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Analysis of Corrosion of Steel by Lead Bismuth Eutectic

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Management Issues

A new graduate student, Brian Hosterman, joined the research group at the end of August. He worked side-by-side with third year graduate student Dan Koury, and is doing well.

In addition, an undergraduate student, Denise Parsons, joined the group. She has experience working for Los Alamos at the Yucca Mountain Project, and previously for the Nevada Test Site. She was very helpful in analysis of data from the XPS. She was particularly helpful in preparation of the presentation at the winter meeting of the ANS in Reno (November 2001).

UNLV chemistry professor Allen Johnson joined the group, and is essential, especially in the XPS.

We have continued our fruitful collaboration with Dr. Ning Li of Los Alamos.

Technical Issues

We examined stainless samples that were exposed to LBE in experiments conducted by the Russians, under contract to Los Alamos. We examined both corroded and uncorroded samples using the Scanning Electron Microscope (SEM), the Energy Dispersive X-Ray (EDAX) Spectroscopy, and the X-ray Photoelectron Spectrometer (XPS). We found that the surface of the corroded sample is covered by oxygen-containing compounds, presumably mostly iron oxide. In samples exposed for shorter times or lower temperatures, we found that some areas were coved by an oxide layer, and some areas was uncovered. We found that the level of Cr in the uncovered area is much higher than the level of Cr in the covered area. Oxygen is present in the spectra of both covered and uncovered areas.
Using EDAX, we examined samples that had been exposed to LBE, and samples that had not been exposed. We found that oxygen was present with a strong signal in samples exposed to LBE, and absent from samples that were not exposed.

We surprised to find Zn present, in both the EDAX data and in the XPS data.

We found carbon peaks using XPS. The carbon 1s peak of the uncorroded sample was much less oxidized than the corroded sample. Further investigation (using sputter depth profiling) will reveal whether the carbon was generated during the LBE exposure or during subsequent handling. Oxygen and other elements showed a shift to higher binding energy in the samples exposed to LBE, compared to those not exposed.

Our findings were presented at the Winter 2001 meeting of the American Nuclear Society in Reno on November 11-15, 2001. Graduate student Dan Koury gave the presentation. The conference paper, after incorporating changes by the peer reviewers, was submitted to the Journal Nuclear Materials, and was accepted (to be published in 2002).