Transatomic Power Corp.
partnered with
Argonne National Laboratory

RFA-17-14583, Fuel Salt Characterization

YEARS AWARDED: 2017

TOTAL PROJECT VALUE: $500K (DOE funds awarded, $400K; Awardee cost share, $100K)

STATUS: Completed

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DESCRIPTION: Under this Gateway for Accelerated Innovation in Nuclear voucher, Argonne National Laboratory (ANL) partnered with Transatomic Power (TAP) of Cambridge, Massachusetts, a company designing a molten-salt reactor capable of using low-enriched fresh uranium fuel from the existing supply chain and featuring a nonreactive coolant, passive shutdown ability, low pressure piping, and negative reactivity coefficient. The purpose of this voucher was to confirm the design and safety basis of TAP's system by determining the thermophysical properties of the fuel salt proposed for use in the system. ANL researchers prepared and characterized a sufficient quantity of TAP fuel salt to allow the characterization of the thermophysical properties including heat capacity, viscosity, and density over temperatures ranging from 550–700°C. Heat capacity measurements for TAP fuel salt were completed over 600–700°C. Prior to conducting the heat capacity measurements, TAP fuel salt was prepared by mixing and heating high purity components and analyzing the fuel salt by spectroscopic and wet chemical methods to determine its composition and impurity level. Differential scanning calorimetry was used to determine the heat capacity of the TAP fuel salt over the desired temperature range. The viscosity of the TAP fuel salt was measured over 550–700°C using a rotating spindle viscometer designed for high-temperature operation. The TAP salt samples prepared as part of the heat capacity measurement task were used for the viscosity measurements. Finally, the density of TAP fuel salt was measured via the Archimedes method at several temperatures in the range of 550–700°C. Salts prepared during the heat capacity task were used for density measurements.

BENEFIT: ANL measured thermophysical property data for molten-salt compositions characteristic of those proposed for use in the TAP molten-salt reactor. The measured property data supported reactor design activities and safety case development.

IMPACT: Although TAP ceased business in 2018, this project contributed to the body of molten-salt technology research. TAP agreed to open-source its intellectual property, and GAIN now hosts its legacy data, allowing other molten-salt reactor companies to exercise the design and lessons learned from the analyses.