

REC-128/94 DCS

CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES

TRIP REPORT

SUBJECT: NACE Annual Corrosion Conference, CORROSION/94
(20-5704-041, 20-5704-004)

DATE/PLACE: February 27 March 4, 1994
Baltimore, MD

AUTHOR(S): N. Sridhar, G. Cragnolino, H. Manaktala, and D. Dunn

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PERSONS PRESENT: N. Sridhar, G. Cragolino, H. Manaktala, and D. Dunn (CNWRA)
M. McNeil (NRC)

The conference was attended by about 3,800 people, of whom a high percentage were involved in research and technical activities, while the rest were exhibitors.

BACKGROUND AND PURPOSE OF TRIP:

The authors presented three formal papers (N. Sridhar, H. Manaktala, and D. Dunn), chaired two symposia (G. Cragolino and H. Manaktala), and were vice-chairman of a committee on Corrosion of Materials in Nuclear Systems (H. Manaktala) and chairman of a committee on stress corrosion cracking (N. Sridhar). They also gave topical presentations in committees (G. Cragolino, N. Sridhar, H. Manaktala, and D. Dunn).

SUMMARY OF PERTINENT POINTS:

The presentations of formal papers by the authors garnered significant interest. There were two other presentations and a student poster related to the crevice chemistry area. The poster (by H. Hua, McMaster University) dealt with the coupling of cathodic and anodic areas in the growth of crevice corrosion which is an aspect deserving further attention in modeling crevice corrosion growth. The implications of the CNWRA approach to localized corrosion prediction through the use of repassivation and corrosion potentials generated significant interest both among participants from the nuclear and non-nuclear industries. Ian Munro (formerly of the Pulp and Paper Research Institute of Canada, PAPRICAN) stated that cathodic protection of stainless steel below the repassivation potential to avoid localized corrosion has been practiced successfully for years in the pulp and paper industry. He suggested that there is a rather large data base of the successful performance (over 10 years) of various stainless steel components under these conditions and that he could provide this information relatively easily.

There was a large contingent of participants from the Department of Energy (DOE) labs involved in waste tank storage issues (Hanford, Savannah River, and West Valley facilities). In addition to 30 presentations in four technical sessions in the Symposium on Corrosion of Materials in Nuclear Systems, chaired by H. Manaktala, a task-group Interim Storage of Radioactive Liquid Wastes (T-2A-2), was initiated. The task group will operate within the Unit Committee, Nuclear Systems (T-2A) for which H. Manaktala was appointed the Chairman for the term 1994-1996. There was also interest expressed by Phil Ohl (Westinghouse-Hanford) in organizing a DOE technology exchange on this topic to enable a better inter-

lab communication of on-going investigations. Currently, this is conceived to be held under the auspices of the local NACE section in Washington state. In addition to the labs, there was also a member of the waste tank over-sight committee (Michael Streicher) present in these meetings. In contrast to waste tank issues, there was no DOE representation of the high-level waste disposal program. H. Manaktala presented a paper titled, Nuclear Fuel Corrosion Over Millenia Interpreted Using Geological Data. The paper was co-authored by E. Percy of CNWRA. The paper was well received with a number of questions related to potential use of information from geologic sites other than Peña Blanca.

One of the authors (G. Cragolino) organized and chaired a session on Environmentally Assisted Cracking in the Corrosion Research in Progress Symposium. Six papers were presented covering mechanistic and experimental aspects of stress corrosion cracking. The attendance was about 60 to 80 people and most of the paper presentations were followed by active discussions. This session was followed by three sessions of the technical symposium on Environmental Cracking of Materials, also organized and chaired by Cragolino. A total of 23 papers were presented. Of particular interest for our program was the paper presented by M. Akashi from Japan. The relationship between the critical potential for stress corrosion cracking and the repassivation potential for crevice corrosion was discussed on the basis of experimental results for sensitized austenitic stainless steels. The remaining papers covered a wide range of applications in the nuclear power and the oil and gas industries among others, including consideration of hydrogen embrittlement, as well as novel developments in experimental techniques for monitoring crack growth. In general, the sessions were well attended (50 to 80 people) and most of the presentations were followed by a period of active discussion.

Jeff Fahey (Teledyne Wah Chang, Albany) presented two informal presentations on electrochemical noise measurements. The first presentation in the T-3L-13 committee focused on the necessary modifications to existing equipment to make electrochemical noise measurements. The second, presented in the T-3L-15 committee, was geared toward the analysis of data acquired as were other presentations in this committee. Electrochemical noise seems to be developing into a monitoring tool rather than an accelerated test method. As such, this technique may be useful for conducting long term tests.

In the research-in-progress symposium, Bernard Covino (U.S. Bureau of Mines, Albany Research Center) presented a paper on the sensitization of high-nitrogen stainless steels. The sensitization temperatures for these materials is significantly higher than that of high chromium containing stainless steels. The paper did provide a comparison of techniques to determine the degree of sensitization. Both single loop and double loop electrochemical potentiokinetic reactivation (EPR) tests are planned as test methods in long term stability tests of alloy 825. Results of a single loop EPR tests on alloy 800 were presented in the Corrosion in Nuclear Power Systems Symposia.

There was also interest in the internal research program conducted at CNWRA on Raman spectroscopy. In discussions with Tom Devine (U.C. Berkeley) and Carlos Melendres (Argonne National Labs), it was evident that the technology for Raman spectroscopy has evolved considerably in the past few years so that expensive triple monochromators which were considered essential for Raman spectroscopy have been replaced by relatively inexpensive filters. With the new technology available, it seems that establishing Raman capability has become even easier. The conference program guide can be made available by any of the authors upon request.

SUMMARY OF ACTIVITIES:

G. Cragnolino chaired a session on Environmentally Assisted Cracking in the Corrosion Research in Progress Symposium and also the technical symposium on Environmental Cracking of Materials. He presented a topical discussion in the T-3E committee entitled Stress Corrosion Cracking in the Nuclear Power Industry - an Overview.

H. Manaktala organized and chaired a symposium on Corrosion of Materials in Nuclear Systems. He also presented a formal paper titled Nuclear Fuel Corrosion over Millennia Interpreted Using Geological Data. The paper was co-authored by E. Percy of the CNWRA.

D. Dunn presented a formal paper entitled Effects of Surface Chromium Depletion on the Localized Corrosion of Alloy 825 as a High-Level Waste Container Material. He also presented a topical discussion in the T-3L-13 task group entitled Icon Based Data Acquisition Software for Corrosion Testing.

N. Sridhar presented a formal paper entitled Effect of Applied Potential on Changes in Solution Chemistry Inside Crevices on Type 304L Stainless Steel and Alloy 825. He also presented a topical discussion in the T-5A-28 task group on austenitic alloy properties entitled Life Prediction of High-Level Waste Container Materials. He chaired a meeting of T-3E committee on stress corrosion cracking.

IMPRESSION/CONCLUSIONS:

The emphasis of the technical papers, from DOE and its contractors, in the area of high-level waste was on the integrity of liquid HLW storage tanks. A newer area of interest in HLW, as exhibited by technical papers and discussions, is the storage problem associated with unreprocessed highly enriched spent fuel at the defense facilities. Some of this fuel, from weapons material production sites, are aluminum clad, while some are zircaloy/stainless steel clad fuel discharged from nuclear ships and submarines. Underwater storage is currently used for such fuels. However, longer term interests are to develop dry storage facilities for such fuel. Currently, there is no experience in dry storage of aluminum clad highly enriched fuels. Spent fuels from research reactors and high-flux isotope production reactors, such as HFIR at Oak Ridge, would also fall in this category of spent fuels. An increased number of papers on this subject are expected at the CORROSION conferences in the future.

The conference attendance (about 3,800) was lower than in the years past, possibly a reflection of the economy and the location. NACE board of directors wants to integrate the research activities (as reflected in the papers presented in the research-in-progress symposia by essentially the academia and some national labs) with the more applied activities to better reach the corrosion practitioners. This year's symposium on environmental cracking (chaired by G. Cragnolino), which combined papers from the research-in-progress symposium with the more applied papers, was considered to be successful. Future symposia along this line are planned. One such area is life prediction for which N. Sridhar was invited to be chairman during the Corrosion/95 research-in-progress symposium.

PROBLEMS ENCOUNTERED:

None

PENDING ACTIONS:

None

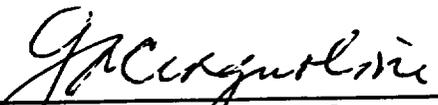
RECOMMENDATIONS:

None

REFERENCES:

None

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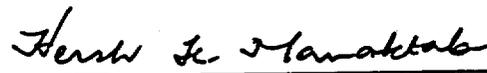
Gustavo Cragnolino
Principal Scientist

3/23/94
Date



Narasi Sridhar
Senior Research Engineer

3/23/94
Date



Hersh Manaktala
Senior Research Engineer

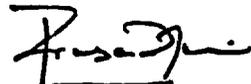
March 23, 1994
Date



Darrell Dunn
Engineer

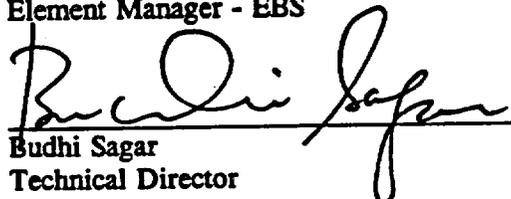
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Date

CONCURRENCE SIGNATURES AND DATE:



Prasad Nair
Element Manager - EBS

3/23/94
Date



Budhi Sagar
Technical Director

3/24/94
Date

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