Crack Propagation in an Interface Between an Elastic Substrate and a Visco-Plastic Crystalline Material Considering Mixed Mode Loading

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ABSTRACT

In this work, crack propagation in a weak interface between two different materials, being one elastic and the other a visco-plastic crystal, is studied in plain-strain. In the crystal, material is modeled by a large deformation higher-order visco-plasticity theory [1] where hardening is associated to geometrically necessary dislocations. Effective crystal systems associated to CFC are determined [2]. Crack propagation is modeled by a cohesive zone model [3]. As hardening increases stresses near the crack tip, consideration of the effects of the geometrically necessary dislocations results in a substantial modification of the crack growth resistance for fixed intrinsic fracture properties. The distance ahead of the crack tip where geometrically necessary dislocations modify stress distributions is computed. The present work also explores the consequences of the introduction of mode II loading [4] on the fracture behavior. The effects of the nature of the hardening, dissipative or energetic, are also considered.

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