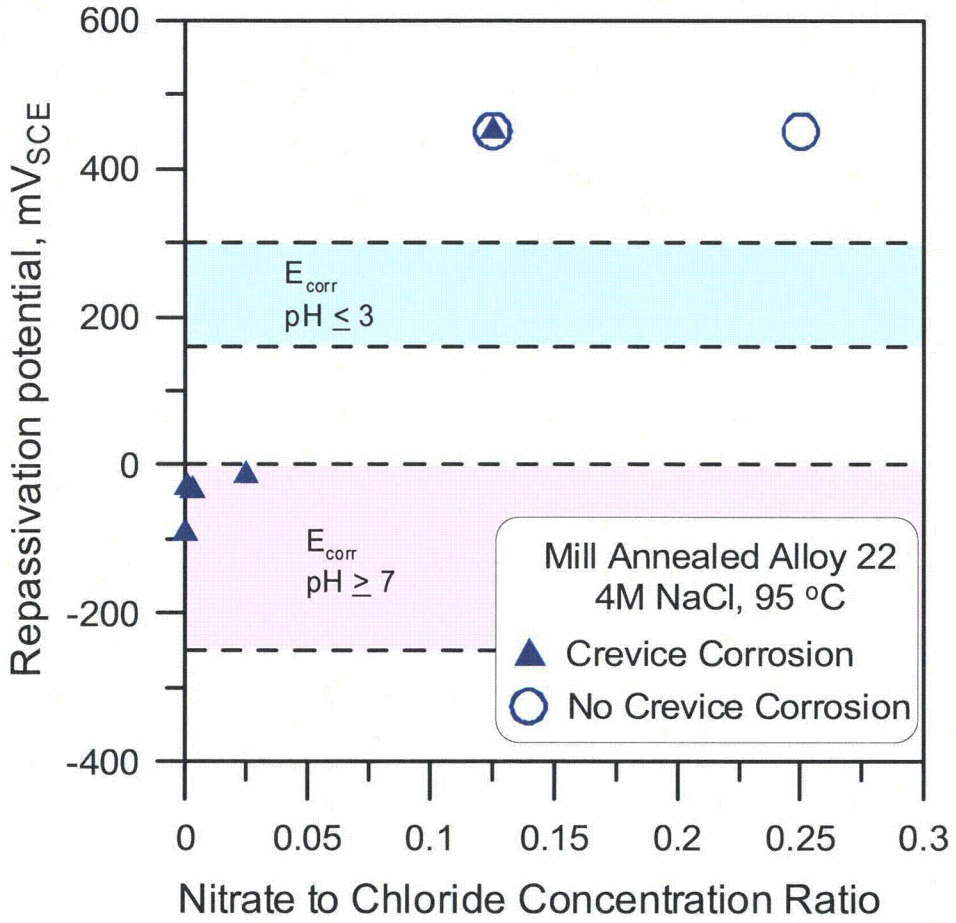
- Thermally oxidized specimens: 200 °C for 30 days

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

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

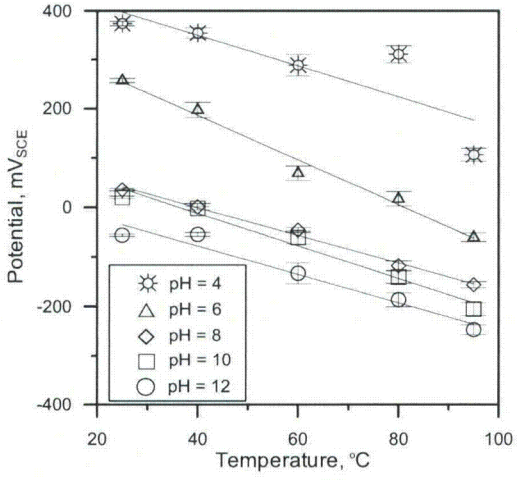


Figure 1. Corrosion potentials of Alloy 22 as a function of temperature. Potentials were measured in 4 M NaCl solution maintained at constant pH values.

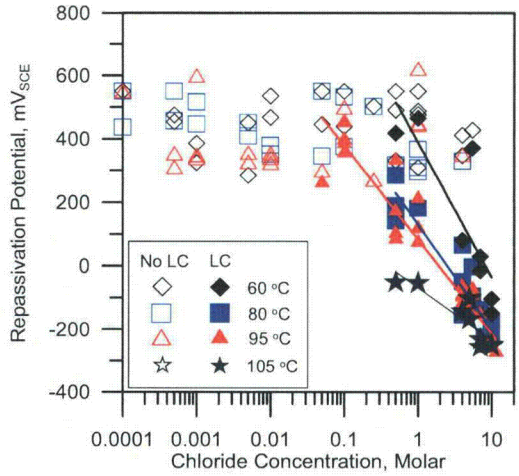


Figure 2. Crevice corrosion repassivation potentials for mill-annealed Alloy 22.

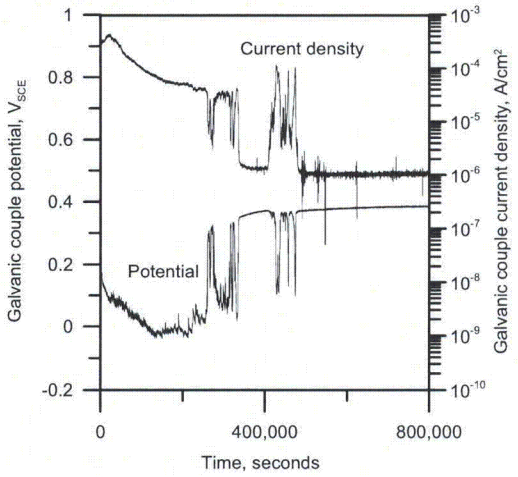


Figure 3. Current and potential transient for an Alloy 22 crevice corrosion test in 5 M NaCl with $CuCl_2$ at 95 °C [203 °F].

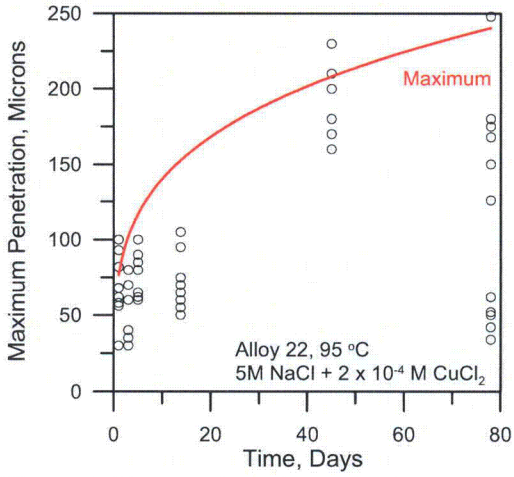


Figure 4. Measured crevice corrosion penetration depths for Alloy 22. Tests conducted at 95 °C [203 °F].