Fatigue behaviors and damage mechanism of a Cr-Mn-N austenitic steel

Four-point bending fatigue tests were conducted on a Cr-Mn-N austenitic steel at room temperature, at frequency of 20 Hz and the stress ratio of $R = 0.1$, in air. The fatigue strength of this Cr-Mn-N austenitic steel was measured to be 503 MPa in the maximum stress from the S-N curve obtained. It was found that multi-site crack nucleation took place on the surface of the steel during fatigue, and that the crack population (i.e., fatigue weak-links) was found to be a Weibull function of the applied stress. Usually only one or two of the initiated cracks could lead to the final failure of the samples. Most of the cracks were initiated at the{111} primary slip bands, especially within coarse grains. The cracks were deflected at grain boundaries, which effectively resisted short crack growth and arrested most of the short cracks in the alloy. It can be anticipated that grain refinement could further enhance the fatigue properties of the alloy. (C) 2016 Elsevier B.V. All rights reserved.