Effects of microstructure on antiplane crack growth in couple stress elastic materials

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The problem of a rectilinear antiplane crack dynamically propagating in an elastic solid with microstructures is investigated in the present work. The material behavior is described by the indeterminate theory of couple stress elasticity. By including the characteristic lengths in bending and torsion, this model is able to account for the underlying microstructure as well as for the size effects arising at small scales. Therefore, this model is suitable for the investigation of the crack-tip fields. The stationary full-field solution, obtained by using Fourier transforms and Wiener-Hopf technique [1], showed that the shear stress occur with negative sign within a small zone ahead of the crack tip. This zone has limited physical relevance and disappears for vanishing characteristic length in torsion. Outside this zone, the shear stress attains a maximum, whose magnitude can be adopted as a measure of the critical stress level for crack advancing. The corresponding fracture criterion defines a critical stress intensity factor, which increases with the characteristic length in torsion. In the proposed research the analysis will be extended in order to investigate the effects of crack speed and inertia terms on the stress and deformation fields near a crack propagating in materials with microstructures.

1. Radi, E. 2008 *Effects of the characteristic lengths ratio on mode III crack in couple stress elastic materials.* Int. J. Solids Struct. 45 (10), 3033–3058.