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Phase field modeling of crack propagation in double cantilever beam under Mode I

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ABSTRACT

A smeared crack approach using a phase-field approach to fracture with unilateral contact condition was used to study the stress distribution and crack propagation in a double cantilever beam (DCB) specimen. The parameters in the numerical model were informed from atomistic simulations and validated with experimental data for poly(methyl methacrylate) that included data for damage initiation under different levels of volumetric and deviatoric stress components and fracture toughness measurements obtained under Mode I conditions. The phase field model includes two quantities, a length scale that controls the width of the crack and the critical fracture energy density. The study considered a sensitivity analysis of the influence of these two parameters to obtain optimal values. Experiments and simulations of DCB are shown to study the toughness of polymer and polymer composite specimens that include residual stresses developed in the specimen during cure.