IN SITU THREE DIMENSIONAL STUDY OF CORROSION FATIGUE CRACK INITIATION AND GROWTH OF CORRODED 7075 ALUMINUM ALLOYS

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Corrosion fatigue crack initiation in aluminum alloys can have significant effects on part life. An improved understanding of the mechanisms governing corrosion and corrosion fatigue damage of Al alloys is necessary. Alloy design and environmental chemistry have significant effects on corrosion fatigue crack initiation and growth. Influential alloy design features include alloy chemistry, precipitate structure, and grain structure. Environmental factors such as environmental chemistry and preexisting corrosion damage can also effect the corrosion fatigue behavior of the alloys. To investigate the effects of environment and precipitate size on corrosion fatigue of aluminum alloys, the *in situ* corrosion fatigue testing of corroded peak-aged and overaged 7075 Al alloys in 3.5 wt% NaCl solution will be presented.

For this study, rolled 7075 Al alloy was heat-treated to peak-aged, overaged, and highly overaged conditions. The samples were machined, mechanically polished, masked, and then soaked in 3.5 wt.% NaCl solution for fifteen days to yield significant corrosion damage in a region of interest. The corroded specimens were fatigue tested *in situ* in 3.5 wt.% NaCl using synchrotron X-ray tomography to gain three dimensional information regarding fatigue crack initiation and growth characteristics. Hydrogen bubbles were observed within the crack during propagation, indicating chemical changes in the sample during corrosion fatigue. The crack initiation, growth, and bubble evolution were quantified and discussed. A relationship was observed between the bubble volume and crack surface area as the test progressed, which suggested an effect from stress at the crack tip. Ultimately, this in situ study provided new insights regarding the localized processes occurring during the corrosion fatigue cracking of aluminum alloys which previous post-mortem and two dimensional studies were unable to discover.