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**Neutron Irradiation Effects on the Hydrogen Solubility in a Zirconium Based Alloy.** P. Vizcaíno[1], A. D. Banchik[2], J.P. Abriata[3], [1]CAE-CNEA, Pres. J. González y Aragón 15, Ezeiza, Argentina, vizcaino@cae.cnea.gov.ar, [2]CAE-CNEA, Pres. J. González y Aragón 15, Ezeiza, Argentina, [3]CAB-CNEA, Av Bustillo km 9, S.C. Bariloche, Argentina.

In recent experiments carried out at the Synchrotron Light National Laboratory (LNLS), x-ray diffraction diagrams have been obtained from neutron-irradiated Zircaloy-4 samples. These samples were taken from a cooling channel that was removed from Atucha 1 Nuclear Power Station -Argentina- after 10.3 years of full power operation. These samples have about 180 ppm hydrogen/deuterium due to the hydrogen pick up which takes place while the component is in service. The diffraction diagrams obtained in similar unirradiated Zircaloy-4 samples clearly show the peaks corresponding to $<111>_{\delta}$ and $<200>_{\delta}$ planes, which are the most intense of the δ-hydride phase, even for concentrations as low as 20 ppm. The high intensity of the x-ray beam and the good peak-background relation has allowed to quantify the hydrogen contents in the unirradiated samples used as a reference for comparisons proposes. The $<111>_{\delta}$ and $<200>_{\delta}$ peaks observed in irradiated samples annealed at 400 and 600°C show a recovery of the hydride crystalline structure compared to the material in the "as received" condition. An increase in the area under the peaks is observed, which is directly related to the amount of hydride phase present in the sample. These results support the hydrogen traps hypothesis posed in previous works.