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Ductile Fracture Initiation with Consideration of Strain Concentration and Stress Triaxiality near Crack Fronts in Compact Tension Specimens of Hydrided Irradiated Zr-2.5Nb Materials with Split Circumferential Hydrides

Shin-Jang Sung, Jwo Pan, Poh-Sang Lam, Douglas A. Scarth

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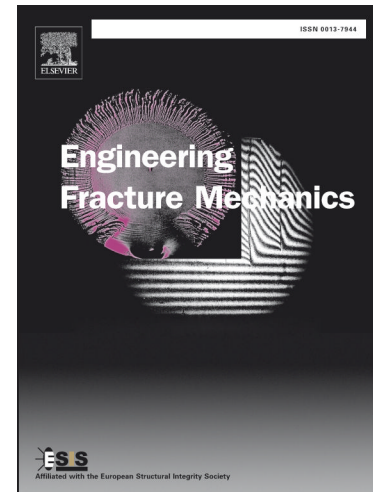
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Ductile Fracture Initiation with Consideration of Strain Concentration and Stress Triaxiality near Crack Fronts in Compact Tension Specimens of Hydrided Irradiated Zr-2.5Nb Materials with Split Circumferential Hydrides

Shin-Jang Sung and Jwo Pan*
Mechanical Engineering, University of Michigan
Ann Arbor, MI, USA

Poh-Sang Lam
Savannah River National Laboratory
Aiken, SC, USA

Douglas A. Scarth
Kinectrics Inc.
Toronto, ON, Canada

October 13, 2017

ABSTRACT

Ductile fracture initiation with consideration of strain concentration and stress triaxiality near crack fronts in compact tension specimens of hydrided irradiated Zr-2.5Nb materials with split circumferential hydrides is investigated by three-dimensional finite element analyses. The results indicate that plastic strain concentration is observed in the middle of the ligaments ahead of the crack front. A strain-based failure criterion with consideration of stress triaxiality is developed from the Gurson yield model. With the failure criterion, the necessary fraction of the load for crack initiation is about 0.60 to 0.70 to fracture the ligaments when compared to that for a CT specimen without split circumferential hydrides.

KEYWORDS: Zr-2.5Nb; hydrides; fracture initiation; stress triaxiality; failure criterion

* Corresponding author: Tel.:+1-734-764-9404; fax:+1-734-647-3170
E-mail address: jwo@umich.edu (J. Pan)

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