U.S. DEPARTMENT OF ENERGY | Office of NUCLEAR ENERGY

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Nuclear Energy Advanced Modeling & Simulation

CINR Annual Planning Webinar - August 2021

Nuclear Energy University Programs (NEUP)
Consolidated Innovative Nuclear Research (CINR)
Office of Nuclear Energy
U.S. Department of Energy

Acceptable levels of Impurities/Fission Products in Molten Salts

Background: During operation of a Molten Salt Reactor (MSR) impurities and the grow-in of fission products collected in the molten salt coolant affect the thermophysical properties of the salt, corrosion kinetics of structural materials, and ultimately reactor operations.

Goal: Proposal is sought to develop impurity limits/guidelines in halide salts based on experimental and computational methods

Focusing to fill gaps:

Gaps: Guideline values and recommendations for the allowable concentrations for impurities (e.g. oxygen, fission products, actinides, etc. - and including evolution of) to ensure sound MSR operation, with a focus on heat transfer, containment corrosion and burnup simulations.

Fundamental Corrosion Mechanism of Austenitic Stainless Steel, Ferritic/Martensitic Stainless Steel and Nickel-based Alloys

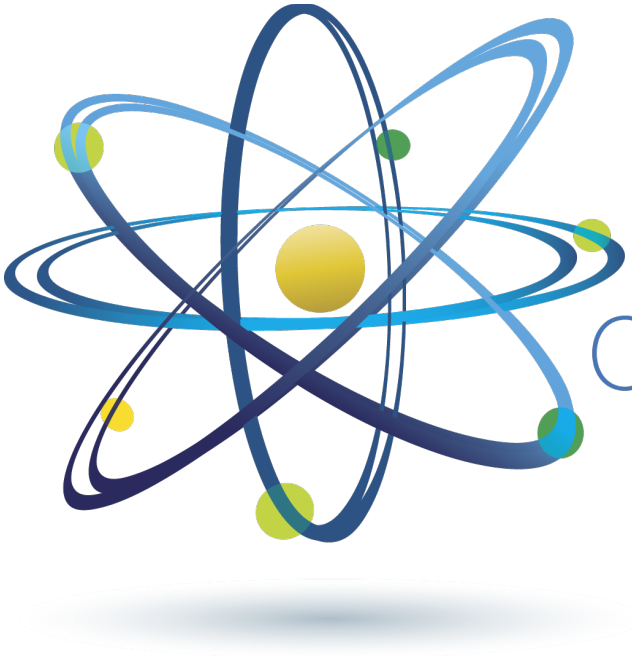
Background: Corrosion of stainless steel and nickel-based alloys in contact with halide salt melts is derived by the leaching of chromium from the alloy matrix and the formation of stable chromium fluoride or chromium chlorides at the salt-containment interface. Corrosion rates of stainless steel and nickel-based alloys could be, as a simplified approach, derived by chromium-self diffusion from the alloy matrices to the surface and the ultimate formation of stable chromium halides.

Goal: Modelling of chromium diffusion (matrix and grain-boundary), and subsequently modelling corrosion of austenitic stainless steels (e.g., Alloy 316H and Alloy 709), ferritic/martensitic stainless steel (e.g., HT9, T91) and nickel-based alloys (e.g., Hastelloy N and Haynes 244).

Focusing to fill gaps:

Gaps: Fundamental theoretical and experimental basis for enhancing the current knowledge on corrosion of austenitic stainless steels (fcc) vs. ferritic/martensitic stainless steel (bcc), vs. the more expensive nickel-based alloys in contact with halide salt melts at temperatures related to MSR operation.

Questions?



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