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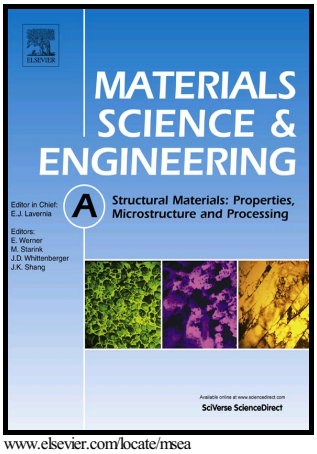


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# Superplasticity of Inconel 718 after Processing by High-Pressure Sliding (HPS)

Yoichi Takizawa[1,2,3*], Takahiro Kajita[1], Petr Kral[4,5],Takahiro Masuda[1,2], Kyohei Watanabe[1], Manabu Yumoto[3], Yoshiharu Otagiri[3], Vaclav Sklenicka[4,5] and Zenji Horita[1,2]

[1]Department of Materials Science and Engineering, Faculty of Engineering, Kyushu University, Fukuoka 819-0395, Japan

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

[3]Technology Department, Nagano Forging Co., Ltd, Nagano 380-0003, Japan

[4]Institute of Physics of Materials, ASCR, Zizkova 22, CZ-616 62 Brno, Czech Republic

[5]CEITEC – IPM, Institute of Physics of Materials, ASCR, Zizkova 22, 616 62 Brno, Czech Republic

[*]Corresponding author at: Department of Materials Science and Engineering, Faculty of Engineering, Kyushu University, Fukuoka 819-0395, Japan. Tel./Fax: +81 92 802 2992. ytakizawa@nsc-com.co.jp

**Abstract**

This study reports a production of a superplastic Ni-based superalloy (Inconel 718) using a process of severe plastic deformation through High-Pressure Sliding (HPS). The grain size of the alloy was reduced to ~120 nm by operating the HPS process under 4 GPa at room temperature with a recently upscaled facility. The ultrafined-grained structure was well retained even after annealing at 1173 K for 1 hour. Tensile tests were conducted in air at a testing temperature in the range of 973 - 1173 K with an initial strain rate of $5.0\times10^{-4}$ - $2.0\times10^{-2}$ $s^{-1}$. Superplastic elongation more than 400% were attained at all testing conditions except at 973 K. High-strain rate superplasticity (defined with strain rates higher than $1\times10^{-2}$ $s^{-1}$) was achieved at temperatures higher than 1073 K. Electron back scatter diffraction analyses revealed that a preferential orientation of the grains was developed by the HPS processing but it was randomized with tensile deformation. Evaluation of the strain rate sensitivity and the activation energy for the superplastic deformation confirmed that the superplasticity of Inconel 718 was controlled by grain boundary sliding through lattice diffusion.

Keywords

High-pressure sliding (HPS); Severe plastic deformation (SPD); Ni-based superalloy; superplasticity; Grain boundary sliding; lattice diffusion