

Effects of stress amplitude ratio on short fatigue crack behaviour under axial-torsion loading

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Abstract

Fatigue tests with solid round bar specimens were carried out to investigate the effect of stress amplitude ratio on the axial-torsion fatigue failure of low carbon steel under a certain equivalent stress. The processing of surface short cracks initiation and propagation were recorded by replica technology. It is observed that all the crack propagation curves based on the criterion of dominant effective short fatigue crack (DESFC) clearly exhibits a similar oscillations tendency caused by the microstructure. In addition, the fatigue life, fracture angle and crack source vary with the value of stress amplitude ratio. Hence, a short crack model incorporating the effects of stress amplitude ratio was used to simulate the short crack growth rate, and the model can directly estimate the biaxial short cracks growth rate under different stress amplitude ratios according to the experimental data of uniaxial short cracks. A good agreement is achieved between simulation results and experimental data.

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