Accepted Manuscript

Decomposition of Dislocation Densities at Grain Boundary in a Finite-Deformation Gradient Crystal-Plasticity Framework

Habib Pouriayevali, Bai-Xiang Xu

PII: S0749-6419(16)30347-3

DOI: 10.1016/j.ijplas.2017.04.010

Reference: INTPLA 2188

To appear in: *International Journal of Plasticity*

Received Date: 21 December 2016

Revised Date: 20 March 2017

Accepted Date: 15 April 2017

Please cite this article as: Pouriayevali, H., Xu, B.-X., Decomposition of Dislocation Densities at Grain Boundary in a Finite-Deformation Gradient Crystal-Plasticity Framework, *International Journal of Plasticity* (2017), doi: 10.1016/j.ijplas.2017.04.010.

Decomposition of Dislocation Densities at Grain Boundary in a Finite-Deformation Gradient Crystal-Plasticity Framework

Habib Pouriayevali*, Bai-Xiang Xu

Mechanics of Functional Materials Division, Institute of Material Science, Technische Universität Darmstadt, Jovanka-Bontschits-Strasse 2, D-64287 Germany

Keywords: Grain Boundary; Gradient Crystal Plasticity; Finite Deformation; Dislocation Transmission

Abstract

The microscopically powerless boundaries are studied based on a finite-deformation gradient crystal-plasticity model which comprises energetic and dissipative governing components. The innovative feature in the present study includes a decomposition of dislocation densities at the boundary which provides a distinct observation of dislocation transmission through the boundary. Here, the relative orientation of the grain boundary to the grains is taken to account. Moreover, a misconception in the literature which renders micro-free GB as a GNDs-free interface is addressed. In addition, a boundary layer is employed and enforces the dislocations to flux only in the tangential direction at the micro-hard boundary as observed in experiments. Numerical results show the effect of powerless boundary conditions, transmission of plastic flows and accumulation of GNDs in multicrystals.