NUCLEAR ENERGY UNIVERSITY PROGRAMS

Neutron Damage and MAX Phase Ternary Compounds

PI: Barsoum, Michel - Drexel University

Project Number: 09-081

Initiative/Campaign: IIR

Collaborators:
Hoffman, Elizabeth - Savannah River National Laboratory
Kohse, Gordon - Massachusetts Institute of Technology
Sindelar, Robert - Savannah River National Laboratory

Abstract

The demands of advanced nuclear power plants for long service life under neutron radiation at high-temperature are severe. Advanced materials that withstand high temperatures up to 1000°C in a high-dose neutron field would be ideal for reactor internal structures. This project will investigate how a new class of machinable, conductive, layered, ternary transition metal carbides and nitrides – the so called MAX phases - respond to moderate neutron dose levels. The microstructures and electrical resistivity of select MAX phases will be characterized following irradiation at neutron fluxes up to $2.5x10^{25}$ n/m^2 ($E_n > 0.1$ MeV), or approximately 1.9 dpa, at 60°C and 500°C.

Researchers will characterize post-irradiation microstructures, resistivity and tensile properties of several MAX phase materials. Electrical resistivity is an important *in-situ* characterization tool. This work will provide a solid base of information to characterize the irradiation response of the MAX phases and provide an initial comparison to leading ceramics proposed for Gen IV in-core components. With additional irradiation characterization, the MAX phases may prove to be superior materials for in-reactor component design, especially with their creep resistance well beyond 1000°C.