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Static High Pressure Studies Under Non-Hydrostatic/Non-Equilibrium Conditions

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This presentation will discuss new developments aimed at measuring phase diagrams and strength under intentionally non-equilibrium, non-hydrostatic conditions. Though static high-pressure studies using diamond anvil cells (DACs) have traditionally sought to achieve ideal conditions (hydrostatic equilibrium), non-ideal configurations permit the measurement of important material properties. At one extreme, samples with no pressure medium have been used to evaluate the strength of materials under load. We find that using various pressure media that are nominally quasi-hydrostatic, though differing in the degree of hydrostaticity, can nonetheless induce wide variations in phase transition pressures. Finally, a dynamic DAC has been used to study phase transitions and metastability of materials over a range of compression rates. Examples of these topics and future directions will be discussed. This work performed under the auspices of the U.S. DOE by LLNL under Contract DE-AC52-07NA27344. Portions of this work were performed at HPCAT (Sector 16), Advanced Photon Source (APS), Argonne National Laboratory. HPCAT is supported by CIW, CDAC, UNLV and LLNL through funding from DOE-NNSA, DOE-BES and NSF. APS is supported by DOE-BES, under Contract No. DE-AC02-06CH11357.