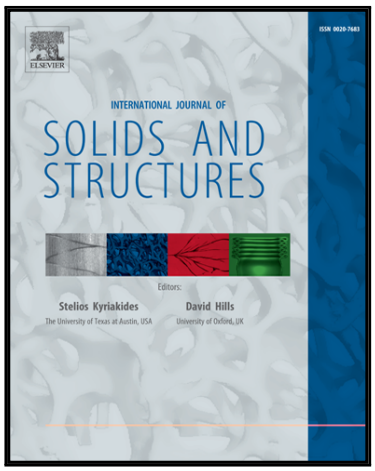

Experimental and modelling study of fatigue crack initiation in an aluminium beam with a hole under 4-point bending

Wenye Ye, Panos Efthymiadis, Christophe Pinna, Anxin Ma, Barbara Shollock, Richard Dashwood

PII: S0020-7683(18)30002-7
DOI: 10.1016/j.ijsolstr.2018.01.001
Reference: SAS 9850

To appear in: *International Journal of Solids and Structures*

Received date: 16 May 2017
Revised date: 30 October 2017
Accepted date: 4 January 2018

Please cite this article as: Wenye Ye, Panos Efthymiadis, Christophe Pinna, Anxin Ma, Barbara Shollock, Richard Dashwood, Experimental and modelling study of fatigue crack initiation in an aluminium beam with a hole under 4-point bending, *International Journal of Solids and Structures* (2018), doi: 10.1016/j.ijsolstr.2018.01.001

Experimental and modelling study of fatigue crack initiation in an aluminium beam with a hole under 4-point bending

Wenye Ye[a,b], Panos Efthymiadis[b], Christophe Pinna[c], Anxin Ma[a], Barbara Shollock[d], Richard Dashwood[e]

[a] *Interdisciplinary Centre for Advanced Materials Simulation, Ruhr-University Bochum, Universitätsstr. 90 a, 44789 Bochum, Germany*
[b] *Warwick Manufacturing Group, International Manufacturing Centre, University of Warwick, Coventry CV4 7AL, UK, previously in the Department of Mechanical Engineering, the University of She-ffield, Mappin Street, Sheffield S1 3JD, UK*
[c] *Department of Mechanical Engineering, The University of Sheffield, Mappin Street, Sheffield S1 3JD, UK*
[d] *Warwick Manufacturing Group, Warwick University, Coventry, CV4 7AL, UK*
[e] *Vice Chancellor's Office, Coventry University, Coventry, CV1 5FB, UK*

Abstract

Slip bands and crack initiations were investigated by in-situ experiments and nonlocal CPFEM simulations systematically. Experimental techniques including EBSD, digital image correlation (DIC) and SEM have been used to obtain consistent grain orientations, local strain, as well as slip bands and microcracks in the same area of the sample surface. The realistic microstructure based on EBSD map has been generated and used for finite element modelling. An advanced nonlocal crystal plasticity model, which considers the isotropic hardening and kinematic hardening of plastic strain gradient, has been adopted. The simulation results match experimental results well from many aspects. It was found that total strain and averaged slip on slip

Email address: P.Efthymiadis@warwick.ac.uk (Panos Efthymiadis)