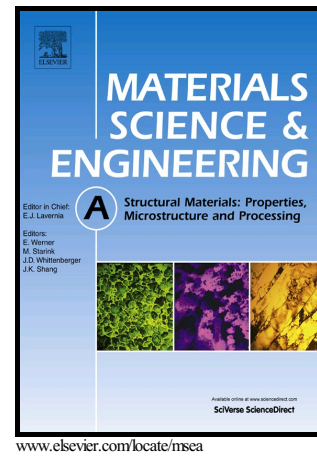


Author's Accepted Manuscript

Long-time stability of metals after severe plastic deformation: Softening and hardening by self-annealing versus thermal stability

Kaveh Edalati, Yuki Hashiguchi, Hideaki Iwaoka, Hiroataka Matsunaga, Ruslan Z. Valiev, Zenji Horita



PII: S0921-5093(18)30737-8
DOI: <https://doi.org/10.1016/j.msea.2018.05.079>
Reference: MSA36517

To appear in: *Materials Science & Engineering A*

Received date: 17 January 2018
Revised date: 30 March 2018
Accepted date: 21 May 2018

Cite this article as: Kaveh Edalati, Yuki Hashiguchi, Hideaki Iwaoka, Hiroataka Matsunaga, Ruslan Z. Valiev and Zenji Horita, Long-time stability of metals after severe plastic deformation: Softening and hardening by self-annealing versus thermal stability, *Materials Science & Engineering A*, <https://doi.org/10.1016/j.msea.2018.05.079>

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.

Long-time stability of metals after severe plastic deformation: Softening and hardening by self-annealing versus thermal stability

Kaveh Edalati^{1,2,*}, Yuki Hashiguchi², Hideaki Iwaoka³, Hirotaka Matsunaga²,
Ruslan Z. Valiev^{4,5} and Zenji Horita^{1,2}

¹ WPI, International Institute for Carbon-Neutral Energy Research (WPI-I2CNER), Kyushu University, Fukuoka 819-0395, Japan

² Department of Materials Science and Engineering, Faculty of Engineering, Kyushu University, Fukuoka 819-0395, Japan

³ Department of Mechanical and Materials Engineering, Yokohama National University, Yokohama 230-8501, Japan

⁴ Institute of Physics of Advanced Materials, Ufa State Aviation Technical University, Ufa, Russia

⁵ Laboratory for Mechanics of Bulk Nanomaterials, Saint Petersburg State University, Saint Petersburg, Russia

*Corresponding author: Kaveh Edalati, Tel/Fax: +81 092 802 2992; kaveh.edalati@zaiko6.zaiko.kyushu-u.ac.jp

Despite superior properties of ultrafine-grained (UFG) materials processed by severe plastic deformation (SPD), their thermal stability is a concern because of the supersaturated fractions of lattice defects. In this study, the microstructural stability of various UFG materials (2 alloys and 15 pure metals) after SPD processing through the high-pressure torsion (HPT) were investigated at room temperature for up to 10 years. While most of the metals with high melting temperatures remained stable, a softening by self-annealing occurred in pure silver, gold and copper with moderate melting temperatures, and an unusual hardening occurred in pure magnesium, Al-Zn alloy and Mg-Li alloy with low melting temperatures. These softening/hardening behaviors by grain coarsening were attributed to the contribution of grain boundaries to dislocation activity or grain-boundary sliding, respectively. It was shown that the self-annealing was accelerated by increasing the processing pressure and strain and by decreasing the processing temperature and stacking fault energy, due to the enhancement of stored energy and/or atomic mobility.

Keywords: severe plastic deformation (SPD); high-pressure torsion (HPT); ultrafine-grained (UFG) metals; magnesium-lithium alloys; aluminum-zinc alloys.

Download English Version:

<https://daneshyari.com/en/article/7971942>

Download Persian Version:

<https://daneshyari.com/article/7971942>

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