Shock wave properties of polymethylmethacrylate: Shock compressibility and temperature

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Understanding the shock-wave response of polymethylmethacrylate (PMMA) is important, as this material is used in various explosive devices. In particular, two-staged devices for explosive launching of plates (sloika), and Mach conical and cylindrical cumulative shock wave generators can be noticed. The principal shock adiabat of PMMA has been well studied in the range of pressures up to 100 GPa, but there are only a few data points at higher pressures, obtained under conditions of an underground nuclear explosion (120, 200 and 500 GPa). Recently, Z-machine produced pressures up to 650 GPa in PMMA. This work provides an overview of experiments with Mach cumulative generators, where it was possible to determine the shock compressibility and temperature of shock wave front in PMMA. In the first type of experiments, the shock adiabat was determined by impedance matching with Quartz ethalone, while the temperature of the shock front was measured by fast optical pyrometry. In the second type of experiments, only the temperature and velocity of the shock front were measured, and the pressure was calculated using both our and existed dataset on Hugoniot of PMMA. The maximum obtained pressure in PMMA was up to 700 GPa. The temperatures of shock wave at such pressures have been obtained for the first time.