

Keying Effect During Fracture of Stainless Steel

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Abstract : Fracture of duplex stainless steels (DSS) was investigated in air and in 3.5 wt % NaCl solution. Two sets of fatigued specimens were heat treated at 475°C for different times and pulled to failure either in air or after kept in 3.5% NaCl with polarization of -900 mV/ SCE. Fracture took place in general by ferrite cleavage and austenite ductile fracture in transgranular mode. Specimens measured stiffness (Ms) was affected by the aging time, with higher values measured for specimens aged for longer times. Microstructural features played a role in "blocking" the crack propagation process leading to lower the CTOD values specially for specimens aged for short times. Unbroken ligaments/ austenite were observed at the crack wake. These features may exerted a bridging stress, blocking effect, at the crack tip giving resistance to the crack propagation process i.e the crack mouth opening was reduced. Higher stress intensity factor K_{Ic} values were observed with increased amounts of crack growth suggesting longer zone of unbroken ligaments in the crack wake. The bridging zone was typically several mm in length. Attempt to model the bridge stress was suggested to understand the role of ligaments/unbroken austenite in increasing the fracture toughness factor.

Keywords : stainless steels, fracture toughness, crack keying effect, ligaments

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