Investigation of materials degradation in extreme environments using GDOES

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Abstract

The Materials Degradation under Corrosion and Radiation, MADCOR, Laboratory is part of the Engineering Physics Department at the University of Wisconsin-Madison.

The research group focuses on the study of complex degradation phenomena of materials subjected to degradation in extreme environments such as current and advanced nuclear reactors, beam accelerators, thermal engines for aerospace applications, etc….

For instance, corrosion can lead to severe materials degradation and it often occurs at the interface with the environment. It is thus critical to investigate the degraded layer using a multiscale approach. GDOES is an excellent tool to bridge the gap between atomic scale characterization performed for instance by Transmission Election Microscope and Atom Probe Tomography and mesoscale characterization such as Scanning Electron Microscope.

As examples, we will show the benefits of using GDOES in multiple areas such as cladding and alloys development for molten salt nuclear reactors, degradation of fuel cladding in accident scenario in pressurized water nuclear reactors and the high-temperature oxidation of refractory compositionally complex alloys for turbine engine applications.