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Substructure Evolution in Energetic-Driven Spherically Shock-Loaded Copper L. SINISYNA, S. NOVIKOV, RFNC-VNIIEF, G.T. GRAY, E. CERRETA, B.L. HENRIE, M.F. LOPEZ, C.A. YABLINSKY, Los Alamos National Laboratory, MST-8, LOS ALAMOS NATIONAL LABORATORY TEAM, RFNC-VNIIEF, SAROV, RUSSIA TEAM — Post-shock-recovered metallurgical analysis of solid metal spheres shock loaded via spherical energetic(HE) loading provides a unique opportunity to quantify the substructure evolution in a material subjected to converging Taylor-wave (triangular-shock pulse) loading. In this paper detailed quantitative metallographic, orientation-imaging microscopy (OIM), and texture analysis is presented characterizing the gradient in substructure generated in Cu subjected to a spherical HE shock loading pulse at VNIIEF. The substructure in the recovered sphere is seen to include: 1) a spherical cavity generated in the center of the sphere due to shock-wave convergence and release, displaying ductile dimpled failure and no evidence of melting, 2) a gradient in deformation (slip and deformation twins) from the center outward to the highest defect density at the surface of the sphere consistent with the gradient in the calculated shock loading peak pressure, and 3) numerous shear cracks and/or spall planes. The substructure evolution is discussed relative to that previously observed in Cu shock prestrained via either 1-D triangular-shaped shockwave loading or 1-D square-topped pulse shock loading.

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