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Hydride-Induced Lattice Strains in Epitaxial Niobium. Brent Heuser, Monica Allain, Nuclear, Plasma and Radiological Engineering, Univ. of Illinois, 103 S. Goodwin Ave. Urbana, IL 61801 USA.

The use of hydrogen as an energy carrier is the basis of the "hydrogen economy," one of the energy methodologies envisioned in the 21st century. The identification of storage media and an understanding of catalytic materials are important issues related to hydrogen as a fuel. It is in this context that we present a detailed study of lattice strain the epitaxial Nb-hydrogen system. *In situ* x-ray diffraction (XRD) and x-ray reflectivity (XRR) measurements during hydride formation were performed for two epitaxial Nb films with thicknesses of 200Å and 1200Å. RD was used to monitor a set of three orthogonal reciprocal lattice points, thereby providing the lattice strain state of both the solid solution and hydride phases throughout the miscibility gap. Simultaneous XRR measurements allowed the overall film expansion to be monitored. The XRD and XRR data provide a picture of the elastic-plastic response of both films during hydride formation. In general, the 200Å film resisted the plastic deformation typically observed during hydride formation in bulk metals, and responded as a clamped elastic medium. The 1200Å film was more compliant with respect to plastic deformation. Discussion will focus on the different responses observed for the two films and will include a proposed model of the elastic-plastic behavior.

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