STUDY OF THE INFLUENCE OF MICROSTRUCTURE AND INTERGRANULAR CARBIDES ON THE CRACKING BEHAVIOR OF A NICKEL BASE ALLOY 690 TT BY MEANS OF IN SITU TESTS

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The nickel base alloy 690, which was first installed in the latest 80, has shown an optimum behavior to Stress Corrosion Cracking (SCC) processes in LWR. For this reason, this alloy was chosen as a material candidate for the next Supercritical Water Reactor (SCWR). For a long time it was believed that as in the A 600, the presence of intergranular carbides improved the corrosion resistance of A 690, however, recent works by Bruemmer [[i]] and Arioka [[ii]] have pointed out that the role of these carbides in the corrosion resistance of this alloy is not clear.

This work, performed in collaboration with CVR laboratories in Czech Republic, continues a previous work carried out in the Structural Materials Division of Ciemat focused on the effect of the intergranular carbides in the corrosion resistance of Nickel Base Alloy 690 in supercritical water. In this case, a tensile specimen of A 690 TT, previously tested in deaerated SCW at 500 ºC and 25 MPa, was then studied by means in situ tensile tests and TEM analysis. The aim of this work was to study the microstructural evolution of the material with temperature (500 ºC) and its influence on the mechanical behavior of a SCC crack formed in this alloy during the test in SCW. The study of the material after the in situ test was completed by Transmission Electron Microscope (TEM). It expected that these results allow to gain more in depth knowledge about the influence of the microstructure and intergranular carbides on the A 690 TT corrosion behavior. This knowledge could be used not only to understand the behavior of this alloy in SCW but in liquid water.

[i] Bruemmer et al. EPRI Alloy 690/52/152 PWSCC Research Collaboration Meeting 2014 Tampa, FL. December 2013

[ii] Arioka, K., et al. CORROSION NACE 67(3) (2011).