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Strength of Shocked Aluminum Oxynitride J. ZHU, R. FENG, University of Nebraska-Lincoln, D.P. DANDEKAR, US Army Research Laboratory —
Aluminum oxynitride (AlON) is a polycrystalline and transparent ceramic. An accurate characterization of its shock response is critically important for its applications as transparent armor. Shock wave profiles measured in a series of plate impact experiments on AlON [Thornhill, et al., SCCM-2005, 143-146 (2006)] have been reanalyzed using finite element wave propagation simulations and considering an effective strength behavior that is pressure- and time-dependent. The results show a stiffer shock response than that calculated previously using the jump conditions. The material has a Hugoniot elastic limit of 10.37 GPa and sustains a maximum shear stress of 4.38 GPa for shock compressions up to a shock stress of 96 GPa. The mean stress response determined from the simulations displays no sign of phase transformation and corresponds to a linear shock speed-particle velocity relation with a slope of 0.857. These results have been successfully summarized into an AlON material model consisting of compression-dependent nonlinear elasticity, pressure-dependent equilibrium strength, and over-stress relaxation. The wave profiles simulated with the model show very good agreement with the experimental measurements.

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