ICSMA19 Metz, France, June 26 - July 1, 2022
International Conference on Strength of Materials

Micro-mechanisms of Anisotropic Deformation in the Presence of Notch in Commercially Pure Titanium: an In situ Study with CPFEM

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The present work addresses the effect of notch severity and initial texture on the micro-mechanism of deformation in commercially pure titanium employing the integrated frames of in situ EBSD experiment and CPFEM. The experimental EBSD microstructures scanned from un-notched and V-notched geometries of off-basal and prismatic-pyramidal orientations were taken as a model material for CPFEM. Simulated microstructures showed a good agreement with profuse prismatic slip traces of experimental microstructure of both orientations. It also captured the early activation of prismatic slip systems in the presence of notch severity irrespective of orientations, where prismatic-pyramidal orientation had higher prismatic slip activity than off-basal orientation. CPFEM results suggested early activation of high CRSS basal and pyramidal <c+a> slip systems with notch severity as well as evidence of early twin activity due to the presence of complex stress state. In addition, the favorable prismatic slip systems attributed higher surface roughness in prismatic-pyramidal orientation than off-basal orientation.

Keywords: micromechanisms of deformation, notch anisotropy, in situ EBSD, CPFEM, commercially pure titanium