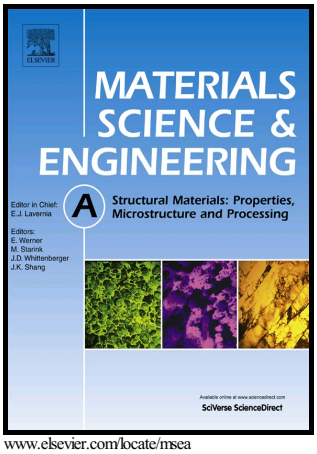
Tensile deformation characteristics of a Cu–Ni–Si alloy containing trace elements processed by high-pressure torsion with subsequent aging

Hikaru Watanabe, Takahiro Kunimine, Chihiro Watanabe, Ryoichi Monzen, Yoshikazu Todaka



www.elsevier.com/locate/msea

PII: S0921-5093(18)30757-3
DOI: https://doi.org/10.1016/j.msea.2018.05.090
Reference: MSA36528

To appear in: *Materials Science & Engineering A*

Received date: 18 April 2018
Revised date: 22 May 2018
Accepted date: 23 May 2018

Cite this article as: Hikaru Watanabe, Takahiro Kunimine, Chihiro Watanabe, Ryoichi Monzen and Yoshikazu Todaka, Tensile deformation characteristics of a Cu–Ni–Si alloy containing trace elements processed by high-pressure torsion with subsequent aging, *Materials Science & Engineering A*, https://doi.org/10.1016/j.msea.2018.05.090

Tensile deformation characteristics of a Cu–Ni–Si alloy containing trace elements processed by high-pressure torsion with subsequent aging

Hikaru Watanabe[a], Takahiro Kunimine[a], Chihiro Watanabe[a], Ryoichi Monzen[a,*], Yoshikazu Todaka[b]

[a] Division of Mechanical Science and Engineering, Graduate School of Natural Science and Technology, Kanazawa University, Kanazawa 920-1192, Japan

[b] Department of Mechanical Engineering, Toyohashi University of Technology, Toyohashi 441-8580, Japan

*correspondence: monzen@se.kanazawa-u.ac.jp

Abstract

Experiments were performed to investigate the tensile deformation characteristics of a Cu-2.5wt%Ni-0.55wt%Si alloy containing trace elements of Zn, Sn and Mg, processed by high-pressure torsion (HPT) under an applied pressure of 5 GPa for 10 revolutions, and then peak-aged or over-aged at 300 °C. The grain size of the HPT-processed (H) alloy was refined to 70 nm. The peak-aged (PA) alloy exhibited a higher tensile strength σ_u of over 1 GPa than the H alloy. The over-aged (OA) alloy exhibited a lower value of σ_u than not only the PA but the H alloy. The PA and the OA alloy revealed unique tensile deformation properties: an extremely small local elongation of 0.1% for the PA alloy, a very small uniform elongation of 0.2% for the OA alloy, and a sudden drop of tensile stress immediately after necking initiation for the OA alloy. The small local and uniform elongation for the PA and OA alloy were explained on the basis of intergranular fracture after and before