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Computational Design Study for Recovery of Shock Damaged Silicon Carbide KAUSHIK IYER, DATTATRAYA DANDEKAR, US Army Research Laboratory — Recovery of shock-damaged specimens of technologically important brittle materials is desirable for relating damage characteristics to the load-unload history. Recovery also provides an opportunity for direct measurement of mechanical properties of the damaged material by performing a second shock experiment. Specimens subjected to standard mechanical characterization tests, e.g. low-rate compression, split Hopkinson pressure bar or plate impact, typically fail explosively and produce highly fragmented debris which makes the relation the load history to recognizable damage features difficult. Definitive data and constitutive models for the residual strength of dynamically impacted ceramics are presently lacking for this reason. This paper presents a computational design study of experimental configurations that may permit the recovery of weak-shock loaded high-strength ceramics such as silicon carbide and alumina. A set of 8 configurations involving nominally planar shock loading ($\sim$ 4 GPa) and a system of impedance matched or impedance graded momentum traps is analyzed using finite element models. Differences in the principal stress and lateral strain histories at a number of locations within the silicon carbide or alumina specimen are examined to identify the influences of the following design modifications: introducing a hole in the specimen center, configuration dimensions and impedance graded trapping.

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