Enabling advanced nuclear reactor technologies through materials design and engineering

Abstract: Materials constraints play a role in dictating the operating envelope, performance limits, and safety bases of virtually all technologies, and nuclear power is no exception. Next-generation nuclear reactors, such as sodium or molten salt cooled reactor concepts, are expected to necessitate new and innovative materials design in order to construct reliable systems that can produce power for 40+ year service lifetimes. Even existing commercial light water reactor designs can be improved via intelligent materials design and engineering, as demonstrated by the Fukushima-Daiichi nuclear accident. This lecture will discuss promising new material classes with the potential to improve the performance and accident-tolerance of existing LWR technologies in addition to the preeminent materials challenges facing the licensing and deployment of Generation IV reactor technologies. Case studies will be presented demonstrating how new materials are developed, and highlighting past and ongoing work at Oregon State University in support of understanding materials performance in advanced nuclear applications and environments.

Biography: Samuel Briggs is an Assistant Professor in the School of Nuclear Science and Engineering at Oregon State University. He obtained his Bachelor’s degree in Nuclear Engineering from Oregon State University, and a Master’s and Ph.D. in Nuclear Engineering & Engineering Physics from the University of Wisconsin-Madison. His expertise is in microstructural characterization and microscopy of radiation damage in materials, with an emphasis on studying damage structures and precipitation in metals using transmission electron microscopy (TEM), atom probe tomography (APT), and diffraction-based techniques. His research interests revolve around addressing materials challenges for next-generation nuclear reactor designs, including degradation in liquid metal and molten salt coolants and high-temperature, high-radiation environments. In his previous appointment, he served as a postdoctoral researcher under Dr. Khalid Hattar in the Ion Beam Laboratory (IBL) at Sandia National Laboratories where he used particle accelerators to emulate neutron damage in reactor environments in-situ using the In-situ Ion Irradiation TEM (I3TEM) facility.

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