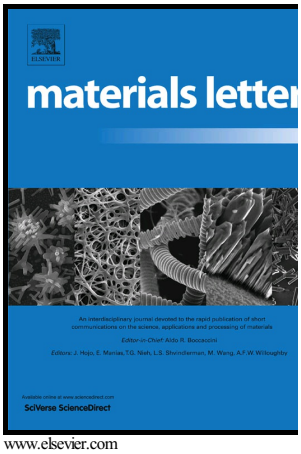
Explore the anisotropic indentation pile-up patterns of single-crystal coppers by crystal plasticity finite element modelling

Mao Liu, Anh Kiet Tieu, Ching-Tun Peng, Kun Zhou



PII: S0167-577X(15)30449-3
DOI: http://dx.doi.org/10.1016/j.matlet.2015.08.093
Reference: MLBLUE19454

To appear in: *Materials Letters*

Received date: 31 July 2015
Accepted date: 19 August 2015

Cite this article as: Mao Liu, Anh Kiet Tieu, Ching-Tun Peng and Kun Zhou Explore the anisotropic indentation pile-up patterns of single-crystal coppers by crystal plasticity finite element modelling, *Materials Letters* http://dx.doi.org/10.1016/j.matlet.2015.08.093

Explore the anisotropic indentation pile-up patterns of single-crystal coppers by crystal plasticity finite element modelling

Mao Liu[1, 2*], Anh Kiet Tieu[1], Ching-Tun Peng[1], Kun Zhou[2*]

[1]*School of Mechanical, Materials and Mechatronic Engineering, University of Wollongong, Wollongong, NSW 2522, Australia*

[2]*School of Mechanical & Aerospace Engineering, Nanyang Technological University, 50 Nanyang Avenue, Singapore 639798, Singapore*

Abstract

We report a new in-depth explanation of the anisotropic pile-up phenomenon based on the plastic slip theory. A crystal plasticity finite element method (CPFEM) model which considers plastic slips and lattice rotations as the only deformation mechanism has been developed to investigate the anisotropic pile-up behaviour of (001), (011) and (111) initially orientated single-crystal copper (Cu) undergoing nanoindentation. It is concluded that the activation of different slip systems contributes to the anisotropy of pile-up patterns.

Keywords: CPFEM; nanoindentation; pile-up; single-crystal Cu

* Corresponding author: Liu M. (ml818@uowmail.edu.au); Zhou K. (kzhou@ntu.edu.sg).