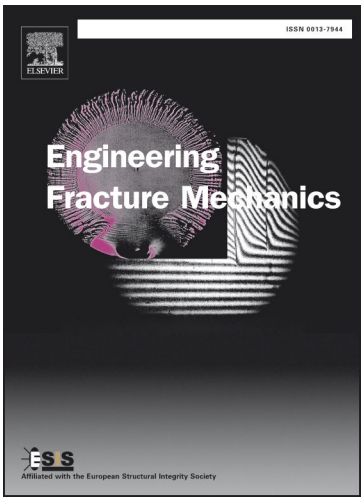

Ultra-low cycle fatigue life of aluminum alloy and its prediction using monotonic tension test results

Ping Xiang, Liang-Jiu Jia, Mingzhe Shi, Minger Wu

PII: S0013-7944(17)30913-X
DOI: https://doi.org/10.1016/j.engfracmech.2017.11.006
Reference: EFM 5744

To appear in: *Engineering Fracture Mechanics*

Received Date: 4 September 2017
Revised Date: 2 November 2017
Accepted Date: 3 November 2017

Please cite this article as: Xiang, P., Jia, L-J., Shi, M., Wu, M., Ultra-low cycle fatigue life of aluminum alloy and its prediction using monotonic tension test results, *Engineering Fracture Mechanics* (2017), doi: https://doi.org/10.1016/j.engfracmech.2017.11.006

Ultra-low cycle fatigue life of aluminum alloy and its prediction using monotonic tension test results

Ping Xiang[1]; Liang-Jiu Jia[2,*]; Mingzhe Shi[3]; Minger Wu[4]

Abstract: Ultra-low cycle fatigue (ULCF) life of ductile metal is closely correlated with monotonic tension coupon test results. This paper aims to propose a novel approach to evaluate crack initiation of aluminum alloy under ULCF loading only with monotonic tension coupon test results. ULCF tests on 15 specimens made of aluminum alloy 6061-T6 were conducted, and numerical analyses using a previously proposed cyclic void growth model indicated that the ULCF life of aluminum can be greatly underestimated by the model. A new fracture model based on the concept of different dislocation structures is thus proposed, which classifies damage into kinematic hardening correlated and isotropic hardening correlated. A material constant is employed to consider the relatively low damage induced by the kinematic hardening compared with the isotropic hardening one. The newly proposed fracture model can well simulate the instants of crack initiation for the specimens. A process to evaluate the ULCF life of aluminum alloy based on both monotonic coupon test results and simple numerical analysis is presented.

Keywords: ultra-low cycle fatigue; ductile fracture; damage; crack initiation; aluminum alloy 6061-T6

[1] Assistant Professor, Department of Structural Engineering, College of Civil Engineering, Tongji University, Siping Road, Shanghai 200092, China
[2] Research Institute of Structural Engineering and Disaster Reduction, College of Civil Engineering, Tongji University, Siping Road, Shanghai 200092, China (Corresponding author), Email: lj_jia@tongji.edu.cn
[3] PhD candidate, Department of Structural Engineering, College of Civil Engineering, Tongji University, Siping Road, Shanghai 200092, China
[4] Professor, Department of Structural Engineering, College of Civil Engineering, Tongji University, Siping Road, Shanghai 200092, China