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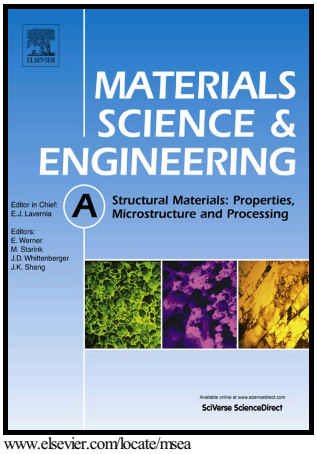

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Evolution of crystallographic orientation during thermomechanical fatigue of heat-resistant stainless steel

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Abstract

We present the evolution of crystallographic orientation and microstructure during thermomechanical fatigue (TMF) of heat-resistant cast austenitic stainless steel at peak temperatures reaching 950 °C using the electron backscatter diffraction (EBSD) method. Higher restraints or peak temperatures induced larger crystal misorientation by geometrically necessary dislocations (GNDs), forming dislocation walls or subgrains in the grains. Networked carbide clusters in the microstructure locally amplified the misorientation in the adjacent matrix and initiated fatigue cracks. The mean value of cumulative misorientations over a specific distance in the matrix was linearly proportional to the cyclic plastic strain.

Keywords: Electron backscattering diffraction (EBSD); Austenitic steel; Fatigue; Misorientation; Dislocation structure; Plastic strain