NE-22-28244 Investigation of the Structural Integrity and Corrosion Resistance of Surface Treatment on Alloy-709 in a Molten Fluoride Salt Environment

The business objective of Terrestrial Energy USA (TEUSA) is to develop, license, construct, commission, and demonstrate the commercial operation of the Integral Molten Salt Reactor (IMSR®) nuclear power plant in the United States within 10 years. TEUSA is located in Charlotte, NC.

While Stainless Steel 316H (SS-316H) is the structural material of choice for use in the IMSR® Core-unit, structural materials with higher temperature creep strength are being sought as an alternative to support higher temperature operation during off normal conditions. Alloy-709 (A709) is currently being code qualified by the DOE Advanced Reactor Technologies (ART) program for inclusion in the ASME Boiler and Pressure Vessel Code, Section III, Division 5 for high temperature reactors. However, A709 is not optimal for molten salt corrosion resistance, but surface treatments may improve the performance. This project seeks to perform baseline studies on surface treated A709 for corrosion resistance and mechanical properties to understand long-term corrosion protection when subject to periods of sustained and cyclic loading at high temperatures and its potential use in the IMSR®.

Idaho National Laboratory (INL) is part of the ART team that is developing data to support the A709 ASME Code Case. Extensive creep-fatigue testing and microstructural characterization of A709 have been performed at INL and TEUSA intends to leverage this knowledge to conduct the testing needed.