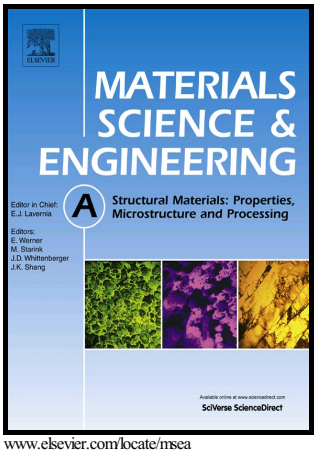
Author's Accepted Manuscript

Dislocation theory-based cohesive model for microstructurally short fatigue crack growth

Shardul Panwar, Veera Sundararaghavan



www.elsevier.com/locate/msea

PII: S0921-5093(17)31256-X
DOI: http://dx.doi.org/10.1016/j.msea.2017.09.087
Reference: MSA35554

To appear in: *Materials Science & Engineering A*

Received date: 30 August 2017
Revised date: 19 September 2017
Accepted date: 20 September 2017

Cite this article as: Shardul Panwar and Veera Sundararaghavan, Dislocation theory-based cohesive model for microstructurally short fatigue crack growth, *Materials Science & Engineering A,* http://dx.doi.org/10.1016/j.msea.2017.09.087

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting galley proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

ACCEPTED MANUSCRIPT

Dislocation theory-based cohesive model for microstructurally short fatigue crack growth

Shardul Panwar*, Veera Sundararaghavan[1,*]

Abstract

A continuous representation of dislocations is used to represent a mode-II crack and the associated plastic zone. In the original formulation of dislocation theory, the friction stress that opposes the motion of the dislocations is represented by a constant stress. In our new formulation, we embed a cohesive zone in the plastic region in front of a crack tip by representing the friction stress as a function of the crack displacement. This allows cohesive zone models (obtainable from a lower scale simulation, such as molecular dynamics) to be integrated into a dislocation theory-based model, for the first time, to predict short crack growth. The details of this new formulation are shown for the two cases: the crack and the associated plastic zone inside a grain, and the crack and the associated plastic zone tip at the grain boundary. The main features of this new model are discussed along with an experimental comparison to the case of microstructurally short fatigue crack growth across two grains in a Ni-based CMSX-4 alloy.

Keywords: dislocation theory, short crack growth, cohesive zone model, microstructure

Accepted manuscript

Introduction

In the last couple of decades, the area of short fatigue crack growth has generated a lot of interest. This is due to the availability of modern experimental techniques, such as X-ray Tomography and Focused Ion Beam

*Department of Aerospace Engineering, University of Michigan, Ann Arbor, MI, 48105, USA

URL: umich.edu/~veeras (Veera Sundararaghavan)

[1]Corresponding author, Associate Professor, veeras@umich.edu

Download English Version:

https://daneshyari.com/en/article/5455134

Download Persian Version:

https://daneshyari.com/article/5455134

Daneshyari.com