

Damage-based low cycle fatigue lifetime prediction of nickel-based single crystal superalloy considering anisotropy and dwell types

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Abstract

Based on the physical phenomenon that the fatigue cracks initiate along specific slip plane, a slip plane damage based low cycle fatigue (LCF) lifetime model for the nickel- based single crystal superalloy is established. The predicted results indicate that the lifetime model can reflect the orientation effect. In addition, in order to characterize the dwell time dependence of the LCF lifetime, creep damage and compression-creep damage are introduced to the lifetime model. Finally, the lifetime predictions under LCF loading with tensile dwell time, compressive dwell time and LCF with tensile-compressive dwell time are conducted by employing the lifetime mode, respectively. The predicted lifetimes show a good agreement with the experimental data, which verifies the accuracy of the developed lifetime model in this paper.

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