A multiscale analysis of transport in nuclear material systems

Abstract: With the energy demands of the world increasing every year, nuclear power remains a reliable alternative energy source which has low carbon emissions and high power density. One of the critical factors involved in the development of next generation reactors is the design of durable corrosion-resistant, radiation-tolerant, thermally-stable alloys that can withstand the harsh environments of nuclear reactors. In this presentation, multiscale modeling techniques encompassing density functional theory, kinetic Monte Carlo and continuum simulations will be used to examine different transport processes that are critical to material operation in reactors. Four topics will be discussed in detail: the transport of tritium through structural alloys which is associated with deleterious effects, the transport of oxygen and the growth of an oxide surface layer protecting against corrosion, the transport of point defects generated through radiation and the transport and deposition of lanthanides and actinides from molten salt reactors in pyroprocessing technology. The important role of electromigration in defect transport, the behavior of tritium in FeCr alloys and binary alloys in general, the complex interactions of oxygen in FeCr systems and an oxide growth model will be discussed. Together, these results provide new insight into the properties of nuclear materials and their design for next generation applications.

Biography: Dr. Adib Samin received his Bachelor’s degree in chemistry from Wayne State University in 2008. After that, he attended the University of Toledo College of medicine for a little over a year before deciding to attend graduate school. He started attending The Ohio State University in 2010. There, he completed both a master’s degree in Chemical Physics and a PhD. in Mechanical Engineering in August 2014. Since then, he has worked as a postdoctoral researcher for three different groups at The Ohio State University. He is currently a Director’s Postdoctoral Fellow at the Los Alamos National Laboratory in New Mexico. His research interests include the multi-scale modeling and simulation of material thermodynamics, kinetics and electrochemical processes with applications focused in the area of nuclear energy. In his free time, Adib enjoys playing the piano.