Title: An extended GTN model for low stress triaxiality and application in spinning forming

Authors: He Wu, Wenchen Xu, Debin Shan, Bo Cheng Jin

PII: S0924-0136(18)30328-5
DOI: https://doi.org/10.1016/j.jmatprotec.2018.07.032
Reference: PROTEC 15859

To appear in: *Journal of Materials Processing Technology*

Received date: 23-4-2018
Revised date: 4-7-2018
Accepted date: 26-7-2018

Please cite this article as: Wu H, Xu W, Shan D, Jin BC, An extended GTN model for low stress triaxiality and application in spinning forming, *Journal of Materials Processing Tech.* (2018), https://doi.org/10.1016/j.jmatprotec.2018.07.032

An extended GTN model for low stress triaxiality and application in spinning forming

He Wu[a], Wenchen Xu[a,*], Debin Shan[a], Bo Cheng Jin[b]

[a] School of Materials Science and Engineering & National Key Laboratory for Precision Hot Processing of Metals, Harbin Institute of Technology, Harbin 150001, P.R. China.

Tel. and fax: +86 451 86416221; Email: xuwc_76@hit.edu.cn

[b] Department of Aerospace and Mechanical Engineering, Viterbi School of Engineering, University of Southern California, Los Angeles, California, 90007, U.S.

Abstract

The Gurson-Tvergaard-Needleman (GTN) models are effective to predict damage evolution and ductile fracture during plastic deformation, while the existing modified GTN models mainly focus on the range of stress triaxiality between $-1/3 < \eta < 1/3$ (shear/compression or shear/tensile), which is not appropriate for low stress triaxility ($\eta < -1/3$). But in the spinning forming process, especially for tube spinning, the stress triaxiality is usually lower than -1/3. Although different ductile fracture criteria have been used to explain the damage evolution during the spinning process, there is no common fracture model which could predict types of fracture and reasonably characterize the fracture zone in tube spinning. In this contribution, a modified GTN model was proposed to predict the ductile fracture during the tube spinning process, wherein the void volume fraction and shear damage evolution were assessed. Through comparing the rupture limit prediction with experimental results, the modified GTN model could accurately predict damage evolution and fracture location in the