

ThorCon USA
partnered with
Argonne National Laboratory

NE-18-16098, Quantify Sodium Fluoride/Beryllium Fluoride Salt Properties for Liquid Fueled Fluoride Molten Salt Reactors

YEAR AWARDED: 2018

TOTAL PROJECT VALUE: \$500k (DOE Funds Awarded: \$400k; Awardee Cost Share: \$100k)

STATUS: Completed

PRINCIPAL LAB INVESTIGATORS: Melissa Rose (marose@anl.gov), Mark Williamson (williamson@anl.gov)

DESCRIPTION: ThorCon is developing a thermal neutron spectrum thorium/uranium molten salt-fueled reactor based on the Molten Salt Reactor Experiment at Oak Ridge National Laboratory in the 1960s. Meeting near term deployment goals requires avoiding new technology wherever possible. The ThorCon reactor is not a breeder, but requires regular additions of fissile material in the form of uranium fluoride. Onsite fuel-salt chemistry control is accomplished by the addition of makeup fuel salt to achieve the desired neutronics and the addition of beryllium metal to maintain redox control. Knowledge of the fuel-salt properties is required to enable detailed design of the ThorCon system. Supported by a GAIN voucher, this investigation was intended to benefit all thermal liquid-fueled MSR companies should lithium-7 not become available in volume at an economical price. Argonne National Laboratory's capability to conduct tests with beryllium and plutonium, and measure these fluoride salt properties were capabilities not available in the private sector. To positively impact the design of an efficient heat transfer system, thermodynamic and thermal conductivity data were required to assess thermal properties of the system under normal and transient conditions.

BENEFIT: A technical report containing methods, calibrations, error analysis and results for all of the tasks completed in this work scope was prepared and made available to ThorCon. With these data, ThorCon assessed and refined the design of the reactor heat exchangers and pumps used to circulate the liquid fuel salt throughout the system.

IMPACT: Argonne measured thermophysical property data for molten salt compositions characteristic of those proposed for use in the ThorCon molten salt reactor. The measured property data support reactor design activities and safety case development.

NEXT STEPS: ThorCon reports much of the design phase has been completed, computationally modelled, expressed in 2D drawings and 3D CAD models, and shared with potential suppliers. The company plans to build a pre-fission test facility (PTF) at full scale. The fuel salt will not contain enriched uranium and will not sustain a chain reaction to generate power. The components will be brought up to operating temperatures using electric heating. The absence of radioactivity allows intrusive instrumentation, direct observation, and internal access to components.