Introduction

An Integrated Research Project titled Nuclear Science, Technology, and Education for Molten Salt Reactors (NuSTEM) funded by the Department of Energy Consolidated Innovative Nuclear Research started in October 2017, as a collaboration among Texas A&M University, University of California Berkeley, and the University of Wisconsin – Madison. The NuSTEM Project involves five technical mission areas (TM) and one educational mission area (EM):

- Modeling and simulation
- Develop test models for physical phenomena specific to MSRs
- Quantitative order-parameter optimization
dynamics, performance and design optimization
- Thermal-hydraulics
- Code of computational CFD models
- Development of passive heat removal using test plans
- Cross-section measurement
- Analysis of CRNS (U.S.) cross-section measurement in the fast spectrum range
- Optical and Chemical analysis
- Development and demonstration of chemical and thermal sensors
- Optical fiber light sensors
- Manufacturing methods and materials for neoplatinization of探

Objective:

- Determine if FLiNaK prepared from high purity (99% minimum) constituents is appropriate for the use in corrosion studies
- Study the effects of electrical contact on dissimilar metal corrosion in the same salt

Preliminary Results

- FLiNaK salt and sample setup
- Microstructure contains large M2C precipitates
- Composition in wt%: 34% Ni, 55% Mo, and 5% Cr
- Excluding precipitates, elements appear to be evenly distributed

Future Work

- High quality salt cannot be produced without purification
- Increase in lattice parameter, showing no visible indications of degradation near surface
- M2C peaks grow more visible

Experimental Approach

- Hastelloy-N developed for use in MSRs during the MSRE program
- TM 1 Investigation
- Effects of UF4 addition
- Effects of pre-irradiation

<table>
<thead>
<tr>
<th>Experiment Matrix</th>
<th>Nominal Composition of Hastelloy-N</th>
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<tbody>
<tr>
<td>Non-DU bearing salt</td>
<td>DU bearing salt (~1 at.%)</td>
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<tr>
<td>Hastelloy-N, non-irradiated</td>
<td>Hastelloy-N/Neutron Flux 700°C Corrosion test in FLiNaK for 1000, 2000, and 3000 hrs</td>
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<tr>
<td>Characterize Cr depletion as a function of exposure time under well controlled conditions</td>
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<td>FLiNaK samples</td>
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<td>Low volatility and previously studied electrochemically</td>
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<tr>
<td>KK’ reference potential is well studied</td>
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<tr>
<td>Constituents are readily available</td>
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<tr>
<td>Studied Extensively for use in MSR</td>
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- CRNS alloy shows radiation-induced segregation (RIS) of Cr away from grain boundaries

- Pre-irradiation of four samples simultaneously
- Proton pre-irradiation to induce Cr depletion at grain boundaries
- 1 day at 500°C
- Above 500°C thermal diffusion prevents RIS