Accepted Manuscript

Strength and toughness in shear of constrained layers

Anders Biel, Ulf Stigh

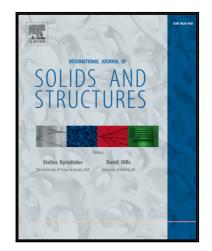
PII:S0020-7683(17)30579-6DOI:10.1016/j.ijsolstr.2017.12.028Reference:SAS 9846

To appear in: International Journal of Solids and Structures

Received date:18 March 2017Revised date:22 December 2017Accepted date:23 December 2017

Please cite this article as: Anders Biel, Ulf Stigh, Strength and toughness in shear of constrained layers, *International Journal of Solids and Structures* (2017), doi: 10.1016/j.ijsolstr.2017.12.028

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 proof before it is published in its final 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.



Strength and toughness in shear of constrained layers

Anders Biel & Ulf Stigh

University of Skövde, SE-541 28 Skövde, Sweden

Abstract

Confined layers may fracture in shear. This occurs, for example in adhesive joints and composite materials. A common mechanism for shear fracture is the formation of shear hackles associated with an expansion of the layer. This makes shear toughness and strength depend on the constraint of the expansion. By constraining the expansion using external loading in experiments, the expansion is reduced but not totally inhibited. The experiments are evaluated using the path independent properties of the *J*-integral. It is shown that the shear toughness increases for the more constrained case. Thus, from a strength analysis perspective, ignoring the expansion leads to a conservative estimate of the fracture properties. Extrapolation of the evaluated properties to totally inhibited expansions gives the traction separation relation and the fracture toughness for a layer in simple shear.

Key words: adhesive; cohesive law; cohesive layer; constrain; dilatation; mode II; shear fracture; shear hackles; simple shear

Nomenclature

- *a* Unbounded length of specimen
- *b* Width of layer
- *c* Position of the compressive load
- *h* Height of substrate
- *m* Length parameter
- t Thickness of layer
- *u* Strain energy per unit volume
- v, v_0 Shear deformation; with subscript 0 indicating the value at the start of the layer
- w, w_0 Normal deformation; with subscript 0 indicating the value at the start of the layer
- *B* Width of substrate
- *E* Young's modulus of the substrates
- *F* Applied force

Download English Version:

https://daneshyari.com/en/article/6748359

Download Persian Version:

https://daneshyari.com/article/6748359

Daneshyari.com