Accepted Manuscript

Dislocation multiplication in stage II deformation of fcc multi-slip single crystals

Markus Stricker, Markus Sudmanns, Katrin Schulz,
Thomas Hochrainer, Daniel Weygand

PII: S0022-5096(18)30115-7
DOI: 10.1016/j.jmps.2018.07.003
Reference: MPS 3380

To appear in: *Journal of the Mechanics and Physics of Solids*

Received date: 5 February 2018
Revised date: 13 June 2018
Accepted date: 2 July 2018

Please cite this article as: Markus Stricker, Markus Sudmanns, Katrin Schulz, Thomas Hochrainer, Daniel Weygand, Dislocation multiplication in stage II deformation of fcc multi-slip single crystals, *Journal of the Mechanics and Physics of Solids* (2018), doi: 10.1016/j.jmps.2018.07.003

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

ACCEPTED MANUSCRIPT

Dislocation multiplication in stage II deformation of fcc multi-slip single crystals

Markus Stricker[a,**], Markus Sudmanns[a], Katrin Schulz[a], Thomas Hochrainer[b], Daniel Weygand[a,*]

[a]*Institute for Applied Materials, Karlsruhe Institute of Technology, Kaiserstraße 12, 76131 Karlsruhe, Germany, phone: +49 721 48508*
[b]*Institut für Festigkeitslehre, Technische Universität Graz, Kopernikusgasse 24, 8010 Graz, Austria, phone: +43 316 873 7164*

Abstract

Dislocation multiplication in plasticity research is often connected to the picture of a Frank-Read source. Although it is known that this picture is not applicable after easy glide deformation, plasticity theories often assume Frank-Read-type models for dislocation multiplication. By analyzing discrete dislocation dynamics simulations in a bulk like setting, a new view on dislocation multiplication is presented. It is observed that only two mechanisms provide a source for dislocations: cross-slip and glissile junctions. Both source mechanisms involve a change of glide system and transfer of dislocation density (line length) from the primary dislocation(s) slip system(s) to the one of the new dislocation. The motion of dislocations is found to be highly restricted by other dislocations and therefore the contribution to plastic deformation of each individual dislocation is small. Also a substantial fraction of the physical dislocation line length is annihilated by the collinear reaction, lowering dislocation storage during plastic deformation. Furthermore, multiplication events involve the loss of a substantial amount of dislocation

*Corresponding author: daniel.weygand@kit.edu
**Current address: Institute of Mechanical Engineering, École Polytechnique Fédérale de Lausanne, CH-1015, Switzerland

Download English Version:

https://daneshyari.com/en/article/7177370

Download Persian Version:

https://daneshyari.com/article/7177370

Daneshyari.com