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The Dynamic Diamond Anvil Cell (dDAC): A Novel Device for Studying the Dynamic Properties of Materials at High Pressure

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We have developed a unique device, a dynamic diamond anvil cell (dDAC), which repetitively applies a timedependent load/pressure profile to a sample. We are adapting this device to pulsed synchrotron radiation to time-resolve and take "snapshots" of pressure-induced transitions and phenomena. This capability allows studies of the kinetics of phase transitions and metastable phases at compression strain rates of up to 500 GPa/sec (~0.16 s-1 for a metal). Our approach adapts electromechanical piezoelectric actuators to a conventional diamond anvil cell design, which enables precise specification and control of a time-dependent applied load/pressure. This capability addresses the sparsely studied regime of dynamic phenomena between static research and dynamic shock-driven experiments. We present an overview of our work and experimental measurements that can be made with this device.

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