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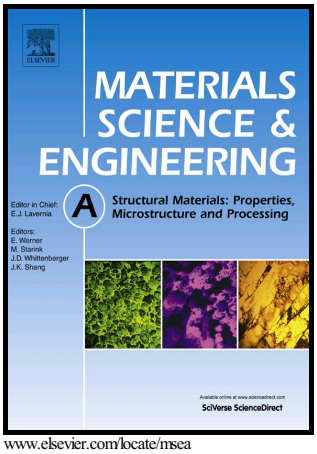

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Low Cycle Fatigue Behavior of Modified 9Cr-1Mo Steel at 300 °C

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Abstract

Low cycle fatigue (LCF) behavior of modified 9Cr–1Mo steel is studied at 300 °C, in the domain of dynamic strain aging (DSA), over a wide range of total strain amplitudes ($\Delta\varepsilon_t/2$) from ±0.25% to ±0.50%, at two different strain rates of 10^{-2} s^{-1} & 10^{-3} s^{-1}. Inverse effect of strain rate is observed on LCF behavior that is increase in the cyclic stress response, reduction in fatigue life and decrease in plastic strain amplitude with decrease in strain rate. Irrespective of strain rate and strain amplitude there is cyclic softening till failure. High dislocation density and bowing of dislocations is observed at low strain rate of 10^{-3} s^{-1}. The observed cyclic softening, irrespective of strain amplitude and strain rate, is attributed mainly to recovery of dislocations and formation of cell structure. The increase in the rate of fatigue crack growth at the strain rate of 10^{-3} s^{-1} is associated with DSA.

Keywords: Modified 9Cr–1Mo Steel; low cycle fatigue; dynamic strain ageing; cell structure; dynamic recovery.

Introduction

Modified 9Cr–1Mo steel, also known as P/T 91 is generally used in power generation industries and is also a candidate material for steam generator (SG) components of fast breeder reactor and