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Dynamic Loading to Study Damage Evolution in Heterogeneous Microstructures using IMPULSE at the Advanced Photon Source JOHN YEAGER, KYLE RAMOS, BRIAN JENSEN, DARLA GRAFF THOMPSON, Los Alamos National Laboratory, ADAM IVERSON, CARL CARLSON, National Security Technologies, LLC, KAMEL FEZZAA, Argonne National Laboratory, DAN HOOKS, Los Alamos National Laboratory — The performance, safety, and thermomechanical response of heterogeneous materials such as plastic-bonded explosives (PBXs) is inherently linked to microstructural phenomena. Experimental resolution of the physics and chemistry of the microstructure at appropriate length scales, both at ambient conditions and under dynamic loading, are highly desirable to develop new materials and models to predict their behavior. Here, the dynamic response of several heterogeneous materials is studied with real-time, *in situ*, spatially resolved measurements using the IMPULSE platform at the Advanced Photon Source (APS) at Argonne National Laboratory. Known PBX damage mechanisms such as void collapse, crack propagation, and plasticity or material flow are imaged at ultrafast speeds under shock loading conditions with simultaneous X-ray phase contrast imaging (PCI). PCI at APS beam line 32-ID is an improvement over radiography because it detects phase shifts in the transmitted X-ray beam, making PCI an ideal technique to image interfaces (i.e. heterogeneity) with high spatial resolution (2um) in-plane. IMPULSE experiments are compared with similar experiments at other length and time scales to discern relevant processing-structure-properties relationships for several PBX materials.

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