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Three-dimensional characterisation and simulation of deformation and damage during Taylor impact in PTFE A.D. RESNYANSKY, Defence Science and Technology Organisation, S.A. MCDONALD, P.J. WITHERS, School of Materials, University of Manchester, Manchester, M13 9PL, United Kingdom, N.K. BOURNE, J.C.F. MILLETT, AWE, Aldermaston, Reading, RG7 4PR. United Kingdom, E.N. BROWN, P.J. RAE, Los Alamos National Laboratory, Los Alamos, New Mexico, USA — Aerospace, defence and automotive applications of polymers and polymer matrix composites have placed these materials under increasingly more extreme conditions. It is therefore important to understand the mechanical response of these multi-phase materials under high pressures and strain rates. Crucial to this is knowledge of the physical damage response in association with the phase transformations during the loading and the ability to predict this via multi-phase simulation taking the thermodynamical non-equilibrium and strain rate sensitivity into account. The current work presents Taylor impact experiments interrogating the effect of dynamic, high-pressure loading on polytetrafluoroethylene (PTFE). In particular, X-ray microtomography has been used to characterise the damage imparted to cylindrical samples due to impact at different velocities. Distinct regions of deformation are present and controlled by fracture within the polymer, with the extent of the deformed region and increasing propagation of the fractures from the impact face showing a clear trend with increase in impact velocity. The experimental observations are discussed with respect to parallel multi-phase model predictions by CTH hydrocode of the shock response from Taylor impact simulations.

Anatoly Resnyansky
Defence Science and Technology Organisation

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