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SIMULATION OF EDGE-ON IMPACT EXPERIMENTS IN SIC AND B4C WITH "INITIALLY RIGID" COHESIVE ELEMENTS

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Edge-on impact (EOI) experiments are used to visualize dynamic fracture in brittle materials, the results, such as crack propagation velocities and cracking patterns, serve as validation for numerical models [1]. In this contribution, we present a numerical methodology which has been recently developed by Knell [2] and its application to the simulation of EOI tests on a silicon carbide and boron carbide ceramics, [1], [3]. The methodology is based on a simple isotropic elastic description of the ceramic, combined with dynamically inserted ("initially rigid") interface cohesive elements to represent discrete cracks (Camacho, 1996), a contact algorithm and a discretization with tetrahedral elements. Our 3D implementation is capable of simulating multiple cracking and fragmentation. A similar method has recently been used in grain scale analyses (Clayton et al., 2012), however, grains are not explicitly represented in our approach. Although there are only few material parameters for the ceramic including the cohesive zone model, the model reproduces many of the experimental observations in this specific type of test, such as crack path orientations and the occurrence of damage ahead of the coherent crack front propagating continuously from the impacted edge. We present qualitative and quantitative comparisons between simulation and experiments for cracking patterns and crack velocities at different impact velocities for both material, and will also discuss the influence of the mesh size for the current approach.

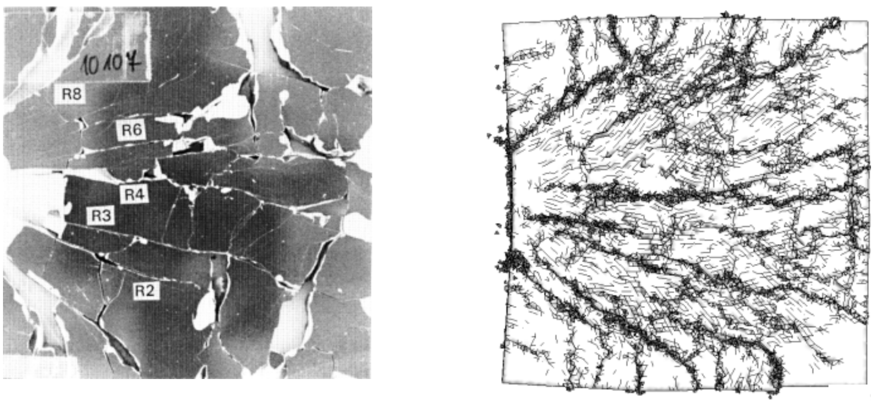

Figure 1: Result of an Edge-on impact experiment with SiC (Impact Velocity 85 m/s) [1] (left), simulation showing fully evolved cracks and damage (right).

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