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Stress wave propagation and mitigation in two polymeric foams PIERRE PRADEL, FREDERIC MALAISE, BAPTISTE CADILHON, JEAN-HUGUES QUESSADA, CEA CESTA, 15 avenue des Sablieres CS60001, 33116 Le Barp Cedex, France, THIBAUT DE RESSEGUIER, Institut Pprime UPR3346 CNRS-Universite de Poitiers-ENSMA, 11 boulevard Marie et Pierre Curie, 86962 Futuroscope Chasseneuil Cedex, France, CATHERINE DELHOMME, CEA LR, BP 16, 37260 Monts, France, GAEL LE BLANC, CEA GRAMAT, BP 80200, 46500 Gramat, France — Polymeric foams are widely used in industry for thermal insulation or shock mitigation. This paper investigates the ability of a syntactic epoxy foam and an expanded polyurethane foam to mitigate intense (several GPa) and short duration ($<10^{-6}$ s) stress pulses. Plate impact and electron beam irradiation experiments have been conducted to study the dynamic mechanical responses of both foams. Interferometer Doppler Laser method is used to record the target rear surface velocity. A two-wave structure associated with the propagation of an elastic precursor followed by the compaction of the pores has been observed. The compaction stress level deduced from the velocity measurement is a good indicator of mitigation capability of the foams. Quasi-static tests and dynamic soft recovery experiments have also been performed to determine the compaction mechanisms. In the polyurethane foam, the pores are closed by elastic buckling of the matrix and damage of the structure. In the epoxy foam, the compaction is due to the crushing of glass microspheres. Two porous material models successfully represent the macroscopic response of these polymeric foams.

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