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Time dependent inelastic deformation of shocked soda-lime glass

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Shock wave compression of soda-lime glass (SLG) has received considerable attention in recent years. To understand inelastic deformation in shocked soda-lime glass between 3 and 10.8 GPa, we have carried out plate impact experiments. In-material, time-resolved, measurements were obtained using longitudinal and lateral stress gauges (4.6 to 10.8 GPa), and electromagnetic particle velocity gauges (2.9 to 6 GPa) at comparable sample thicknesses. The 4.6 and 6 GPa experiments revealed time-dependent inelastic response along with time-dependent loss of material strength. The combination of our experimental results and related analyses demonstrate that previous interpretations of shocked SLG response in terms of a propagating failure wave are not valid. At higher peak stresses ($\sim$ 10GPa), the SLG results do not display time-dependent strength loss. The shock response of SLG over the 4-10GPa range is complex and depends significantly on the peak stress. The experimental results and simulations from a phenomenological continuum model will be discussed. Work supported by DOE. Much of this work was carried out by Dr. Hari Simha.