

## MICROSTRUCTURAL AND ENVIRONMENTAL EFFECTS ON STRESS CORROSION AND CORROSION FATIGUE OF 7075 ALUMINUM ALLOY

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The design and development of high performance structural materials requires a thorough understanding of the relationship between environment, mechanical stresses, microstructure, and properties. The corrosion and fatigue behavior of aluminum alloys is greatly influenced by environment and precipitate structure. A comprehensive, mechanistic understanding of the role of environment on cyclic fatigue of Al alloys is needed. The relationship between environmental and mechanical effects is not well understood. The driving force at the crack tip is clearly a combination of chemical and mechanical processes operating together. A synergy between these processes is also present.

In this talk, the role of moisture on stress corrosion and corrosion-fatigue of 7075 Al alloy will be presented. Rolled 7075 Al alloy was heat-treated to underaged, peak-aged, and overaged conditions. To investigate the effects of corrosion and fatigue on peak-aged 7075 aluminum alloy, corroded samples were tested via *in situ* x-Ray tomography. The samples were mechanically polished, then soaked in covered 3.5 wt.% NaCl for fifteen days to allow for significant corrosion to occur. Then, they were fatigue tested in situ in 3.5 wt.% NaCl using synchrotron x-ray tomography to analyze the fatigue crack initiation and growth characteristics. Hydrogen bubbles were observed between the sample and the fluid upon crack initiation, indicating chemical changes in the sample during in situ corrosion fatigue. The effect of oxide layers forming during corrosion and 2nd phase inclusions, on fatigue initiation and propagation, will be discussed. The microstructure and morphology of the fracture surfaces were examined by scanning electron microscopy (SEM) and correlated with the crack growth behavior. The crack initiation, growth, and damage were also quantified by sophisticated three dimensional (3D) *in situ* x-ray synchrotron tomography technique. This technique provided interesting insights into the onset of crack initiation and growth