Webinar Invite

GEN IV International Forum
Expertise | Collaboration | Excellence

Education and Training Working Group

Join us on April 17, 2024, 8:30 a.m. EST (UTC-4)

Multiphysics Depletion & Chemical Analyses of Molten Salt Reactors

Molten Salt Reactors (MSRs) are an innovative Generation-IV reactor concept which use nuclear fuel dissolved in a high temperature liquid salt and allow for enhanced safety and economic performance. The liquid fuel feature also entails several multiphysics effects that can complicate reactor design. One primary effect, coined here as depletion-driven thermochemistry, is the changing chemical redox potential of the fuel salt due to chemical composition changes driven by depletion. As the fuel is consumed and fission products are formed, the redox potential of the fuel salt shifts toward a more oxidizing state. Without active control, the changing chemistry can have multiple effects on the multiphysics behavior of the reactor that are important for both steady state operation and for accident scenario transients.

A new multiphysics framework capability developed at Idaho National Laboratory can now simulate these coupled processes occurring in MSR systems during depletion including neutron transport, nuclide generation, thermal hydraulics, thermochemical equilibrium, chemical species transport, corrosion, and active chemistry control. The application of this work includes modeling source term, decay heat removal, reactivity transients, corrosion, chemistry control, and safeguards analyses. Future work focuses on validation efforts by defining a thermochemical benchmark against the Molten Salt Reactor Experiment (MSRE) and future digital twins of near-term experiments.

Free webcast!

April 17, 2024
8:30 am EST (UTC-4)

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Who should attend:
policymakers, managers, regulators, students, general public

Dr. Samuel Walker is an R&D Staff Scientist in the Advanced Reactor Technology & Design Department of Idaho National Laboratory (INL). He earned his Ph.D. in Nuclear Engineering from Rensselaer Polytechnic Institute in 2021 where he worked developing mass transfer modeling approaches for insoluble fission product transport in Molten Salt Reactor (MSR) systems. His graduate work was funded by a Department of Energy Nuclear Energy University Program (DOE NEUP) Fellowship that he was awarded in 2017. His current work at INL focuses on coupling Nuclear Energy Advanced Modeling and Simulation (NEAMS) tools for multi-scale and multi-physics analysis of advanced reactors with a heavy focus on MSR multiphysics. His expertise lies in modeling chemical species transport phenomena in molten salts used in fission and fusion systems. Applications of his work include source term and safety analyses, multiphysics core and system design, chemistry control system modeling, and novel MSR safeguard approaches.

Upcoming Webinars

22 May 2024, GIF/IAEA panel discussion on Regulatory Activities in support of SMRs and Advanced Reactor Systems

05 June 2024, Directed Energy Deposition Process of Corrosion Resistant Coating for Lead-Bismuth Eutectic Environment, Gidong Kim, UNIST, Korea

31July 2024, On-line Monitoring Development in Support of the Nuclear Fuel Cycle, Samantha Lines and Sam Bryan, PNNL, USA

For more information, please contact Patricia Paviet at patricia.paviet@pnnl.gov or visit the GIF website at www.gen-4.org