THE UNIVERSITY OF ARIZONA

Arizona State University

MateriAlZ Seminar Series

The New Molten Salt Nuclear Reactors and Their Thermochemical Modeling and Simulation

Friday, November 18, 2022, 10:50 am MST

Abstract

The Aircraft Nuclear Propulsion program started in the late 1940s looked to address the problem of U.S. military aircraft not being able to carry enough fuel to reach their targets in the Soviet Union and then return home. A solution that was explored involved powering a plane with a compact nuclear reactor fueled by a molten salt containing uranium, such that the fuel and coolant are one and the same. While that effort was ultimately abandoned, it spawned the idea for similar reactors that would generate electricity; and led to the Oak Ridge Molten Salt Reactor Experiment (MSRE) of the 1960s and early 1970s. The success of the MSRE has decades later resulted in a revival of the concept in myriad worldwide endeavors. Driven by the rapidly growing domestic commercial interest in MSRs, a Department of Energy program was created to support the nascent industry with both experimental and computational R&D. This includes an effort at the University of South Carolina to create and maintain a thermochemical database for relevant salt systems: the Molten Salt Thermal Properties Database-Thermochemical (MSTDB-TC). That includes generating new thermodynamic assessments or reassessments for salt systems to obtain accurate and consistent Gibbs energy functions and models for MSTDB-TC. This seminar will cover development of MSTDB-TC content, including methodologies for assessing salt systems that include complex melt structures. It will also demonstrate use of MSTDB-TC in generating realistic multi-component phase equilibria for MSRs, in computing vapor pressures to support accident analysis, and in evaluating corrosion potential between the salts and structural alloys. The design and use of MSTDB-TC will be covered and information provided as to how individuals can access MSTDB-TC for their own work.

Prof. Ted Besmann

University of South Carolina

Dr. Ted Besmann is Professor and General Atomics SmartState Chair for Transformational Nuclear Technologies at the University of South Carolina. He has a B.E. in chemical engineering from New York University and a M.S. from Iowa State University and PhD from Penn State University, both in nuclear engineering. He joined the USC in 2014 following his years as a Group Leader at Oak Ridge National Laboratory where he also held a joint appointment as Professor of Nuclear Engineering at the University of Tennessee. Besmann's research has focused on the high temperature chemistry of energy materials, including fundamental property measurements and thermochemical modeling, and on incorporating thermochemical analysis into the development of new nuclear fuel and other materials. He is the Deputy Director of the DOE *Center for Hierarchical Waste Form Materials*, which focuses on fundamental studies and novel waste form design for holding difficult-to-sequester radionuclides. Besmann was recently appointed to a Joint Faculty Position at Oak Ridge National Laboratory to assist in managing the DOE Nuclear Energy Advanced Modeling and Simulation program on molten salt reactor structural materials and chemistry. He is a Fellow of both the American Ceramic Society and the American Nuclear Society.

Zoom link: https://arizona.zoom.us/j/82212452898: Passcode: 305760

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