

Modelling the influence grain misorientations have on fatigue behaviour of Ni-based DS superalloys: State-of-the-art

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Abstract

Influence grain miss-orientations have on mechanical behaviour of Ni-based DS superalloys was investigated using crystal plasticity finite element modelling, in this review. Loading axes aligned with solidification direction, in both low-cycle-fatigue (LCF) and fatigue-crack-growth (FCG) behaviour, were considered. Influences of grain miss-orientations were investigated based on FE-modelling using actual microstructures measured with EBSD. Since the FE-modelling was able to simulate full history of fatigue stress-strain responses, under LCF loading, it was employed to explain heterogeneous deformation and localised high-stresses (dependent on grain-sizes and miss-orientations) linked to shorter LCF-life in test data that validated the FE-model. The model was then used to study FCG behaviour by considering crack-tip deformation under fatigue loading. Since FCG was exclusively due to mechanical deformation, it was sufficient to use accumulated plastic strain as a damage criterion, in XFEM. Results revealed a high dependency on grain-orientation.

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Modelling the influence grain misorientations have on fatigue behaviour of Ni-based DS superalloys Sta available at <https://authorea.com/users/310854/articles/441926-modelling-the-influence-grain-misorientations-have-on-fatigue-behaviour-of-ni-based-ds-superalloys-state-of-the-art>