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Life, dislocation evolution, and fracture mechanism of a 41Fe-25.5Ni-23.5Cr alloy during low cycle fatigue at 700 °C

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Abstract

The low-cycle fatigue behavior, dislocation evolution, and fracture mechanism of a 41Fe-25.5Ni-23.5Cr alloy, Sanicro 25, were investigated under various total strain amplitudes of 0.3%, 0.35%, 0.4%, and 0.5% at 700 °C. According to strain-controlled fatigue tests, this alloy exhibited a cyclic hardening behavior. The back stress and friction stress increased with increasing total strain amplitude, which was attributed to the increase in the interactions of the dislocations with precipitates and dislocations. The hysteresis loops showed that the serrated flow was particularly pronounced at the total strain amplitude of 0.5%. Furthermore, the plastic strain amplitude and the hysteresis loop area increased as the total strain amplitude increased. The modified relationship of fatigue life and plastic strain amplitude ($N_f - \Delta\varepsilon_p / 2$) was established based on the energy-based prediction model of fatigue life, which was influenced by the parameters cyclic strain hardening exponent n' and cyclic strength coefficient

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