

Flibe Energy  
partnered with  
Argonne National Laboratory

NE-23-29866, Thermal Property Measurements for an LEU-Fueled Molten Salt Reactor

**YEAR AWARDED:** 2023

**TOTAL PROJECT VALUE:** \$406,000 (DOE: \$324,800, Flibe: \$81,200)

**STATUS:** Completed

**PRINCIPAL LAB INVESTIGATORS:** Melissa Rose (ANL), Kurt Harris (Flibe)

**DESCRIPTION:** Flibe Energy, Inc. (FEI) is a company based in Huntsville, Alabama, whose stated mission is to supply the world with energy that is safe, reliable, efficient, and sustainable. A molten salt reactor (MSR) fueled by low-enriched uranium (LEU) requires a carrier salt with a low-melting point at high concentrations of actinide fluorides. This project sought to model and experimentally confirm the composition of two known salt systems, LiF-NaF-UF<sub>4</sub> and LiF-NaF-ThF<sub>4</sub>, as fuel and shielding salts for FEI's Lithium Fluoride Low-Enrichment Uranium Reactor (LFLEUR). FEI partnered with Argonne National Laboratory (ANL) to model, synthesize, and characterize the thermophysical property measurements under a strict quality assurance program. This allows FEI to utilize the salt properties in existing modeling tools to support further technology development.

**BENEFIT:** LFLEUR takes high-potential MSR technology and combines it with a readily available fuel supply. This provides an important step in accelerating the deployment of MSRs domestically and around the world.

**IMPACT:** Lithium fluoride reactors like LFLEUR couple well with sCO<sub>2</sub> power conversion systems and open the door to dry cooling. This would decoupling reactor siting from available water sources, allowing owners to site anywhere and further enabling adoption of this carbon-free energy solution.

**SIGNIFICANT CONCLUSIONS:** Argonne performed thermodynamic modeling to predict eutectic compositions in the LiF-NaF-UF<sub>4</sub> and LiF-NaF-ThF<sub>4</sub> systems. Three compositions each of LiF-NaF-UF<sub>4</sub> and LiF-NaF-ThF<sub>4</sub> molten salts were produced and the thermal properties between 400 and 600 °C were measured. One composition from each salt system was selected for measurements of heat capacity and thermal diffusivity across temperature ranges suggested by Flibe Energy's experts as beneficial to industry.

**NEXT STEPS:** Initial property measurements were very promising, but additional property measurements (e.g., density and viscosity) are required.