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Analysis of intersonic crack growth in unidirectional fiber-reinforced composites. (English)

Zbl 0963.74050

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From the summary: For unidirectional fiber-reinforced graphite/epoxy composite materials, we obtain the asymptotic fields near an intersonically propagating crack tip. It is shown that mode-I intersonic crack propagation is impossible because the crack tip energy release rate supplied by the elastic asymptotic field is negative and unbounded, which is physically unacceptable since a propagating crack tip cannot radiate out energy. For mode II, however, we establish that there exists a single crack tip velocity (higher than the shear wave speed) that gives a finite and positive crack tip energy release rate. At all other intersonic crack tip speeds the energy release rate supplied by the elastic asymptotic field is identically zero. This critical crack tip velocity agrees well with the stable crack tip velocity observed in experiments.

MSC:

74R10 Brittle fracture

74E30 Composite and mixture properties

74H35 Singularities, blow-up, stress concentrations for dynamical problems in solid mechanics

74H10 Analytic approximation of solutions (perturbation methods, asymptotic methods, series, etc.) of dynamical problems in solid mechanics

Cited in **1** Review
Cited in **9** Documents

Keywords:

mode II crack; unidirectional fiber-reinforced graphite/epoxy composite; mode-I intersonic crack propagation; crack tip energy release rate; elastic asymptotic field

Full Text: [DOI](#)

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