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Full length article

Analysis of a three-dimensional slip field in a hexagonal Ti alloy from in-situ high-energy X-ray diffraction microscopy data

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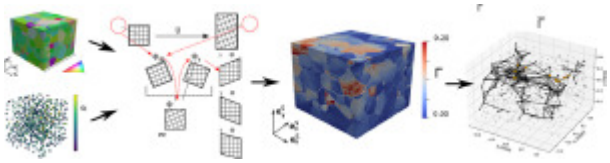
Abstract

Here we analyze a three-dimensional distribution of crystallographic slip measured in-situ during the uniaxial deformation of hexagonal Ti-7Al. The slip field is reconstructed using a novel methodology that combines spatially resolved lattice orientation fields and grain-averaged stresses measured using high-energy X-ray diffraction microscopy (HEDM) with crystal plasticity. Analysis is performed to explore lattice orientation dependence, stress dependence, and connectivity (network relationships) of grains experiencing elevated amounts of slip. Elevated slip is found to be primarily associated with a single large network of connected grains, and within this network, a clustered group of grains oriented favorably for slip are found to have outsized

structural importance. The effect of different slip system strengths and rate sensitivities of families of slip systems on reconstructed slip activity is also discussed.

Graphical abstract



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