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An interacting micro-crack damage model for brittle failure: Experiments and Modeling[1] BHASKER PALIWAL, KALIAT T. RAMESH, Johns Hopkins University, JAMES W. MCCAULEY, US Army Research Laboratory — Experimental observations using high-speed photography, on a transparent polycrystalline ceramic undergoing compressive loading* have demonstrated that the interaction among the growing micro-cracks has a profound influence on the failure behavior of brittle materials, particularly under dynamic loading. We model the failure process with distributed inhomogeneities subjected to varying strain rates and pressure. Interactions among the cracks is modeled by means of a 'crack-matrix-effective medium' approach in which the cracks experiences a stress field different from that acting on isolated cracks. Load induced damage in the material is defined as a scalar crack density parameter whose evolution is a function of the existing flaw distribution and the crack growth dynamics. The model provides a natural prediction of a peak stress and also of a transition strain rate, beyond which the compressive strength increases dramatically with the imposed strain-rate. The influences of the crack growth dynamics, flaw distribution, imposed strain-rate and confining pressure on the constitutive response and the damage evolution are also studied..*B. Paliwal, K.T. Ramesh, J.W. McCauley, J. Amer. Ceram. Soc.(2006).

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