Abstract Submitted
for the SHOCK19 Meeting of
The American Physical Society

Modeling High Rate Stress Upturn for Brittle Materials YEHUDA PARTOM, Retired — High rate stress upturn in ductile materials for strain rates between 10^3 and 10^4/s has been known since the 1980s, and previously we've shown how to model this behavior, based on our overstress approach to dynamic viscoplasticity. It turns out that brittle materials also undergo high rate stress upturn, but at a lower strain rate of 1-10/s. Most available data on high rate stress upturn of brittle materials are for concrete (from obvious reasons), and they are usually represented as DIF (strain rate), where DIF=Dynamic Increase Factor. Here we model high rate stress upturn for brittle materials using our overstress brittle response (OBR) model. Our OBR model includes: 1) damage onset function for both compression and tension; 2) damage accumulation rate as function of overstress; 3) damage onset reduction as function of damage level down to the fully damaged state; 4) plastic flow of the fully damaged material as for a granular material; and 5) finite limit of the damage accumulation rate. This last item stems from the finite rate of fracturing, and from the finite speed of crack growth, and it turns out that this is the feature that leads to the high rate stress upturn response. To demonstrate how our model works, we compute several examples in cylindrical symmetry, with different ratios of axial to radial flow velocities.

Yehuda Partom
Retired

Date submitted: 19 Feb 2019 Electronic form version 1.4