

Technical University of Denmark



Prediction of dislocation boundary characteristics

Winther, Grethe

Publication date:
2016

Document Version
Peer reviewed version

[Link back to DTU Orbit](#)

Citation (APA):
Winther, G. (2016). Prediction of dislocation boundary characteristics. Abstract from Dislocations 2016, West Lafayette, United States.

DTU Library

Technical Information Center of Denmark

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Prediction of dislocation boundary characteristics

Author: Grethe Winther

Affiliation: Department of Mechanical Engineering, Technical University of Denmark,
grwi@mek.dtu.dk

ABSTRACT

Plastic deformation of both fcc and bcc metals of medium to high stacking fault energy is known to result in dislocation patterning in the form of cells and extended planar dislocation boundaries. The latter align with specific crystallographic planes, which depend on the crystallographic orientation of the grain [1]. For selected boundaries it has been experimentally verified that the boundaries consist of fairly regular networks of dislocations, which come from the active slip systems [2]. The networks have been analyzed within the framework of Low-Energy-Dislocation-Structures (LEDS) and it is found that to a large extent the dislocations screen each other's elastic stress fields [3].

The present contribution aims at advancing the previous theoretical analysis of a boundary on a *known* crystallographic plane to actual *prediction* of this plane as well as other boundary characteristics, such as the dislocation content and misorientation. The prediction is based on the expected active slip systems and assumptions of mutual stress screening. In general, networks of dislocations with three linearly independent Burgers vectors fulfilling the criterion of mutual stress screening may form on any plane. Crystal plasticity calculations combined with the hypothesis that these boundaries separate domains with local differences in the slip system activity are introduced to address precise prediction of the experimentally observed boundaries. The presentation will focus on two cases from fcc metals: boundaries aligned with a {111} slip plane and boundaries, which bisect the angle between two slip planes. Finally, the effect of long-range plastic strain gradients is also discussed.

- [1] X. Huang, G. Winther, Dislocation structures. Part I. Grain orientation dependence, Phil. Mag., **87**, 5189 (2007)
- [2] C. S. Hong, X. Huang, G. Winther, Dislocation content of geometrically necessary boundaries aligned with slip planes in rolled aluminum, Phil. Mag, **93**, 3118 (2013)
- [3] G. Winther, C. S. Hong, X. Huang, Low-Energy Dislocation Structure (LEDS) character of dislocation boundaries aligned with slip planes in rolled aluminium, Phil.Mag., **95**, 1471 (2015)