Presents:
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Using Fundamental Characterization Tools to Understand the Chemistry of Accident Tolerant Nuclear Fuels

Abstract: Out in the “real world,” systems are typically much less clean and much more complex than what is seen in the laboratory. This is often the case in the extreme environment of the core of a nuclear reactor. However, complexity often makes it very difficult to understand the dynamics that are occurring in the “real world” systems. Often our understanding can be greatly improved by using measurements on the “real world” system in combination with fundamental characterization on model systems. We have studied both model systems and reactor irradiated fuels to understand the behavior of accident tolerant nuclear fuels. Development of new accident tolerant nuclear fuels is important because the explosions at Fukushima were the direct result of interactions between water and the Zr cladding on the fuel. The high temperature chemistry of those interactions led to the production of hydrogen gas which eventually ignited. Our research group has looked at potential claddings such as ZrC, ZrN, and SiC. Specifically, we are using synchrotron radiation techniques to collect data on reactor irradiated materials. We compare the results of those measurements with well controlled laboratory grown systems. The data is then provided to modelers to evaluate the performance of reactor components in extreme environments (temperature, neutron flux, chemistry). This talk will focus on the carbides and nitrides that may be used in accident tolerant, TRISO fuel pellets for application in both conventional and advanced nuclear reactors.

Biography: Jeff Terry is a professor of physics at the Illinois Institute of Technology, where his main research focus is on energy systems. His group works to develop new ways to deal with radioactive waste; to understand radiation damage mechanisms in materials; and to synthesize novel materials for energy storage and conversion. He also simulates the economic costs of building new energy systems, including small modular nuclear reactors. Prior to joining the faculty at Illinois Tech, he was a staff scientist at Los Alamos National Laboratory. There, he worked on the Stockpile Stewardship and Management Program and the Waste Isolation Pilot Plant (WIPP), and was a member of the team that sent the first waste shipment to WIPP. He currently writes a regular column for the Bulletin of the Atomic Scientists. He is a former scientific director of the Advanced Test Reactor National Scientific User Facility. Terry received his doctorate in chemical physics from Stanford University in 1997 after obtaining a bachelor’s degree in chemistry from the University of Chicago in 1990.

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