PURDUE UNIVERSITY | School of Nuclear Engineering

Nuclear Engineering Seminar

Dr. Michael Short

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3:30pm | PHYS 112

Solving Major Challenges for Advanced Reactors: Coupled Effects and Radiation Damage Measurement

Abstract

Advanced fission and fusion reactors are absolutely necessary to combat climate change in our lifetime. Their performance hinges upon the continued health of their materials, and because few have ever been constructed, few data exist which predict how structural materials will behave in these advanced reactors. In this talk, recent work will be presented regarding three major topics, which represent key findings and capabilities for advanced reactors. (1) The coupled effects of radiation and corrosion in molten salt and liquid lead, where we observe radiation decelerated corrosion in some cases, and (2) The direct measurement of radiation damage via Wigner energy, in which defect reactions reveal a sixth stage of radiation damage recovery previously unknown from resistivity measurements. (3) In situ monitoring of structural material health during irradiation to 100 DPA using picosecond ultrasonic spectroscopy, where changes in surface acoustic waves indicate the onset of radiation void swelling. These new findings and capabilities help us to derisk advanced reactor designs, making their safe operation more certain and predictable. We use similar techniques to perform nuclear forensics on enrichment equipment, helping to verify non-proliferation treaty (NPT) adherence and reducing the threat of unaccounted-for nuclear weapons.

Michael Short joined the faculty in the Department of Nuclear Science and Engineering in July, 2013. He brings 15 years of research experience in the field of nuclear materials, microstructural characterization, and alloy development. His group's research is a mixture of large-scale experiments, micro/nanoscale characterization, and multiphysics modeling & simulation. The main areas of Short's research focus on 1) Non-contact, non-destructive measurement of irradiated material properties using transient grating spectroscopy (TGS), 2) Preventing the deposition of deleterious phases, such as CRUD in nuclear reactors, as fouling deposits in energy systems, 3) Quantification of radiation damage by stored energy fingerprints, and 4) Rapid alloy development and down-selection for fusion reactor components.