Abstract: The mission of the Office of Nuclear Energy (NE) of the Department of Energy is to advance nuclear power to meet the nation’s energy, environmental, and energy security needs. A variety of research and development activities in the advanced materials areas is being supported by NE to significantly improve the efficiency, safety, performance, and economics of advanced high temperature reactor systems. In addition to the operating temperature range, the selection of construction materials for an advanced reactor is critically dependent on the coolant system because of material compatibility and mass transfer issues, particularly for the lengthy design lifetime desired to reduce the annualized capital cost.

In this presentation, the multi-Laboratory efforts in the down-selection, further improvement, and fabrication scale-up of an advanced austenitic stainless steel for sodium-cooled fast reactor applications are reviewed. The requirements and challenges for the Code qualification of this material in support of the design, construction and licensing of a new advanced reactor are discussed.

Climate change is an extremely important issue and nuclear can be part of the energy mix in addressing CO2 emission. We encourage the best and the brightest graduates to join us to address these materials challenges.

Bio: Dr. Sham is a Senior Mechanical Engineer and Technology Director in the Nuclear Engineering Division at Argonne National Laboratory. His technical specialty is in deformation and failure of advanced materials and structural mechanics technologies for high temperature reactors. He is Technology Area Lead for the multi-Laboratory advanced materials R&D activities of the Office of Advanced Reactor Technologies, DOE-NE. The portfolio includes advanced alloys, graphite, and SiC/SiC composites for structural applications in high temperature thermal and fast reactors. In addition, he leads the DOE-NE international R&D efforts on advanced materials and code qualification for sodium-cooled fast reactor structural applications. He is Chair, Subgroup on Elevated Temperature Design, ASME Boiler and Pressure Vessel (BPV) Committee on Construction of Nuclear Facility Components (III), responsible for the development and maintenance of design rules for elevated temperature nuclear components.

Before he joined Argonne in 2015, Dr. Sham was a Distinguished R&D Staff Member at Oak Ridge National Laboratory, held senior positions with AREVA NP Inc. and Knolls Atomic Power Laboratory, and was tenured faculty at Rensselaer Polytechnic Institute. He holds M.S. and Ph.D. degrees (Mechanics of Solids and Structures) as well as an M.S. (Applied Mathematics) from Brown University.