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by

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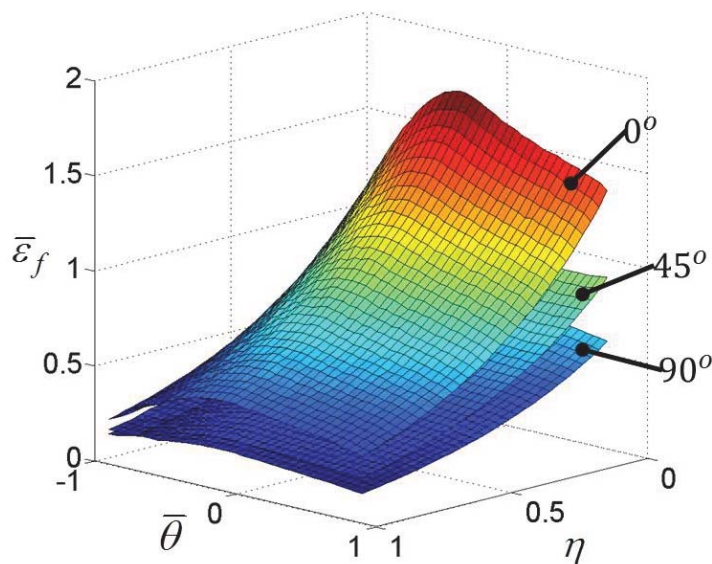
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Abstract

The anisotropic ductile fracture of AA6260-T6 extruded aluminum alloy profiles is studied within a phenomenological framework. A basic fracture testing program covering a wide range of stress states and three distinct material orientations (i.e. 0°, 45° and 90°) with respect to the extrusion direction) is carried out. It comprises notched tensile specimens, tensile specimens with a central hole, butterfly shear specimens and circular punch specimens. The surface strain fields are determined using Digital Image Correlation (DIC), while a finite element simulation is performed of each experiment to determine the local stress and strain histories at the material point where fracture initiates. The experimental-numerical analysis reveals a strong anisotropy of the present material ductility/fracture, which cannot be approximated by existing isotropic fracture models. A new non-associated anisotropic fracture model is proposed incorporating the stress state dependent Modified Mohr-Coulomb (MMC) weighting function and a material direction sensitive damage rule. All seven fracture model parameters are identified for the present extruded aluminum using an inverse method. The good agreement of the model predictions with the results from fourteen distinct experiments demonstrates the remarkable predictive capabilities of the proposed model.

Keywords: Ductile fracture, aluminum extrusions, anisotropy, Modified Mohr-Coulomb, stress triaxiality, Lode angle
