HYDROGEN TRAPPING BY IRRADIATION-INDUCED DEFECTS IN A 316L STAINLESS STEEL

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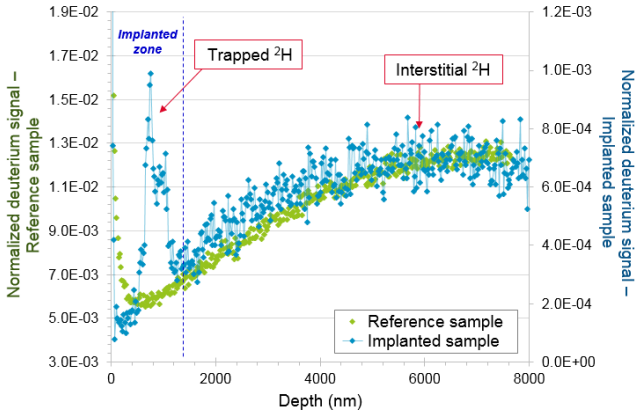

^{2}H concentration profiles obtained by SIMS on the reference stainless steel (SS) and the ion implanted SS after ^{2}H charging and aging.

- Work with model materials : reference material "without defect" and ion implanted materials
- Characterization of implantation-induced defects by TEM
- Deuterium cathodic charging to focus on hydrogen - defects interactions
- Oxidation tests in simulated PWR environment to study hydrogen uptake in real conditions
- Simulation of hydrogen diffusion and trapping in steels

Abstract:

The irradiation-induced defects in stainless steel internal components of pressurized water reactors combined with hydrogen uptake during the oxidation process could be a key parameter in the mechanism for Irradiation-Assisted Stress Corrosion Cracking (IASCC). The aim of this study is to characterize the effects of irradiation defects on hydrogen uptake during the oxidation of an austenitic stainless steel (SS) in primary water. The focus was made on the interactions between hydrogen and these defects. A heat-treated 316L SS containing a low amount of defects is compared with ion implanted samples. After the characterization of each ones by Transmission Electron Microscopy (TEM), hydrogen uptake of the samples is promoted either by room temperature cathodic charging or during corrosion experiments in PWR primary conditions. Then the trapping of hydrogen is studied by different characterization techniques such as GD-OES (Glow discharge Optical Emission Spectroscopy), SIMS (Secondary Ions Mass Spectrometry) or TDS (Thermal Desorption Spectroscopy) in association with a kinetic model to simulate diffusion and trapping of hydrogen in stainless steel.