

Neutron Irradiation of Structural Materials in Molten Chloride Salt

Stephen S. Raiman, N. Dianne Bull Ezell, Kurt Smith, Richard T. Mayes, Joel McDuffee

Oak Ridge National Laboratory, Oak Ridge, Tennessee, USA

Molten chloride salts possess many attractive properties for use as a coolant and storage medium in advanced nuclear reactors. For most common structural alloys in molten halides, selective leeching of chromium into the salt is the dominant form of material degradation. Limited data exists on the contribution of neutron irradiation to alloy degradation in molten salts, especially in chloride salts for fast reactor applications.

For this work, stainless steel and Alloy-N coupons were sealed in static capsules containing NaCl-MgCl₂. Two different salt were used: a highly pure chloride salt, and a more aggressive salt with added moisture. The capsules were irradiated at 800°C for 21 hours in the Ohio State University Research Reactor, with a thermal flux of 1.1×10^{12} n/cm²·s. After irradiation, samples were removed from the salt, and characterized with SEM and EDS to determine the extent of corrosive attack. These samples were compared to unirradiated specimens exposed to the same conditions to isolate the effects of irradiation on corrosion.

This talk will report on a new experiment for studying the effect of neutron irradiation on corrosion in molten chloride salts. The design of the experiment will be discussed, along with recent results and future plans

This work was funded by the U.S. Department of Energy, Office of Nuclear Energy, Molten Salt Reactor Campaign

This manuscript has been authored by UT-Battelle, LLC under Contract No. DE-AC05-00OR22725 with the U.S. Department of Energy. The United States Government retains and the publisher, by accepting the article for publication, acknowledges that the United States Government retains a non-exclusive, paid-up, irrevocable, world-wide license to publish or reproduce the published form of this manuscript, or allow others to do so, for United States Government purposes. The Department of Energy will provide public access to these results of federally sponsored research in accordance with the DOE Public Access Plan (<http://energy.gov/downloads/doe-public-access-plan>).