Thermophysical Property Measurements of NaCl-UCI3

Final CRADA Report

Chemical and Fuel Cycle Technologies Division
Themophysical Property Measurements of NaCl-UCI3

Final CRADA Report

prepared by
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Participants: TerraPower, LLC

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CRADA Number: CRADA-A21011
CRADA Title: Thermophysical Property Measurements of NaCl-UCl3
CRADA Start Date 12/21/2020 – End Date 1/31/2022

DOE Program or Other Government Support
Program office: Department of Energy, Office of Nuclear Energy, Gateway for Accelerated Innovation in Nuclear
Program manager name: Dr. John H. Jackson
Program manager phone or email: john.jackson@inl.gov

Participant(s)
Participant 1 name: Dr. Perry Motsegood, TerraPower, LLC
Complete address: 15800 Northup Way, Bellevue, WA 98008

Participant 2 name: Hilary Fitzgerald, TerraPower, LLC
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Participant 3 name: James Vollmer, TerraPower, LLC
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Argonne National Laboratory
Argonne PI(s): M.A. Rose

Funding Table
To add rows, right-click in bottom row and select “Insert” “rows above”.

<table>
<thead>
<tr>
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<th>Planned Funding</th>
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Nature of Work
Describe the research (summary of Scope of Work and principal objectives of the CRADA):
Argonne produced and measured thermochemical and thermophysical properties of eutectic NaCl-UCl3 salt at several temperatures in the range of interest. (Note measurements made with UCl3 instead of PuCl3 at participant’s request.)

DOE mission area(s):
Energy and Environmental Science and Technology
Choose an item.
Choose an item.
Conclusions drawn from this CRADA; include any major accomplishments:
Argonne generated eutectic NaCl-UCl₃ for use in property measurements. The eutectic was confirmed by the presence of a single melting transition peak in replicate differential scanning calorimetry analyses giving consistent onset temperature of 791 K in agreement with values in literature. Measurements were made following procedures developed at Argonne and using calibrated instruments and devices to generate quality data and data analysis methods to derive reliable property values. Replicate measurements of the density, heat capacity, thermal diffusivity, and viscosity of molten salt and replicate measurements of the density, heat capacity, and thermal diffusivity of solid salt were made at several temperatures to quantify the precision of each measurement and determine temperature dependencies. Additional calculations were performed to determine the surface tension, thermal expansion coefficient, and thermal conductivity of the molten salt.

Technology Transfer-Intellectual Property
Argonne National Laboratory background IP:
none

Participant(s) background IP:
none

Identify any new Subject Inventions as a result of this CRADA:
none

Summary of technology transfer benefits to industry and, if applicable, path forward/anticipated next steps towards commercialization:
Argonne measured thermophysical and thermochemical property values for a salt composition proposed for use in the TerraPower molten chloride salt reactor. The measured property values support reactor design activities and safety case development.

Other information/results (papers, inventions, software, etc.):
none