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Thin film metal thermistors with microsecond time response for shock temperature measurements of polymers NICHOLAS TAYLOR, DAVID WILLIAMSON, ANDREW JARDINE, SMF Fracture and Shock Physics Group, Cavendish Laboratory, JJ Thomson Avenue, Cambridge, CB3 0HE, UK — Equations of state can be used to predict the relationship between pressure, volume and temperature. However, in shock physics, they are usually only constrained by experimental observations of pressure and volume. Direct observation of temperature in a shock is therefore valuable in constraining equations of state. Bloomquist and Sheffield (1980, 1981) and Rosenberg and Partom (1984) have attempted such observations in PMMA. However, their results disagree strongly above 2 GPa shock pressure. Here we present an improved fabrication technique, to examine this outstanding issue. We make use of the fact that the electrical resistivity of most metals is a known function of both pressure and temperature. If the change in resistance of a thin metal thermistor gauge is measured during a shock experiment of known pressure, the temperature can be calculated directly. The time response is limited by the time taken for the gauge to reach thermal equilibrium with the medium in which it is embedded. Gold gauges of thickness up to 200 nm have been produced by evaporation, and fully embedded in PMMA. These reach thermal equilibrium with the host material in under 1 μs, allowing temperature measurement within the duration of a plate impact experiment.

Nicholas Taylor
SMF Fracture and Shock Physics Group, Cavendish Laboratory,
JJ Thomson Avenue, Cambridge, CB3 0HE, UK

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