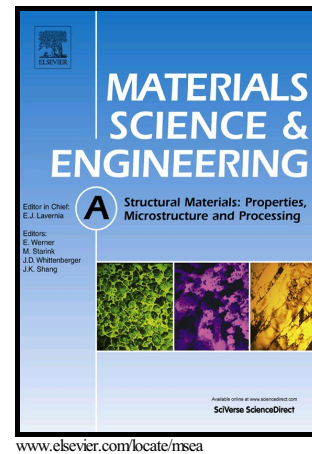


Author's Accepted Manuscript

Experimental and Computational Study of
Microstructural Effect on Ductile Fracture of Hot-
Forming Materials

Yang Liu, Yiguo Zhu, Caglar Oskay, Ping Hu,
Liang Ying, Dantong Wang



PII: S0921-5093(18)30385-X
DOI: <https://doi.org/10.1016/j.msea.2018.03.049>
Reference: MSA36242

To appear in: *Materials Science & Engineering A*

Received date: 6 February 2018
Revised date: 10 March 2018
Accepted date: 12 March 2018

Cite this article as: Yang Liu, Yiguo Zhu, Caglar Oskay, Ping Hu, Liang Ying and Dantong Wang, Experimental and Computational Study of Microstructural Effect on Ductile Fracture of Hot-Forming Materials, *Materials Science & Engineering A*, <https://doi.org/10.1016/j.msea.2018.03.049>

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.

Experimental and Computational Study of Microstructural Effect on Ductile Fracture of Hot-Forming Materials

Yang Liu¹, Yiguo Zhu^{1*}, Caglar Oskay², Ping Hu¹, Liang Ying¹, Dantong Wang¹

¹State Key Laboratory of Structural Analysis for Industrial Equipment, Faculty of Vehicle Engineering and Mechanics, International Research Center for Computational Mechanics, Dalian University of Technology, Dalian 116024, People's Republic of China

²Department of Civil and Environmental Engineering, Vanderbilt University, Nashville, TN 37235

*Corresponding author. Tel.: 86-411-84707330; fax: 86-411-84708390. zhuyg@dlut.edu.cn

Abstract

Thermo-mechanical experiments at different elevated temperatures are carried out for tensile and shear-dominant specimens extracted from warm forming materials of 7075 aluminum alloy and 22MnB5 boron steel, respectively. A specimen-embedded furnace jointed by temperature control system to perform the high temperature shear experiments. Driven by microscale anisotropic plastic flow, damage is embedded in each slip system and damage evolution is controlled by the preferential dislocation slip. Combined with microscale damage and dislocation density based constitutive model, an advanced crystal plasticity method is proposed to perform predictions of mechanical behavior of face-center-cubic materials at various temperatures. Reasonable agreement is obtained between experimental and numerical results for different specimens, temperature conditions and materials. This approach simultaneously captures the strain hardening rate, damage softening, non-linear post-necking and fracture strain. Microstructural effects on ductile fracture are tracked and investigated including dislocation density and crystallographic orientation. The results show that local dislocation density rise is associated with damage initiation. Different fracture morphologies and necking paths are caused by distinct initial misorientation distributions in comparison with experimental observation of 7075 aluminum alloy. Local misorientations are investigated and critical misorientation ranges are computed for promoting void growth in zigzag and straight fracture morphologies. Schmid factor is computed as not necessary variable to trigger void growth.

Download English Version:

<https://daneshyari.com/en/article/7972504>

Download Persian Version:

<https://daneshyari.com/article/7972504>

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