

## HIGH TEMPERATURE X-RAY DIFFRACTION STUDIES DURING HYDRIDING OF $Zr_2Fe$

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Hydrogen or tritium may be stored in the intermetallic  $Zr_2Fe$  which is being currently being used as a tritium gettering system. This  $Zr_2Fe$  is not stable at room temperature according the equilibrium phase diagram of Zr-Fe. However, a metastable  $Zr_2Fe$  phase is observed at room temperature in a commercial alloy, SAES St 198. X-ray diffraction analyses have shown that  $Zr_2Fe$ , along with  $ZrFe_2$  and  $\alpha$ -Zr coexist in St 198. During prolonged hydrogen/tritium absorption/desorption cycling, there is reduction in absorption capacity. We have performed in-situ hydriding experiments of St 198 in a high temperature X-ray diffractometer to observe time-resolved structural changes during hydriding. Another objective was to determine the effect of nitrogen during hydriding using mixtures of  $N_2$  (96%)-4%  $H_2$ .

HTXRD studies of St 198 under  $N_2/H_2$  environment show that stable zirconium nitrides did not form during initial absorption studies; however, it is possible that nitrides may form during cycling or thermal aging. Our studies showed formation of a  $Zr_3FeH_x$ , whereas other investigators have reported the formation of  $Zr_2FeD_x$ . Crystal structure analyses have been performed and simulated XRD patterns have been generated. Scanning electron microscopy (SEM) on metallographic polished sections has shown two phase regions in as-received St 198 (+325 mesh powder). Energy x-ray dispersive (EDAX) analyses confirmed that there were two different phases present, Zr-Fe matrix (major) phase and Zr-Fe-Sn (minor embedded) phase. We are presently trying to determine if disproportionation is responsible for the reduced capacity of hydrogen or its isotopes after cycling. HTXRD results obtained at constant temperature using a position sensitive detector showing evolution of  $Zr_3FeH_x$  phase from  $Zr_2Fe$  phase, line-broadening aspects of the  $Zr_2Fe$  will be discussed.

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