

## Accepted Manuscript

High-resolution transmission electron microscopy analysis of bulk nanograined silicon processed by high-pressure torsion

Yuta Fukushima, Yoshifumi Ikoma, Kaveh Edalati, Bumsoo Chon, David J. Smith, Zenji Horita



PII: S1044-5803(17)30675-7  
DOI: doi: [10.1016/j.matchar.2017.04.025](https://doi.org/10.1016/j.matchar.2017.04.025)  
Reference: MTL 8648

To appear in: *Materials Characterization*

Received date: 8 March 2017  
Revised date: 25 April 2017  
Accepted date: 25 April 2017

Please cite this article as: Yuta Fukushima, Yoshifumi Ikoma, Kaveh Edalati, Bumsoo Chon, David J. Smith, Zenji Horita , High-resolution transmission electron microscopy analysis of bulk nanograined silicon processed by high-pressure torsion, *Materials Characterization* (2017), doi: [10.1016/j.matchar.2017.04.025](https://doi.org/10.1016/j.matchar.2017.04.025)

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.

## High-resolution transmission electron microscopy analysis of bulk nanograined silicon processed by high-pressure torsion

Yuta Fukushima<sup>1</sup>, Yoshifumi Ikoma<sup>1\*</sup>, Kaveh Edalati<sup>1,2</sup>, Bumsoo Chon<sup>1</sup>, David J. Smith<sup>3</sup>, Zenji Horita<sup>1,2</sup>

<sup>1</sup>*Department of Materials Science and Engineering, Kyushu University, 744 Motoooka, Fukuoka 819-0395, Japan*

<sup>2</sup>*WPI, International Institute for Carbon-Neutral Energy Research (WPI-I2CNER), Kyushu University, 744 Motoooka, Fukuoka 819-0395, Japan*

<sup>3</sup>*Department of Physics, Arizona State University, Tempe, AZ 85287, USA*

We report on high-resolution transmission electron microscopy observations of bulk nanograined silicon processed by severe plastic deformation through high-pressure torsion (HPT). Single crystalline Si(100) was subjected to HPT processing under a nominal pressure of 24 GPa at room temperature. The HPT-processed samples contained lattice defects such as dislocations and nanotwins in diamond-cubic Si-I, and metastable phases such as body-centered-cubic Si-III and hexagonal-diamond Si-IV. The grain size ranged from several nanometers up to several tens of nanometers. Subsequent annealing at 873 K led to the phase transformation to Si-I. No appreciable grain coarsening occurred after annealing while dislocations and nanotwins remained in the Si-I nanograins. The Si-I nanograin structure was retained even after annealing for 12 h.

Keywords: severe plastic deformation, high-pressure torsion, HRTEM, phase transformation, metastable phase, lattice defects

\*Corresponding author.

E-mail addresses: yt.fksm@gmail.com (Y. Fukushima), ikoma@zaiko.kyushu-u.ac.jp (Y. Ikoma), kaveh.edalati@zaiko6.zaiko.kyushu-u.ac.jp (K. Edalati), chon@zaiko6.zaiko.kyushu-u.ac.jp (B.Chon), DAVID.SMITH@asu.edu (D.J. Smith), horita@zaiko.kyushu-u.ac.jp (Z. Horita)

Download English Version:

<https://daneshyari.com/en/article/5454857>

Download Persian Version:

<https://daneshyari.com/article/5454857>

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