

Materials Science & Engineering Graduate Seminar

Wednesday, March 4, 2020, 4:10-5:00PM, FASB 295

Lingfeng He

Advanced Characterization of Oxide Fuels

Abstract: Oxide nuclear fuels have been widely used in light water reactors. As the oxide fuels are burned, a large number of fission products are produced. The chemical and physical states of the fission products can influence the oxygen potential of the fuel (chemical reactivity with cladding materials) and fuel swelling, respectively. The release of gaseous fission products (xenon and krypton) can increase the pressure inside the fuel elements and contribute to the internal stresses on the cladding. In addition, phonon scattering by radiation induced point defects, extended defects such as dislocation loops and bubbles and grain boundaries plays a significant role in limiting the thermal transport properties of oxide fuels. Therefore, it is of significance to characterize the chemical and physical states of fission products and understand the effects of defects on phonon transport in irradiated oxide fuels. At Idaho National Laboratory (INL), the fine microstructure of fission products, including metal precipitates and fission gas bubbles, and the relationships between defects and thermal properties in irradiated oxide fuels have been recently characterized using atomic-resolution scanning transmission electron microscopy (STEM), scanning electron nanobeam diffraction (SEND), atom probe tomography (APT) and laser-based modulated thermoreflectance microscopy (MTRM) techniques. These results further the fundamental understanding of radiation damage and fission products in nuclear fuels.



Bio: Lingfeng He is a distinguished staff scientist and TEM group leader in Characterization and Advanced PIE Division at Idaho National Laboratory (INL). He is interested in materials behavior under extreme environments, with a focus on environmental degradation of materials in nuclear power systems. Dr. He received a Ph.D. degree in Materials Science at the Chinese Academy of Sciences in 2009. He worked as a Post-doctoral Research Associate and Assistant Scientist at Nagaoka University of Technology in Japan and the University of Wisconsin before joined INL in 2014. Dr. He services as the PI/Co-PI for 3 Laboratory Directed Research and Development (LDRD) projects, 1 International Nuclear Energy Research Initiative (I-NERI) project, 2 Energy Frontier Research Centers (EFRCs), 1 Basic Energy Sciences (BES) Core Program, 1 Nuclear Energy University Program (NEUP) project, and over 40 Nuclear Science User Facility (NSUF) projects. Dr. He has authored/co-authored 80 peer-reviewed journal publications, with an H-index of 24 (Web of Science) and held 5 patents.