

Accepted Manuscript

Binary dislocation junction formation and strength in hexagonal close-packed crystals

Chi-Chin Wu, Sylvie Aubry, Athanasios Arsenlis, Peter W. Chung



PII: S0749-6419(15)00202-8

DOI: [10.1016/j.ijplas.2015.12.003](https://doi.org/10.1016/j.ijplas.2015.12.003)

Reference: INTPLA 1993

To appear in: *International Journal of Plasticity*

Received Date: 17 September 2015

Revised Date: 18 November 2015

Accepted Date: 5 December 2015

Please cite this article as: Wu, C.-C., Aubry, S., Arsenlis, A., Chung, P.W., Binary dislocation junction formation and strength in hexagonal close-packed crystals, *International Journal of Plasticity* (2016), doi: 10.1016/j.ijplas.2015.12.003.

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.

Binary dislocation junction formation and strength in hexagonal close-packed crystals

Chi-Chin Wu^{a,*}, Sylvie Aubry^b, Athanasios Arsenlis^b, Peter W. Chung^{c,d}

^a Materials and Manufacturing Science Division, Weapons and Materials Research Directorate, US Army Research Laboratory, Aberdeen Proving Ground, MD 21005, USA

^b Materials Science Division, Lawrence Livermore National Laboratory P.O. Box 808, L-367 Livermore, CA 94551-0808, USA

^c Department of Mechanical Engineering, University of Maryland, College Park, MD 20742, USA

^d Computational Sciences Division, Computational and Information Sciences Directorate, US Army Research Laboratory, Adelphi, MD 20783, USA

*Corresponding author. Tel: +1 410-306-1481

Email address: chi-chin.wu.ctr@mail.mil (Chi-Chin Wu)

Abstract

This work examines binary dislocation interactions, junction formation and junction strengths in hexagonal close-packed (*hcp*) crystals. Through a line-tension model and dislocation dynamics (DD) simulations, the interaction and dissociation of different sets of binary junctions are investigated involving one dislocation on the (01 $\bar{1}$ 0) prismatic plane and a second dislocation on one of the following planes: (0001) basal, (1 $\bar{1}$ 00) prismatic, (1 $\bar{1}$ 01) primary pyramidal, or ($\bar{2}$ 112) secondary pyramidal. Varying pairs of Burgers vectors are chosen from among the common types: the basal type $\langle a \rangle: \frac{1}{3} \langle 11\bar{2}0 \rangle$, prismatic type $\langle c \rangle: \langle 0001 \rangle$, and pyramidal type $\langle a + c \rangle: \frac{1}{3} \langle 11\bar{2}\bar{3} \rangle$. For binary interaction due to dislocation intersection, both the analytical results and DD-simulations indicate a relationship between symmetry of interaction maps and the relative magnitude of the Burgers vectors that constitute the junction. Using analytical formulae, a simple regressive model is also developed to represent the junction yield surface. The equation is treated as a degenerated super elliptical equation to quantify the aspect ratio and tilting angle. The results provide analytical insights on binary dislocation interactions that may occur in general *hcp* metals.

Keywords

A. Dislocations, A. Dynamics, B. Elastic material, C. Analytic functions

Download English Version:

<https://daneshyari.com/en/article/7174914>

Download Persian Version:

<https://daneshyari.com/article/7174914>

[Daneshyari.com](https://daneshyari.com)