

Sound velocity measurement in shock-compressed fluoroplastic, epoxy resin and polycarbonate at 16–35 GPa

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In this work, three polymer materials were investigated (fluoroplastic, epoxy resin and polycarbonate). These materials, likely many other polymers, are utilized in airplane structure and used during gas-dynamic processing of special-purpose items. The study was aimed at obtaining the experimental data on sound velocity behind the shock wave front in the pressure range from 16 to 35 GPa in order to refine the equations of state of above-mentioned materials and to calibrate the existing mathematical models.

The paper presents the setups of explosive experiments and the data on sound velocity measurements in shock-compressed specimens of fluoroplastic F-4 (24–44 GPa), epoxy compound EC-34 (14–38 GPa) and polycarbonate PC-ET-3.5 (16–35 GPa) obtained by means of the rarefaction overtake technique. The photoelectric and the manganine gauge methods were used to measure sound velocity. The specimens were loaded by explosive loading devices based on powerful high explosives with steel impactor. The impactor velocities ranged from 2.7 to 4.8 km/s. The obtained experimental data is in good agreement with similar results obtained by other researchers within the experimental measurement error of 6–8%.