Hugoniot temperature measurements of Silicon Carbide

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The silicon carbide (SiC) phase diagram under extreme conditions is of great interest in geology and planetary science. It is predicted that SiC can be the main component of some carbon-rich exoplanets' interiors using mass and radius models[1,2]. SiC undergoes a phase transition from Zinc-blende structure (B3) to rock-salt structure (B1) at around 60 GPa using a laser-heated DAC[3,4], and it was found to melt incongruently below 10 GPa[5]. In this work, we apply laser-based decaying shock compression techniques to measure the Hugoniot of SiC from 226 to 1026 GPa. Experiments were conducted on Omega-EP at Laboratory for Laser Energetics, where high pressures were achieved by a 1 ns laser pulse of 1026-1286 J, which produced a well reflecting and decaying shock wave. The VISAR (Velocity interferometric system for any reflector) diagnostic monitored the reflecting shock front through the quartz-SiC-quartz target package to determine pressure of the shock front. Temperature of the propagating shock was measured using streaked optical pyrometry (SOP) diagnostic[6] where these quartz windows served as an in-situ calibrant[7,8]. We observed a distinct temperature jog along Hugoniot at around 210 GPa which we interpret as a sign of melting.

References

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