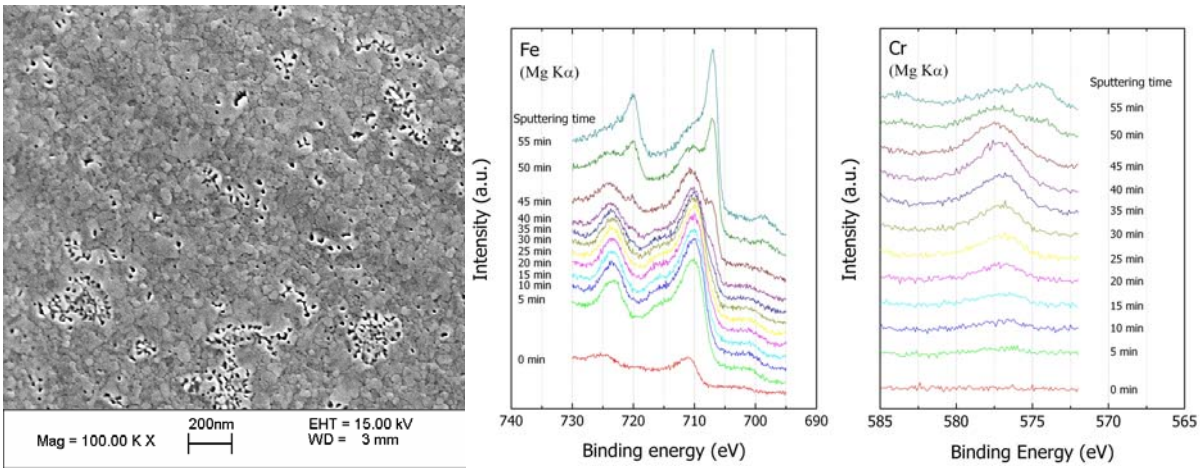
Perkin Elmer 5400 ESCA

To improve the corrosion resistance of candidate materials in extreme environments, plasma-based surface modifications and thin film deposition were performed to alter the ~50 to 200 nm near-surface chemistry, microstructure, and stress-state of materials. The Perkin Elmer 5400 X-ray Photoelectron Spectrometer at the Material Science Center, UW-Madison is an essential tool to measure the elemental composition, chemical state and electronic state of the elements of investigated materials, fig 1.



(a) Morphology of implanted surface (b) Fe 2p spectrum (c) Cr 2p spectrum

Fig 1. XPS examination revealed that, after oxygen ion implantation modification, the surface of the treated alloy was composed of oxides. The depth profile indicated this oxide formation to be approximately ~150 nm thick. The shifts of the characteristic peaks for Fe indicate Fe is present as FeO and Fe_2O_3. Up to depths of ~30 nm, only Fe-oxides are observed and no Cr is observed. At depth greater than ~30 nm from the surface, both Fe-oxides and Cr-oxides co-exist, and Cr is observed as Cr-oxide with Cr in the 3^+ oxidation state. After 55 min sputtering (~165 nm depth), Fe and Cr are present in their elemental form and are representative of the base alloy.