

Impact of Zirconium Hydride Precipitates on Fracture of a Zirconium Alloy

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Zirconium alloys are of major importance to the nuclear industry, with primary application as a structural material for the in-reactor environment. The formation of brittle hydrides within zirconium alloys results in a degradation of the mechanical properties of the component in which they form. Thus, the rate and characteristics of formation as well as the subsequent impact of these hydrides are critical factors in the determination of zirconium component service life. We have carried out a three part study of hydrides in zirconium using high energy synchrotron x-ray diffraction. Part I characterized the mechanical response of zirconium hydride, *in situ* within a bulk Zircaloy-2 matrix. Part II studied the near crack tip behavior of un-hydrated Zircaloy-2. The current work (Part III) focuses on characterizing the effect of crack tip hydrides; the aim is to quantify the influence of crack tip hydrides on the local strain field around the crack tip and to characterize the internal strains in the crack tip hydrides themselves. Results from this work will be discussed in the context of current crack tip hydride models. Comparative characterization of crack tip hydride morphology with scanning electron microscopy will also be presented.