

## **Experiments and Numerical Simulations of Initiation and Growth of Cracks Under Mixed Mode I + III Loading**

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The problem of initiation and growth of cracks under combined mixed-mode I+III loading has received much attention in the literature over the past few decades both from experiments and analysis, but suitable failure criteria are still not available. Specifically, the existence of a threshold ratio of mode III to mode I stress intensity factors below which fragmentation of the crack front (formation of daughter cracks) does not occur has been debated and the length scale associated with the spacing of the fragments when they do occur are still under debate. The continued growth of cracks under remote mode I + III loading is also of interest; it is observed that in some cases the fragmented cracks coalesce, while in others they maintain their independent development. We approach this problem through carefully designed experiments on polymers and gels to examine the physical aspects of crack initiation and growth. This is then explored further through numerical simulations of the stress state that explore the influence of perturbations on the formation of daughter cracks. Finally, the direct numerical simulation of crack initiation and growth is explored using a phase-field model.