Abstract Submitted
for the SHOCK19 Meeting of
The American Physical Society

Dynamic Strength of Soda-Lime Glass at High Pressures and Strain Rates[1] CHRISTIAN KETTENBEIL, ZEV LOVINGER, Caltech, TONG JIAO, RODNEY CLIFTON, Brown University, GURUSWAMI RAVICHANDRAN, Caltech — Understanding the behavior of silica glasses at high pressures and strain rates is of great importance for geological processes and highly relevant to many technological applications including high-powered laser-matter interactions in optical elements and impact/blast damage in defense systems. A high-pressure pressure-shear plate impact (HP-PSPI) experimental technique is developed and applied to the investigation of the dynamic strength of soda-lime glass. Sample layers with thicknesses of 5-300 μm, sandwiched between high-impedance tungsten carbide plates, are impacted at skew angles of 16 and 18 degrees. A forward analysis method, based on finite element simulations, is employed to match the experimentally observed sample response while considering the inelastic deformation of the utilized tungsten carbide anvils. A constitutive law for soda-lime glass has been developed, which transitions the material strength from an intact value of 2.8 GPa below pressure-dependent characteristic strains of 10-30% to a failed granular state following extensive inelastic shear deformation. The proposed rate independent material description accurately predicts the measured response during HP-PSPI experiments over a wide range of normal stresses (9-21 GPa) and strain rates ($3x10^5$-$2x10^7$ /s).

[1]Office of Naval Research

Christian Kettenbeil
Caltech

Date submitted: 19 Mar 2019 Electronic form version 1.4