University of Central Florida
NanoScience Technology Center
Advanced Materials Processing & Analysis Center

Graduate Research Seminar Series

Friday
November 18, 2016

12:15 PM

Research Pavilion
NSTC
Room 169

Pizza and drinks will be provided

Anomalous Non-Planar Interfacial Growth in Binary Diffusion Couples

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In the Materials Management and Minimization (M^3) Reactor Conversion program, formerly known as Reduced Enrichment for Research and Test Reactors (RERTR), undesirable interaction between fuel and Al alloy cladding within monolithic fuel plate design is minimized by the application of a diffusion barrier. Refractory metals such as Mo and Zr are considered as potential candidate materials for the diffusion barrier application due to their desirable properties. While studying the functional effectiveness of these two diffusion barriers using a diffusion couple approach (Al vs. Zr and Al vs. Mo), anomalous non-planar interfacial growth of interdiffusion products was observed.

In a binary system, intermetallic growth maintains planar morphology when annealed at constant temperature and pressure, as no degree of freedom is available to describe the shape of the interface according to Gibbs phase rule. Experimentally, Gibbs phase rule is largely obeyed by most binary systems as plane front morphology is predominantly observed. However, few binary systems have shown pronounced non-planar interfacial growth. Systems such as Mo vs. Si, Ni vs. Si, and Fe vs. Al in addition to Al vs. Zr and Al vs. Mo are reported to clearly violate the Gibb's phase rule. In these systems, irregular non-planar morphology was observed in the growth of one intermetallic compound. So far no concrete explanation exists which explains the non-planar interfacial growth in a binary system. This presentation will discuss the possible reasons and theories which could potentially explain this unconventional growth.