Quantify Sodium Fluoride / Beryllium Fluoride Salt Properties for a Liquid Fueled Fluoride Molten Salt Reactor

Final CRADA Report

Chemical and Fuel Cycle Technologies

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prepared by
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Participants: ThorCon US, Inc.

February 2, 2021

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Non Proprietary Final CRADA Report

For the Office of Scientific and Technical Information (OSTI)

CRADA Number: C2018-18168

CRADA Title: Quantify Sodium Fluoride / Beryllium Fluoride Salt Properties for a Liquid Fueled Fluoride Molten Salt Reactor

CRADA Start Date 4/16/2019 – **End Date** 12/23/2020

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: Mr. Lars Jorgensen

Complete address: ThorCon US, Inc., 142 Lyons Road, Stevenson, WA 98648

Participant 2 name: Click or tap here to enter text.

Complete address: Click or tap here to enter text.

Participant 3 name: Click or tap here to enter text.

Complete address: Click or tap here to enter text.

Argonne National Laboratory

Argonne PI(s): M.A. Rose, E. Wu, T. Lichtenstein, J. Krueger, S. Thomas and M.A. Williamson

Funding Table

To add rows, right-click in bottom row and select "Insert" "rows above".

	Planned Funding	Actual Funding	In-Kind
Government	400,000.00\$	400,000.00\$	
ThorCon US, Inc.	\$	\$	100,000.00\$
Enter Participant 2 here	\$	\$	\$
Enter Participant 3 here	\$	\$	\$
Total	400,000.00\$	400,000.00\$	100,000.00\$

Nature of Work

Describe the research (summary of Scope of Work and principal objectives of the CRADA):

ThorCon is developing a thermal thorium - uranium fueled molten salt reactor that uses a fuel salt consisting of NaF - BeF₂ - ThF₄ - UF₄ - UF₃, which uses 19.75% enriched uranium. It is not a breeder reactor but requires regular additions of fissile material. A thorough understanding of the thermophysical properties of the fuel salt at the beginning (BOL) and end (EOL) of its life is critical to establishing its thermal hydraulic behavior and enables ThorCon to design a system with the required natural convection. Experimentally determining the heat capacity and thermal conductivity of the fuel salt will provide data necessary for detailed system design and safety analysis.

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:

Thermophysical properties of beginning of life (BOL) and end of life (EOL) fuel salt compositions were measured to support the design of the ThorCon Power molten salt reactor. Initial measurements were made for a small range of optional BOL salt compositions to determine a preferred BOL composition to be used for property measurements. The EOL salt was prepared at Argonne as part of a related project. The properties measured included phase transition temperatures, heat capacity, density, and thermal diffusivity at temperatures up to approximately 700 °C. Measurements were also made with eutectic LiF-NaF-KF (FLiNaK) salt to confirm the proper operation of instruments based on comparisons with values in the literature. This work provided results for all property measurements and calculations including those of thermal conductivity and the volumetric thermal expansion coefficient of the liquid phase.

Technology Transfer-Intellectual Property**Argonne National Laboratory background IP:**

N/A

Participant(s) background IP:

N/A

Identify any new Subject Inventions as a result of this CRADA:

N/A

Summary of technology transfer benefits to industry and, if applicable, path forward/anticipated next steps towards commercialization:

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.

Other information/results (papers, inventions, software, etc.):

N/A

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Chemical and Fuel Cycle Technologies Division

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