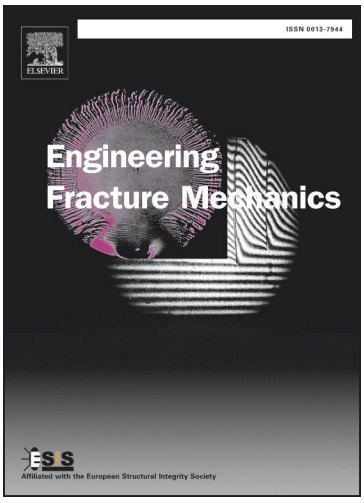

Prediction of Ductile Fracture for Metal Alloys Using a Shear Modified Void Growth Model

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Prediction of Ductile Fracture for Metal Alloys Using a Shear Modified Void Growth Model

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Abstract

Shear stress ratio have recently been recognized as an important parameter, in addition to stress triaxiality, that influences the initiation of ductile fracture in metals. In this paper, the roles of stress triaxiality and shear stress ratio in the micro-mechanisms of ductile fracture are first discussed. A modified ductile fracture model coupling both stress triaxiality and shear stress ratio is then proposed. The model is developed based on the Rice-Tracey and modified maximum shear stress models. Parametric studies are performed to demonstrate the behaviors of the model parameters. The proposed model is applied to construct the fracture loci of four types of metal alloys: aluminum 2024-T351, aluminum 6061-T6, ASTM A572 Gr. 50 steel and AISI 1045 steel. The predicted results are in good agreement with the experimental data over a wide range of triaxialities. Comparison between the proposed model and several popular fracture criteria is also provided, and the results indicate that the proposed model has significant potential to predict ductile fracture at both low and high triaxialities.

Keywords: Ductile fracture, Metal alloys, Void growth, Stress triaxiality, Shear stress ratio

1. Introduction

Prediction of ductile fracture in crack-free bodies has been of great interest and extensively studied during recent decades. Starting with the micro-

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