Department of Engineering Physics
UNIVERSITY OF WISCONSIN–MADISON

INSTITUTE FOR NUCLEAR ENERGY SYSTEMS

Presents:

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Hastening Innovation in Materials for Energy

Abstract: Energy production and availability is the root driving force behind economic development and prosperity. The energy sector employs 5% of all Americans, with 7% of new job growth attributed directly to energy. Its sustainability and cleanliness drives our largest modern international agreements. It is also one of the largest sources of lost value when things don't go as planned. The reliable production of clean energy comes down to the structural materials used in carbon-free energy production systems. After all, things tend to be made out of materials, and when those materials fail, so do the systems in which they reside. Due to the intense energy flow, regulation, and risk aversion in large-scale, green power production systems, material improvements are difficult to ideate, and even harder to implement at scale.

In this talk, we will discuss the technical causes and solution to two of the biggest problems in geothermal and nuclear energy systems - fouling and radiation damage - which together contribute to the loss of over

0.25% of the GDP of most developed nations. First, a rare geothermal/nuclear utility partnership has resulted in a universal anti-fouling coating design principle, as the conditions found in geothermal wells and nuclear power plants are surprisingly similar. Matching the optical properties of a coating is the key to avoiding fouling in extreme conditions found in large-scale energy production systems. Second, a new type of non-destructive evaluation (NDE) promises to hasten the qualification of nuclear structural materials by a factor of 1,000. This has the potential to reduce the timescale of experiments from years to hours, as we will show in a first-of-a-kind experimental demonstration. Together these results show that rapid innovation is possible in energy systems, provided the problem as posed takes scientific and societal inputs on equal footing.

***Biography*:** 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. A core mission of Short's lab is moving into industry in a five-year timeframe, from ideation to implementation. Short's research focuses on: non-contact, non-destructive measurement of irradiated material properties using transient grating spectroscopy (TGS); preventing the deposition of deleterious phases, such as CRUD in nuclear reactors, as fouling deposits in energy systems; and quantification of radiation damage by stored energy fingerprints. This last project was recently selected for an NSF CAREER award.

Tuesday, 4/23/2019
12:00 PM, ERB 106