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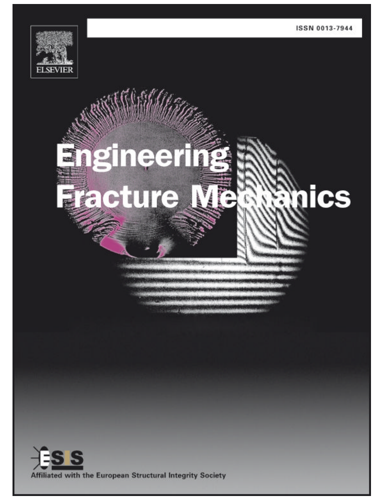

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Fracture toughness of adhesively bonded joints with large plastic deformations

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Abstract

An elastoplastic fracture mechanics model is formulated for determining the fracture toughness of adhesively bonded joints (ABJs) with large plastic deformation and elastic springback. The analysis is made on the basis of the post-fracture configuration of double cantilever beam (DCB) specimen consisting of two adhesively bonded thin plates of ductile metals (*e.g.*, thin aluminum alloy or mild steel plates). Due to the springback after large plastic deformation, the post-fracture configuration of the adherends was noticeably different from that at the peak loading. To model the fracture process, the ductile metal adherends are treated as elastoplastic solids with power-law strain-hardening behavior, and springback of the adherends is considered in the strain energy calculation. The present model is capable of determining the fracture toughness of ABJs with extensive plastic deformation. Numerical simulations are performed to evaluate the effects of material parameters and specimen geometries on the springback and fracture toughness of the ABJs. Compared to the experimental data available in the literature, the present model can predict reliable fracture toughness of ABJs with large plastic deformations. The present study is applicable for the analysis of various fracture tests of thin ductile films with large plastic deformations and elastic springback such as peeling test, metal cutting, etc.

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