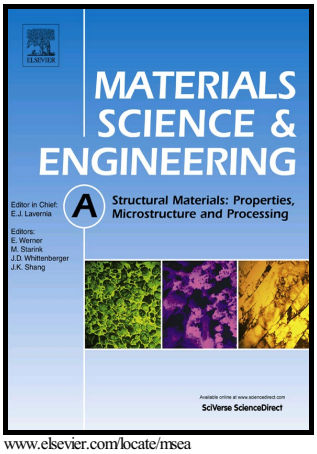
Author's Accepted Manuscript

Influences of high strain rate, low temperature, and deformation direction on microstructural evolution and mechanical properties of copper

Dong-Hyun Ahn, Minju Kang, Lee Ju Park, Sunghak Lee, Hyoung Seop Kim



www.elsevier.com/locate/msea

PII: S0921-5093(16)31589-1
DOI: http://dx.doi.org/10.1016/j.msea.2016.12.091
Reference: MSA34522

To appear in: *Materials Science & Engineering A*

Received date: 20 April 2016
Revised date: 19 December 2016
Accepted date: 20 December 2016

Cite this article as: Dong-Hyun Ahn, Minju Kang, Lee Ju Park, Sunghak Lee and Hyoung Seop Kim, Influences of high strain rate, low temperature, and deformation direction on microstructural evolution and mechanical properties of copper, *Materials Science & Engineering A* http://dx.doi.org/10.1016/j.msea.2016.12.091

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 galley proof before it is published in its final citable 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

Influences of high strain rate, low temperature, and deformation direction on microstructural evolution and mechanical properties of copper

Dong-Hyun Ahn[a,b], Minju Kang[c], Lee Ju Park[d], Sunghak Lee[a], Hyoung Seop Kim[a,*]

[a]Department of Materials Science and Engineering, Pohang University of Science and Technology (POSTECH), Pohang 790-784, Republic of Korea
[b]Nuclear Materials Safety Research Division, Korea Atomic Energy Research Institute, Daejeon 305-353, Republic of Korea
[c]Material Research Department Hyundai Heavy Industries, Ulsan, 682-792, Republic of Korea
[d]Agency for Defense Development (ADD), Daejeon 305-152, Republic of Korea

*Corresponding author. Tel.: +82 54 279 2150; Fax: +82 54 279 2399. E-mail address: hskim@postech.ac.kr (H.S. Kim)

Accepted manuscript

Abstract

Step-wise deformations are applied to pure copper along uniaxial direction or multiaxial directions in three conditions of speed and temperature: static and room temperature, dynamic and room temperature, or dynamic and low temperature. Through examinations of total 36 deformation stages, the influences of strain rate, temperature, and deformation direction on microstructural evolution and mechanical properties are investigated. According to the results, the deformation mechanism at extreme conditions (high strain rate and low temperature) changes from only dislocation slip to dislocation slip and deformation twinning. Although deformation-direction change has no significant effect on the final mechanical properties and total dislocation densities measured from X-ray diffraction results, the evolutions of grain-boundary misorientation and geometrically necessary dislocations (GNDs) are clearly influenced. The trend of microstructural evolution, i.e. larger grain size and lower GND densities by multi-axial deformation than the uniaxial case, is reversed when twinning occurred. Based on the results, we suggest four evolution models: uniaxial or multi axial cases with dislocation slip, or with dislocation slip and deformation twining. Even if the homogenous and almost fully twinned microstructure producing improved mechanical strength was obtained by applying the extreme deformations, poor ductility of the processed specimen were observed.

Keywords: low-temperature deformation, dynamic plastic deformation, deformation twinning,

Download English Version:

https://daneshyari.com/en/article/5456343

Download Persian Version:

https://daneshyari.com/article/5456343

Daneshyari.com