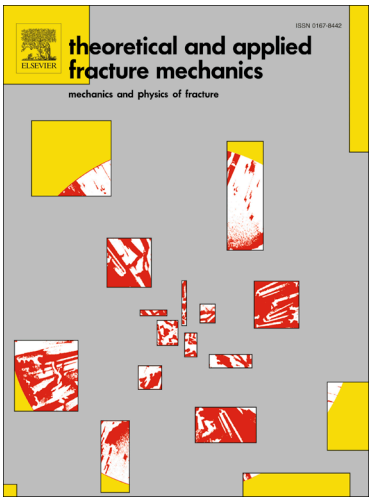

Analysis of semi-elliptical surface cracks in the interface of bimaterial plates under tension and bending

Zheng Liu, Xu Chen, Dunji Yu, Xin Wang

PII: S0167-8442(17)30151-9
DOI: http://dx.doi.org/10.1016/j.tafmec.2017.07.019
Reference: TAFMEC 1924

To appear in: *Theoretical and Applied Fracture Mechanics*

Received Date: 28 March 2017
Revised Date: 17 July 2017
Accepted Date: 17 July 2017

Please cite this article as: Z. Liu, X. Chen, D. Yu, X. Wang, Analysis of semi-elliptical surface cracks in the interface of bimaterial plates under tension and bending, *Theoretical and Applied Fracture Mechanics* (2017), doi: http://dx.doi.org/10.1016/j.tafmec.2017.07.019

Analysis of semi-elliptical surface cracks in the interface of bimaterial plates under tension and bending

Zheng Liu[a], Xu Chen[a], Dunji Yu[a] and Xin Wang[a, b, *]

[a] School of Chemical Engineering & Technology, Tianjin University, Tianjin 300072, China

[b] Department of Mechanical and Aerospace Engineering, Carleton University, Ottawa, Ontario, K1S 5B6, Canada

*corresponding author: email: xin.wang@carleton.ca; Tel:+1-613-520-2600X8308

Revised for publication in *Theoretical and Applied Fracture Mechanics*

July 2017

Abstract: A semi-elliptical surface crack widely exists in the multilayered electronic devices, fibre reinforced laminated composites and solder joints. To ensure the safety of these structural components, three-dimensional interface fracture mechanics analysis is required. In this study, three-dimensional finite element analyses have been conducted to calculate the fracture mechanics parameters, including the stress intensity factors (SIFs), the strain energy release rate G and two phase angles ψ and φ for semi-elliptical interface surface cracks in finite thickness plates. A wide range of crack aspect ratios and relative depths are considered. The SIF computations are presented along the front of a three-dimensional bimaterial interface cracks with a/t values of 0.2, 0.4, 0.6 or 0.8 and a/c values of 0.2, 0.4, 0.6 or 1.0. In particular, far-field loads i.e., remote tension and bending, and various combinations of materials are investigated. These fracture mechanics parameters' solutions are suitable for fracture and fatigue life prediction for semi-elliptical bi-material interface surface cracks in engineering components.

Keywords: Interface cracks; Stress intensity factors; Strain energy release rate; Three-dimensional finite element analysis; semi-elliptical surface crack.