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Effect of Pulse Duration on Polytetrafluoroethylene Shocked Above the Crystalline Phase II–III Transition ERIC N. BROWN, GEORGE T. GRAY III, PHILIP J. RAE, CARL P. TRUJILLO, Los Alamos National Laboratory, Materials Science and Technology Division, NEIL K. BOURNE, AWE, UK —
We present an experimental study of crystalline structure evolution of polytetrafluoroethylene (PTFE) due to pressure-induced phase transitions in a semi-crystalline polymer using soft-recovery, shock-loading techniques coupled with mechanical and chemical post-shock analysis. Gas-launched, plate impact experiments have been performed on pedigreed PTFE 7C, mounted in momentum-trapped, shock assemblies, with impact pressures above and below the phase II to phase III crystalline transition. Below the phase transition only subtle changes were observed in the crystallinity, microstructure, and mechanical response of PTFE. Shock loading of PTFE 7C above the phase II–III transition was seen to cause both an increase in crystallinity from 38% to ∼53% (by Differential Scanning Calorimetry, DSC) and a finer crystalline microstructure, and changed the yield and flow stress behavior. We particularly focus on the effect of pulse duration on the microstructure evolution.

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