

Study of the hydriding behaviour of cerium containing iron-rich impurities

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Cerium is used here as a non-radioactive surrogate for plutonium to demonstrate and optimize devices in a new glovebox dedicated to plutonium studies. The glovebox contains devices with camera and a PM-IRRAS (Polarization-Modulation InfraRed Reflection-Absorption Spectroscopy) device.

Hydriding reaction of cerium is studied. H₂-cerium interaction initiates with the formation of localized hydride sites as for plutonium.

The objective of this work is to investigate the morphology of these hydride sites and to identify the nature of the hydride nucleation sites. Focused ion-beam scanning electron microscopy (FIB-SEM) associated with energy dispersive X-ray spectroscopy (EDS) was applied for this purpose.

Figure 1 shows a hydride site and the corresponding EDS iron map. As for many other hydride sites on the sample, an iron-rich zone is observed near the centre of the site. Some of the Fe-rich inclusions present in the cerium used in this study could play a role in the hydriding behaviour. Figure 2 shows the cross-sectional morphology of this hydride spot exhibiting a complex microstructure with large cracks.

Characterisations are still in progress to elucidate the nature(s) of nucleation sites on cerium and similar studies are also underway to investigate the plutonium hydriding behaviour (nucleation and growth, nucleation sites).

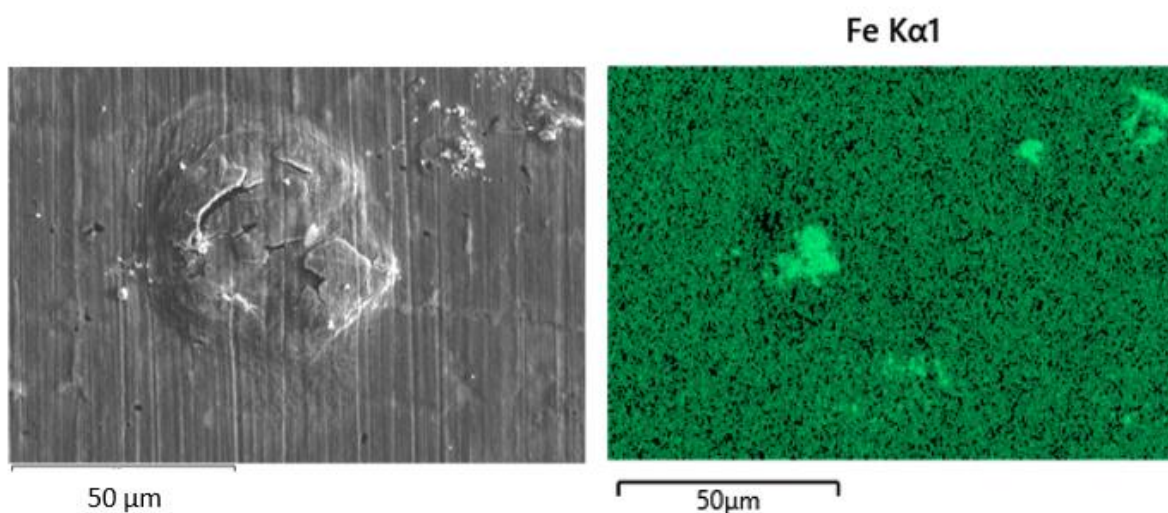


Figure 1: Cerium hydrided at ambient temperature under 530 mbar H₂:
(a) Secondary electron image of a hydride site, (b) EDS map of Fe K-edge of the same area.

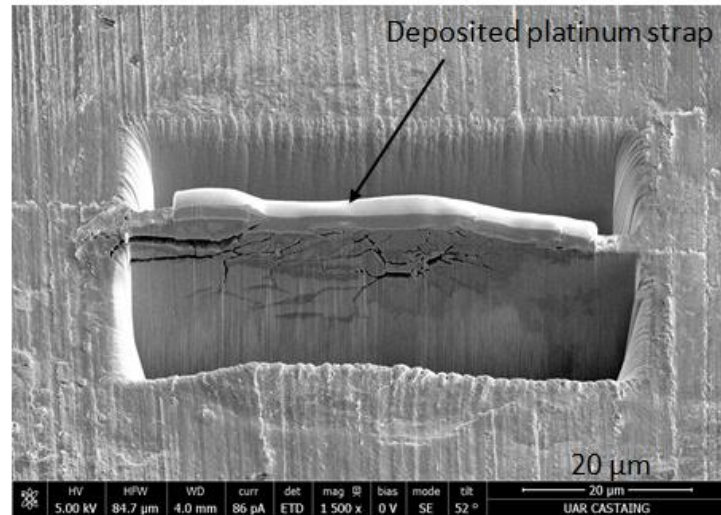


Figure 2: Secondary electron image of the FIB cross-section of the hydride site shown in Figure 1.