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Probing Shock-Initiation of Plastic-Bonded Explosives with a Tabletop Microscope LAWRENCE SALVATI, University of Illinois at Urbana-Champaign, WILL BASSETT, Lawrence Livermore National Laboratory, BELINDA JOHNSON, ZHIWEI MEN, DANA DLOTT, University of Illinois at Urbana-Champaign — Highly heterogeneous energetic materials like plastic-bonded explosives (PBX) are an important example of shock-initiated materials where both microscale and molecular factors couple to its shock-to-detonation transition. The complicated nature of this process necessitates high quality data on the nanosecond timescale, where the shock-to-detonation transition can be directly observed. We explore this time and space scale though a tabletop laser-driven flyer plate initiation process to generate 5-nanosecond shock waves over 40 to 165-micron distances of PBX. Using coupled spectroscopic probes, including nanosecond-scale particle velocity, emission spectroscopy and high-speed gated photography measurements, we probe shock-to-detonation transition of a PETN-based PBX under detonation success and failure conditions. Detonation success cases were characterized by a dramatic rise in bulk cooling rates and emissivity, likely attributed to creation and expansion of product gases. Failure cases were observed to have longer emission lifetimes whose initial hot spot growth can be observed by camera.

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