EVALUATION OF CHLORIDE STRESS CORROSION SUSCEPTIBILITY OF STAINLESS STEELS

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The comparative chloride stress corrosion cracking (Cl-SCC) susceptibility for 304L, 316L, 317L, and AL-6XN was evaluated using double cantilever beam (DCB) specimens in boiling $MgCl_2$ by measuring the threshold stress intensity (K_{1SCC}), crack initiation time, and stage-II crack growth rate (CGR) for each material using in-situ monitoring. Materials 304L, 316L, and 317L were measured to have K_{1SCC} upper limit values of 2.5 to 5 MPa$\sqrt{m}$, substantially lower than has been previously measured for 304L in DCB specimens in boiling $MgCl_2$. The K_{1SCC} for AL-6XN was measured to be substantially higher, as would be expected in this more highly alloyed material. This work describes the challenge in measuring low K_{1SCC} values and how this was accomplished in the present work. In addition, more prototypical conditions were used to evaluate Cl-SCC behavior of 304L using a DCB-like geometry with a smooth gage area in a low humidity environment at 50 °C in the presence of $MgCl_2$ salt. Finite element modeling (FEM) was used to establish the relationship between applied loads and stress and strain at the bottom of the smooth notch. When the at a maximum strain of 15%, low temperature creep and Cl-SCC were both observed. In contrast, when the maximum stress was below the yield stress, no low temperature creep was observed, and Cl-SCC cracking could be distinguished using in-situ methods.