In-situ Raman Spectroscopic Study of Oxide Films on Alloy 600 in Simulated PWR Water

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Abstract

Although there has been no general agreement on the mechanism of intergranular stress corrosion cracking (IGSCC) as one of major degradation modes of Ni-base alloys in PWR's, common belief derived from previous studies is that the damage to the alloy substrate is related to mass transport characteristics and/or repair properties of overlaying oxide film. Recently, it was shown that the oxide film structure and IGSCC initiation time aw well as crack growth rate were systematically varied as a function of hydrogen partial pressure in high temperature water, providing supporting evidences. This study is aimed at demonstrating a capacity to characterize the oxide film by an in-situ Raman spectroscopy as a function of PWR primary water conditions in order to understand how the oxide film chemistry can vary with water chemistry and participate in the cracking process as a key variable. This is achieved by analyzing the oxide film properties obtained for alloy 600 in various conditions leading to different IGSCC susceptibility. The in-situ Raman spectroscopic information obtained for various oxide films on alloy 600 in primary water of PWR as a function of hydrogen partial pressure is compared with thermodynamic predictions.