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An initial investigation of the sub-microsecond features of dynamic crack propagation in PMMA and the RDX-based explosive PBX 9205 PETER WASHABAUGH, University of Michigan, LARRY HILL, Los Alamos National Laboratory — A dynamic crack propagating in a brittle material releases enough thermal energy to produce visible light. The dynamic fracture of even macroscopically amorphous materials becomes unsteady as the crack propagation velocity approaches the material wave-speeds. The heat generated at a crack-tip, especially as it jumps, may be a mechanism to initiate a self-sustaining reaction in an energetic material. Experiments were conducted in specimens to simulate an infinite plate for 20 μs. The initial specimens were 152 mm square by 6 mm thick acrylic sheets, and were fabricated to study non-steady near-wave-speed crack propagation. A variant of this specimen embedded a 25 mm x 3 mm PBX 9205 pellet to explore the influence of dynamic Mode-I cracks in these materials. The crack was initiated by up to 0.2 g of Detasheet placed along a precursor 50 mm long notch, with a shield to contain the reaction products and prevent propagation along the fractured surfaces. The crack was studied by means of a streak camera and a Fourier-filter of the light reflecting off the newly minted surfaces. The sub-microsecond behavior of holes initiating, preceding and coalescing with the main crack were observed in the PMMA samples. The embedding and mechanical loading of explosives by this technique did not initiate a self-sustaining reaction in preliminary testing.

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