

Abstract Submitted
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Mode I Failure of Armor Ceramics: Experiments and Modeling

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The pre-notched edge on impact (EOI) experiment is a technique for benchmarking the damage and fracture of ceramics subjected to projectile impact. A cylindrical projectile impacts the edge of a thin rectangular plate with a pre-notch on the opposite edge. Tension is generated at the notch tip resulting in the initiation and propagation of a mode I crack back toward the impact edge. The crack can be quantitatively measured using an optical method called Digital Gradient Sensing, which measures the crack-tip deformation by simultaneously quantifying two orthogonal surface slopes via measuring small deflections of light rays from a specularly reflective surface around the crack. The deflections in ceramics are small so the high speed camera needs to have a very high pixel count. This work reports on the results from pre-crack EOI experiments of SiC and B₄C plates. The experimental data are quantitatively compared to impact simulations using an advanced continuum damage model. The Kayenta ceramic model in Alegra will be used to compare fracture propagation speeds, bifurcations and inhomogeneous initiation of failure will be compared. This will provide insight into the driving mechanisms required for the macroscale failure modeling of ceramics.

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