

INL *Symposia*

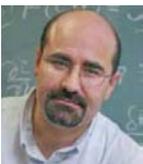
Microstructural Stability in Irradiated Materials

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Abstract

In a reactor environment, intense particle irradiation induces microchemical and microstructural evolution and phase changes in fuel and structural materials. Over the past several decades, researchers have gathered large databases on various aspects of radiation effects in materials, and developed a wide range of models, however a unified view of how to describe radiation effects in materials is still largely missing. This presentation will highlight a new approach to modeling, measuring and understanding the changes that occur in materials as a result of irradiation. In particular, the concept of concurrent defect dynamics and microstructure and microchemical evolution (including phase changes) in complex alloys and ceramics, and a fairly general theoretical and computational framework for radiation effects in materials will be discussed. Specific attention will be given to the mesoscale, where a systematic derivation of a phase field model from the principles of non-equilibrium thermodynamics will be shown and demonstrated for the case of void and gas bubble nucleation and growth, macroscopic swelling, and microchemical evolution in alloys. The physical, mathematical, and computational aspects of the phase field modeling framework will be discussed. The presentation concludes with a perspective on how this mesoscale framework can be integrated into the continuum level design codes, and how it can be validated experimentally.

Bio



Anter El-Azab is a Professor of Computational Science and Materials Science at Florida State University. He obtained his Ph.D. in Nuclear Engineering in 1994 at UCLA, and his B.S. and M.S. also in Nuclear Engineering at the University of Alexandria (Egypt). He worked for six years as a senior scientist at Pacific Northwest National Laboratory in the computational mechanics, applied mathematics, interfacial and nanoscience, and computational materials groups. He joined Florida State in 2004 as an Associate Professor of Mechanical Engineering, and held a Computational Science/Mechanical Engineering position two years later.

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Thursday, August 19, 2010 — 12:00-1:00 pm — Hilton Garden Center