

8-15-2001

## Analysis of Corrosion of Steel by Lead Bismuth Eutectic

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Farley, J., Perry, D. L. (2001). Analysis of Corrosion of Steel by Lead Bismuth Eutectic. 1-4.

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## Analysis of Corrosion of Steel by Lead Bismuth Eutectic

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The goal is to achieve a basic understanding of the corrosion of stainless steel by Lead Bismuth Eutectic (LBE), which has been proposed for use in the transmuter as both a coolant and as a sputtering target.

## Management Issues

Since this was the first quarter of funding, the first task was to assemble the team. Physics graduate student Dan Koury was hired. A second physics graduate student, Brian Hosterman, arrived on campus just at the very end of the quarter. We spoke with an undergraduate chemistry student, Denise Parsons, who wants to join the research group, for a few hours a week, because of her full schedule. We are seeking another undergraduate student as well. UNLV chemistry professor Allen Johnson became a collaborating scientist. Prof. Johnson is a welcome addition because he brings a great deal of relevant expertise to the team, particularly on the new XPS facility, which Johnson is helping to install (the XPS is discussed below).

We are collaborating well with DOE laboratory scientists. Dr. Ning Li, head of the LBE effort at Los Alamos, visited UNLV on May 16 and August 6<sup>th</sup>, and we had productive meetings with him.

In addition, we attended a AAA seminar on fuel development on June 21, and a meeting on Separation Science with Drs. George Vandegrift and James Laidler on July 2<sup>nd</sup>.

A major management issue was getting a signed subcontract with LBNL for Dale Perry. That was a big problem. It was not solved during the quarter. However, it was solved shortly afterwards: about Aug 21. One issue was overhead. LBNL received the full overhead for Dale Perry's time. For the first year only, and as a special case, this additional expense was met by rebudgetting funds from the UNLV infrastructure account. It is unclear what will happen in the 2<sup>nd</sup> and 3<sup>rd</sup> year of the project. This is one area where we could use some help.

## Technical issues

Dr. Li provided samples of steel that has been exposed to LBE and which have been analyzed by the Russians.

Graduate student Dan Koury became familiar with the instruments that are used to analyze samples: the Scanning Electron Microscope (SEM) and X-ray Photoelectron Spectrometer (XPS). Prof. Allen Johnson was a great help on the XPS. We took the first data using the SEM and XPS, examining the samples that had been previously analyzed by the Russians.

Koury examined corroded and uncorroded samples of steel, and found important differences, particularly with regard to oxygen and chromium. He made a June 29 presentation to a delegation from DOE headquarters, including Bill Magwood.

Our first task is to verify the Russian sample analysis.

We plan to do experiments taking advantage of synchrotron radiation at the Advanced Light Source (ALS). In late May and early June, John Farley travelled to the ALS to become familiar with facilities there, and met with Dale Perry.

Overall things are going well

Plans for the next quarter (Aug 15-Nov 15).

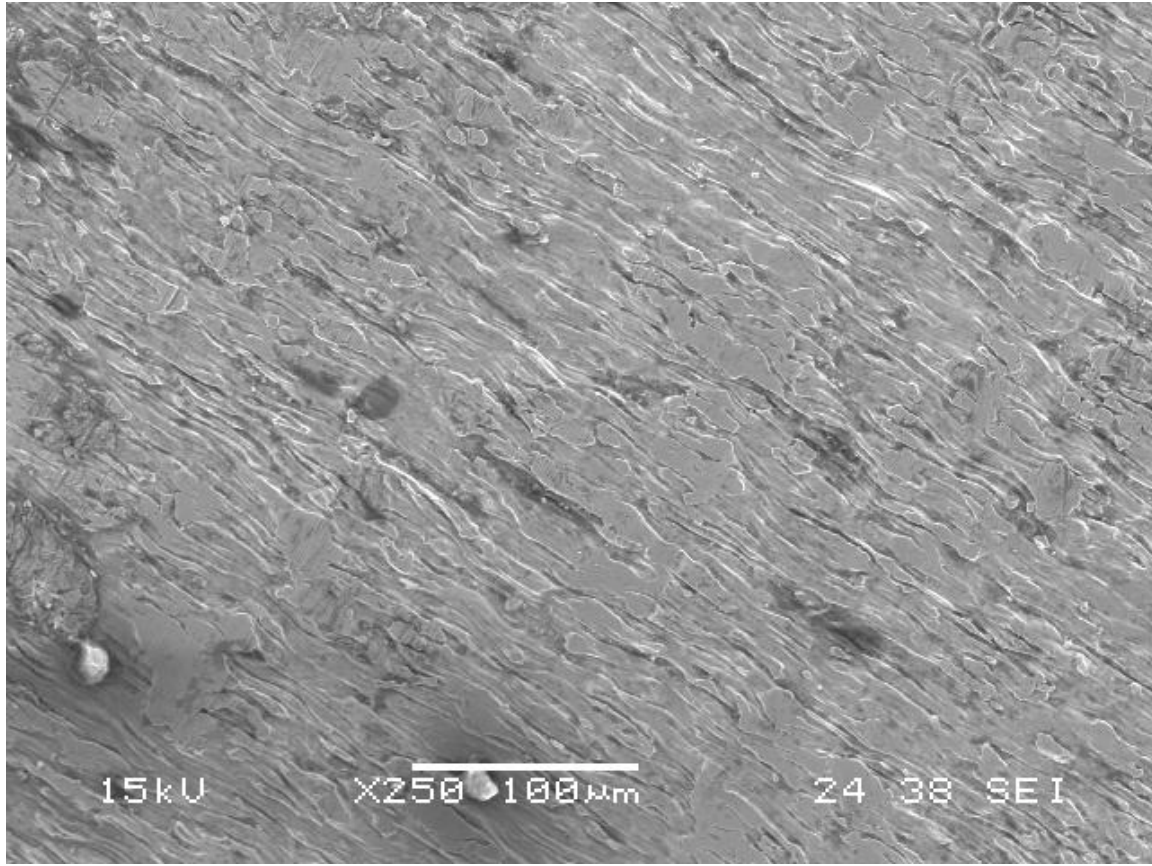
Management issues: we expect to have newly arrived graduate student Brian Hosterman fully integrated into the project. In addition, we will seek additional undergraduate student help.

Spending: the major item is the LBNL overhead issue mentioned above in connection with the LBNL subcontract. That was solved for the first year, but remains unsolved for years 2 and 3.

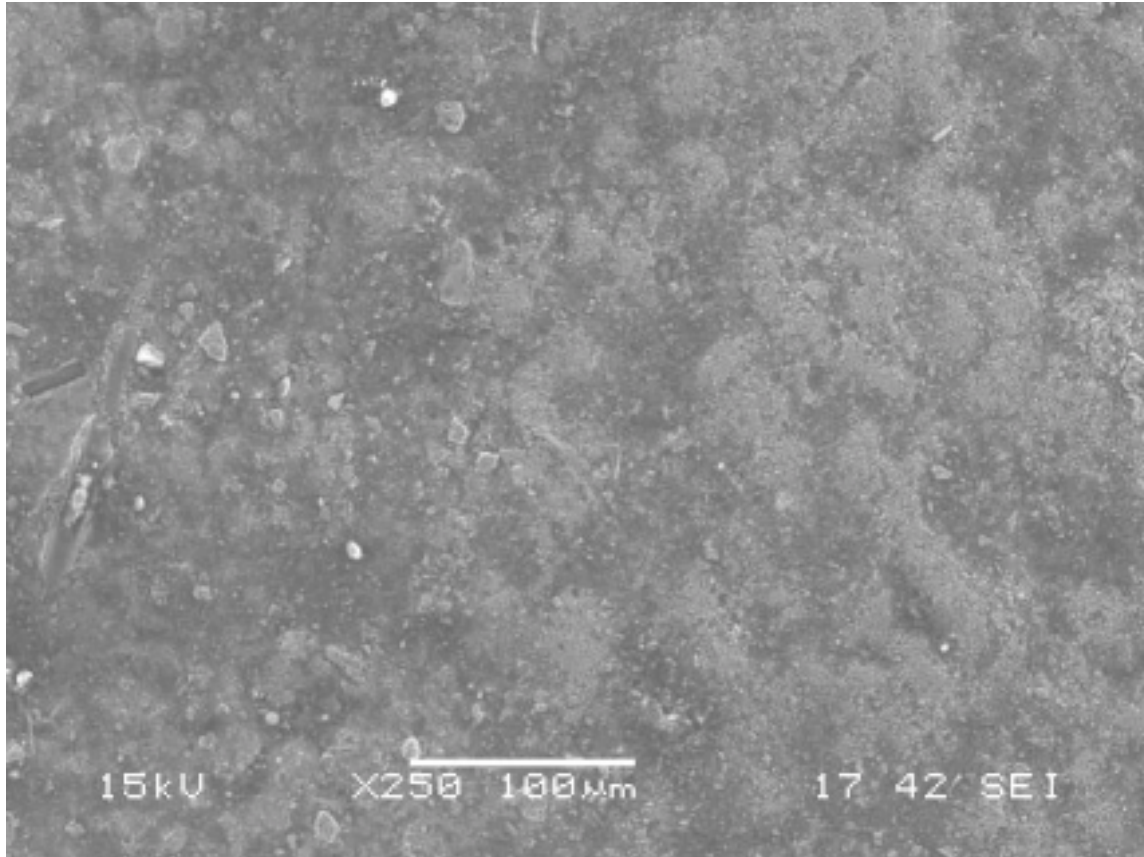
We are under budget on the graduate students, since the two will have TAs, hence are funded in part by the State of Nevada. We are over budget on time on the Scanning Electron Microscope, which is a recharge center. Funds for the SEM were not included in the original budget. Overall, we are about on budget so far. Undoubtedly there are some items that were forgotten.

Technical issues: we plan to submit a manuscript for the winter 2001 meeting of the ANS in Reno (Nov 11-15), and to attend the conference. This will be the first publication (refereed conference proceeding) from this project, and the proceedings will be published in Nuclear Materials about Feb. 2002.

Now that we have the first data from the steel, we need to start finding the chemical species present in the corrosion process. Studies of the steel using ablation of the surface will help.



This is a SEM image of the surface of 316 steel before exposure to LBE.



In contrast, this is an SEM image of 316 steel that is corroded from being exposed to LBE.