World Academy of Science, Engineering and Technology
International Journal of Materials and Metallurgical Engineering
Vol:12, No:09, 2018

Effect of Temperature on Corrosion Fatigue Cracking Behavior of Inconel 625 in Steam and Supercritical Water

Authors : Hasan Izhar Khan, Naiqiang Zhang, Hong Xu, Zhongliang Zhu, Dongfang Jiang

Abstract : Inconel 625 is a nickel-based alloy having outstanding corrosion resistance and developed for use at service temperatures ranging from cryogenic to 980°C. It got a wide range of applications in nuclear, petrochemical, chemical, marine, aeronautical, and aerospace industries. Currently, it is one of the candidate materials to be used as a structural material in ultra-supercritical (USC) power plants. In the high-temperature corrosive medium environment, metallic materials are susceptible to corrosion fatigue (CF). CF is an interaction between cyclic stress and corrosive medium environment that acts on a susceptible material and results in initiation and propagation of cracks. For the application of Inconel 625 as a structural material in USC power plants, CF behavior must be evaluated in steam and supercritical water (SCW) environment. Fatigue crack growth rate (FCGR) curves obtained from CF experiments are required to predict residual life of metallic materials used in power plants. In this study, FCGR tests of Inconel 625 were obtained by using compact tension specimen at 550-650 °C in steam (8 MPa) and SCW (25 MPa). The dissolved oxygen level was kept constant at 8000 ppb for the test conducted in steam and SCW. The tests were performed under sine wave loading waveform, 1 Hz loading frequency, stress ratio of 0.6 and maximum stress intensity factor of 32 MPa√m. Crack growth rate (CGR) was detected by using direct current potential drop technique. Results showed that CGR increased with an increase in temperature in the tested environmental conditions. The mechanism concerning the influence of temperature on FCGR are further discussed.

Keywords : corrosion fatigue, crack growth rate, nickel-based alloy, temperature
Conference Title : ICHTCME 2018 : International Conference on High Temperature Corrosion and Materials Engineering
Conference Location : Rome, Italy
Conference Dates : September 17-18, 2018