

Nuclear Engineering Seminar

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Fuel-Cladding Chemical Interaction and Corrosion of Structural Materials in Nuclear Systems

Abstract

Increasing the chemical stability of nuclear fuels has the potential to enhance fuel reliability to high burnup. A notable fuel application issue that limits the lifetime and reliability utilizing U-Zr based fuels is fuel-cladding chemical interaction (FCCI), which is the chemical reactions between fission product lanthanides and Fe-based cladding forming brittle intermetallic compounds and eutectic liquids. One approach to mitigate FCCI is by doping the fuels with additives that can strongly bind with lanthanides and reduce their mobility and chemical reactivity. In this talk, I will describe experiments and simulations that address the FCCI problem. The approach involves a rapid computational screening of candidate minor dopants and characterization of fuel alloys with the minor dopants, followed by out-of-pile diffusion couple tests and irradiation with post-irradiation examination. Additionally, fundamental mechanisms for damage in nuclear systems, such as corrosion in used nuclear fuel dry storage canister and sodium fast reactor, will be presented and discussed.



Dr. Xie is a Research Scientist in the Advanced Fuels Manufacture and Development Department at INL. She joined INL as the first Glenn T. Seaborg Distinguished Postdoctoral Research Associate. Prior to joining INL, she earned the bachelor's degree at University of Science and Technology of China, the PhD degree at Ohio State University, and worked at Virginia Tech as a postdoc. Dr. Xie has a diverse background and attended numerous US Department of Energy and Nuclear Regulatory Commission sponsored research projects, which include nickel-alloy stress corrosion cracking, light water reactor containment corrosion, used nuclear fuel dry storage canister, metallic fuel additive, and fission products retention capability in sodium. She has authored 20+ publications in peer-reviewed journals, including 14 first-author and corresponding-author publications.