

Effect of Pressure and Dissolved Oxygen on Stress Corrosion Cracking Susceptibility of Inconel 617 in Steam and Supercritical Water

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Abstract : Inconel 617, a nickel-based alloy designed for high-temperature applications, got an excellent amalgamation of strength and oxidation resistance at high temperatures. For a better understanding of its suitability to be used in superheater and reheater tubes in ultra-supercritical power plants, stress corrosion cracking (SCC) susceptibility must be evaluated. In the present study, the effect of medium environment on SCC behavior of Inconel 617, in the form of a round bar tensile specimen, was tested via slow strain rate tensile tests in steam and supercritical water (SCW) at 650 °C. The results showed that SCC susceptibility has a linear relationship with exposed pressure and increases monotonically with an increase in pressure. A severe SCC susceptibility was observed in SCW followed by that in a steam environment. Fracture and gage surface showed apparent characteristics of brittle fracture. Intergranular cracks initiated from the edge region and propagated into the matrix through cross section until ductile rupture. When dissolved oxygen contents were decreased in SCW environment, it showed no noticeable effect on mechanical properties but SCC susceptibility slightly decreased. The research revealed the influence of environment on SCC susceptibility of Inconel 617 in steam and SCW.

Keywords : Inconel 617, steam, supercritical water, stress corrosion cracking

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