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Measurement of Carbon Condensates Using Small-Angle X-ray Scattering During Detonation of High Explosives TREVOR WILLEY, M. BAGGE-HANSEN, L. LAUDERBACH, R. HODGIN, S. BASTEA, L. FRIED, A. JONES, D. HANSEN, J. BENTEROU, C. MAY, T. VAN BUUREN, Lawrence Livermore National Laboratory, T. GRABER, Washington State University, B. JENSEN, Los Alamos National Laboratory, J. ILAVSKY, Argonne National Laboratory — The lack of experimental validation for processes occurring at sub-micron length scales on time scales ranging from nanoseconds to microseconds hinders detonation model development. Particularly, quantification of late-time energy release requires measurement of carbon condensation kinetics behind detonation fronts. A new small-angle x-ray scattering (SAXS) end station has been developed for use at The Dynamic Compression Sector to observe carbon condensation during detonation. We started with hexanitrostilbene (HNS) due to its stability, ease of initiation, vacuum compatibility, and oxygen deficiency. The endstation and beamline demonstrate unprecedented fidelity; the first SAXS data contains a clear Guinier knee and power law slope, giving information about the size and morphology of the resultant carbon nanoparticles. HNS detonation produces particles with an Rg of 2.7 nm in less than 400 ns, and this size is constant over the next several microseconds. This result with HNS differs dramatically compared with previous pioneering work on RDX/TNT and TATB, where observations indicate significant particle growth (>50%) continues over several microseconds. The power-law slope is consistent with sp^2 carbon. We have also begun to measure, and will present preliminary results on carbon condensates from Comp B, DNTF, and other explosives.

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