

Nuclear Engineering Seminar

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3:30pm | PHYS 112

**From Numerical Methods (1980s) to Virtual Reality
(2020s)**

Abstract

The realization of advanced nuclear reactors requires the qualification of new fuel forms. The DOE Advanced Gas Reactor Fuel Qualification and Development (AGR) Program has undertaken an effort to qualify tristructural-isotropic (TRISO) coated particle fuel for high temperature gas reactors (HTGRs) absent a specific reactor design. The multidecade, applied program has re-established domestic coated particle fuel fabrication expertise and irradiation testing and post irradiation examination (PIE) capabilities. This overall effort has ultimately demonstrated excellent fuel performance, that is, retention of fission products over a broad range of irradiation conditions (temperature, fast fluence, burnup). The implementation of a novel multi-scale PIE approach has provided a mechanistic understanding of TRISO fuel performance to support the rigorous fuel qualification data packages. This mechanistic understanding of fuel performance provides opportunity to evolve the TRISO fuel design to improve performance for HTGRs and beyond. An overview of the TRISO fuel form will be presented along with the specific examples of PIE observations informing fuel performance such as integral SiC layer failure behavior and fission product transport. The research framework established for TRISO fuels has applicability across other fuel forms. Along with the TRISO focus a brief extension towards LWR UO₂ evolution including understand high burnup structure formation will be presented followed by a vision for new research topics and scientific goals using the methods and approaches presented.



Dr Rizwan Uddin is Professor and Head of Nuclear, Plasma, and Radiological Engineering Department; Professor of Computational Science and Engineering; and Director of Master of Engineering in Energy Systems program at the University of Illinois at Urbana-Champaign. His areas of interest include thermal hydraulics; CFD; computational methods development; coupled neutronics and thermal hydraulics; biological systems and general modeling and simulation. With guidance from his undergraduate and graduate students, he has also been exploring the use of computer- and video-games for education and training.