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Femtosecond x-ray probes of shock-driven phase transitions in nanocrystals AARON LINDENBERG, Stanford University / SLAC National Accelerator Laboratory, JOSH WITTENBERG, TIMOTHY MILLER, ELIZABETH SZAILGYI, Stanford University — We have utilized laser-generated shock waves to induce the wurtzite to rock salt structural phase transformation in cadmium sulfide nanorods, and have probed the resulting dynamics and transition state using femtosecond hard x-rays at the Linac Coherent Light Source (LCLS) in diffraction. Colloidally grown nanocrystals are an ideal model system with which to study phase transformations because they are defect-free single crystalline domains. Simulations of this transformation at the nanoscale have suggested a two–stage model consisting of a compression along the c-axis to form a 5 coordinate h-MgO intermediate followed by compressive shear along the a-axis, with the transformation rate limited by the shear step. We observe a stress-dependent transition path: At higher peak stresses, the majority of the sample is converted directly into the rock salt phase, with no evidence of an h-MgO intermediate prior to rock salt formation. At lower peak stresses, an h-MgO structure is observed. Additionally, the observed transformation stress is ∼3GPa, significantly below the ∼7GPa required under hydrostatic compression, confirming previous observations of shear catalyzed structural transformation under shock compression.

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