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Formation Pathways of Carbon Allotropes in Detonation Condensates MICHAEL NIELSEN, MICHAEL BAGGE-HANSEN, JOSH HAMMONS, LISA LAUDERBACH, RALPH HODGIN, SORIN BASTEA, LARRY FRIED, JONATHAN LEE, TONY VAN BUUREN, PHIL PAGORIA, CHADD MAY, Lawrence Livermore Natl Lab, SHAUL ALONI, Lawrence Berkeley National Lab, TREVOR WILLEY, Lawrence Livermore Natl Lab — Time-resolved small-angle scattering (TR-SAXS) data reveal evolution in the size and morphology of nano-carbon particles that form during the first microsecond during the detonation of high explosive (HE) materials, but do not provide chemical or phase information. Herein, we present analysis of complementary post-detonation soots collected with minimal environmental carbon or other contamination: HE samples are detonated whithin clean ice capture layers to yield aqueous dispersions of the carbonaceous soot. We report substantial variation in soots formed through the detonation of HE materials that attain a variety of temperatures and pressures during detonation. Transmission electron microscopy analysis of these recovered soots provides physical and chemical information that we compare directly to TR-SAXS data and SAXS measurements from recovered soots. We observe various structures including graphitic and amorphous carbon, nanodiamond, and spherical carbon onions. These experimental data correlate to models of how products from HE materials traverse the carbon phase diagram during detonation. Prepared by LLNL under Contract DE-AC52-07NA27344.

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