

Dynamic XRD, Shock and Static Compression of CaF₂

Patricia Kalita, Paul Specht, Seth Root

Sandia National Laboratories

Nicholas Sinclair, Adam Schuman,

Dynamic Compression Sector (DCS), Institute for Shock Physics, Washington State University,
Argonne, IL 60439

Melanie White, Andrew Cornelius

High Pressure Science and Engineering Center, University of Nevada Las Vegas, Las Vegas NV
89154

Jesse Smith, Stanislav Sinogeikin,

High-Pressure Collaborative Access Team, Carnegie Institution of Washington, Argonne, IL
60439

The high-pressure behavior of CaF₂ is probed with x-ray diffraction (XRD) combined with both dynamic compression, using a light gas gun, and static compression, using diamond anvil cells. We use XRD to follow the unfolding of a shock-driven phase transition on the timescale of nanoseconds. The dynamic behavior of CaF₂ under shock loading is contrasted with its behavior under static compression. This work leverages experimental capabilities at the Advanced Photon Source: XRD and impact experiments using a two-stage light gas gun at the Dynamic Compression Sector, as well as XRD and static compression in diamond anvil cell at the High-Pressure Collaborative Access Team. These experiments and cross-platform comparisons [1], open the door to an unprecedented understanding of equations of state and phase transitions at the microstructural level and at different time scales and will ultimately improve our capability to simulate the behavior of materials at extreme conditions. [1] S. Root et al., Shock Compression Response of Calcium Fluoride. This Conference.

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