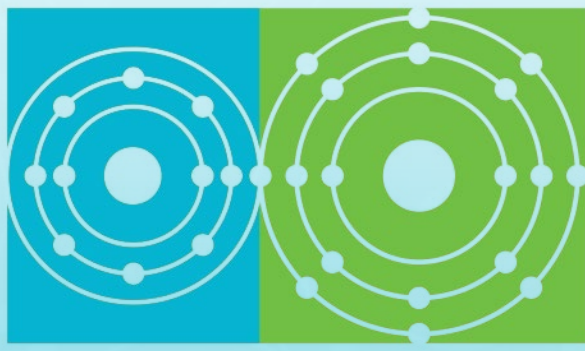




Molten Salt Reactor
P R O G R A M

Materials Session

DOE - Office of Nuclear Energy supports seven national laboratories to efficiently and effectively addressing, in partnership with other stakeholders, the technology challenges for MSR to enter the commercial market.



SALT and FUEL SALT CHEMISTRY

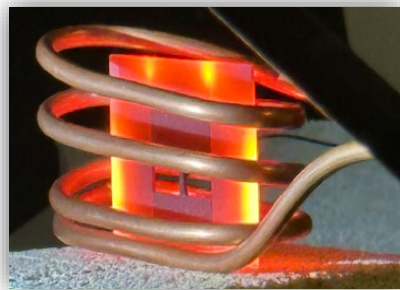
Thermophysical and Thermochemical Properties of Molten Salts –
Experimental and Computational
Salt purification and synthesis
UF3, UF4, UCl3, PuCl3, AmCl3
Databases
ASTM Standard Method Development

MODELING & SIMULATION FOR MSR SAFETY

NEAMS Tools & MELCOR used for
Species Tracking
MSR Safety
Accident Scenario
Mechanistic Source Term....

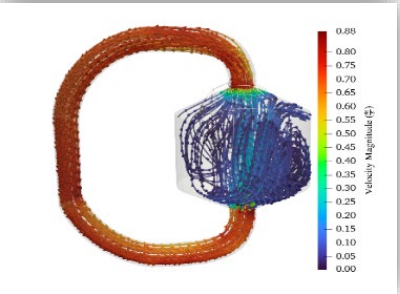
MATERIALS

Development of materials surveillance technology
Graphite/Salt Interaction
Corrosion studies (SS316H, Alloy 709, Alloy 625, Haynes 244) in F and Cl salts
Under AMMT and GCR programs



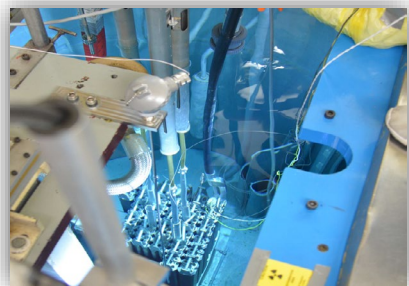
TECHNOLOGY DEVELOPMENT

Off-Gas Integrated System
Salt Chemistry Monitoring Tools
Radionuclide Release Monitoring
MSR Gas and Particles Transport Phenomena



SALT IRRADIATION

Fuel salt irradiation and post irradiation examination capabilities
NRAD, ATR, HFIR
Under AFC



ENGINEERING SCALE FACILITY

LSTL- FLiNaK loop - ORNL
FASTR –NaCl/ MgCl2/ KCl loop-ORNL
MSTTE – Molten Salt Tritium Transport Experiment - INL
SAAF- Salt Accident Analysis Facility - ANL
ASL – Actinide Salt Loop - ANL
CIESF – Chlorine Enrichment & Separation Facility - PNNL

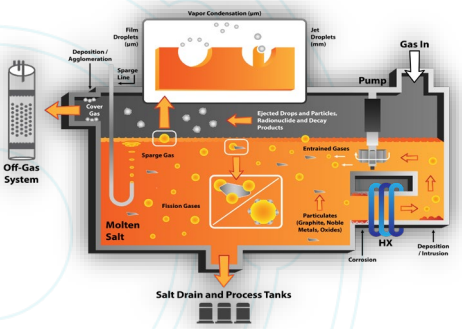
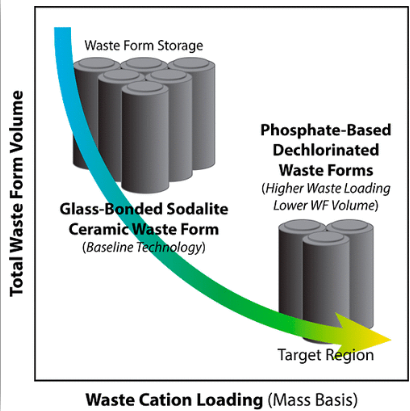


MSR RADIOISOTOPES

Developing new Technologies to separate Radioisotopes of Interest to the MSR Community.

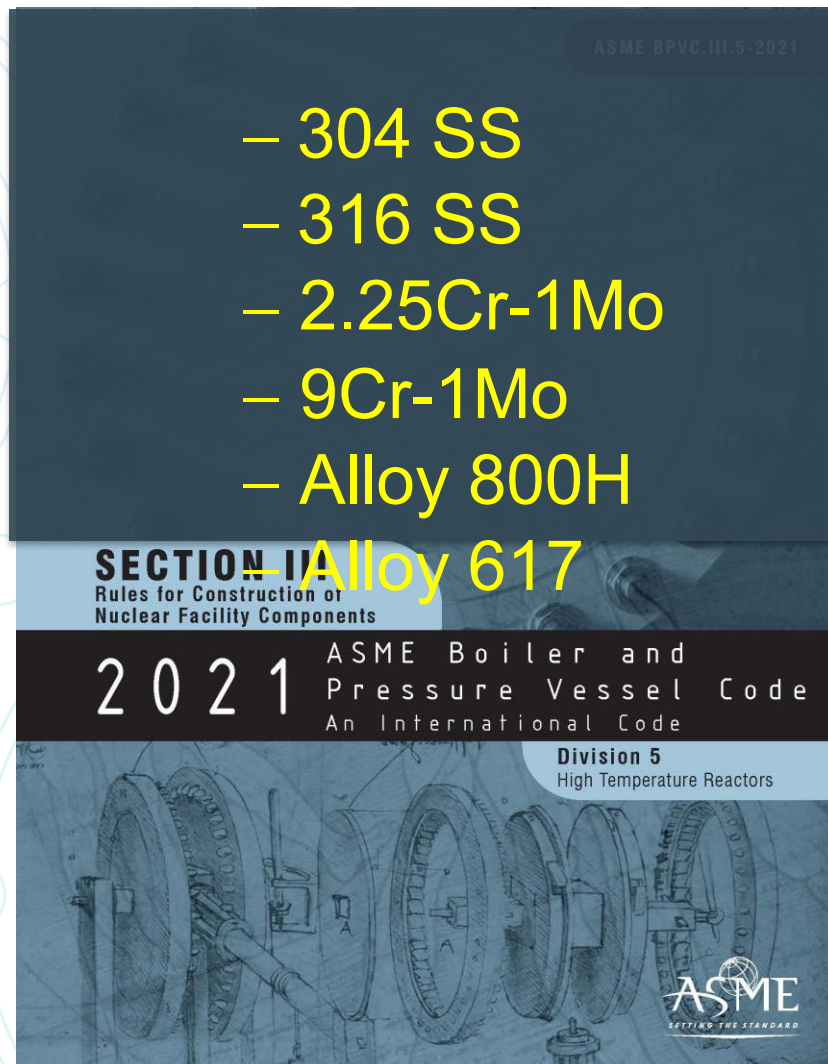
WASTE FORM DEVELOPMENT

Off-gas waste-form development (Iodine)
Dehalogenation process for chloride and fluoride salt waste treatment
Under MRFWD Program

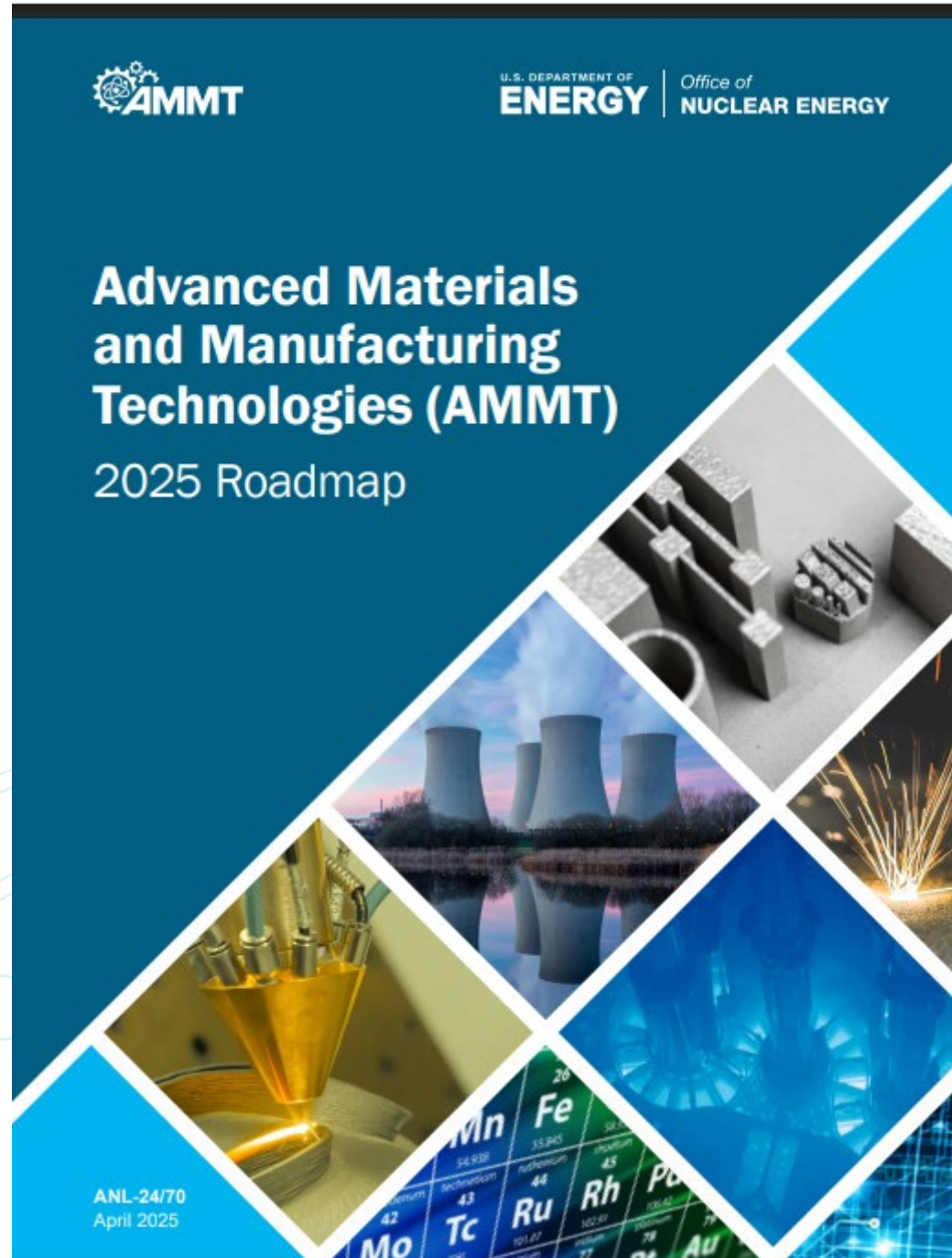


The Challenge: Qualification of High-temperature Materials

Only **six materials** have been approved for nuclear construction at elevated temperatures in the ASME Code.



- “Alloy 617 was added to the code in the fall of 2019 and is the first high-temperature material cleared for commercial use since the 1990s.”
- “**Getting a new material into the code is a lengthy process** and requires significant amounts of data. The national labs spent years testing the material properties of Alloy 617 in order to qualify the metal for commercial use.”
- **Current qualification approach relies on extensive testing and empirical modeling and limits the number of qualified materials.**



Meimei Li et al, 2025

“Structural and functional materials are foundational to Molten Salt Reactor (MSR) performance.

While adequate material solutions exist for first generation designs, significantly improved plant characteristics would be enabled by maturing innovative material technologies”

David Holcomb “Overview of Potential Impact and Development Issues for MSR Materials



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of ENERGY**
Office of Nuclear Energy