Shock induced B1–B2 phase transition and melting of periclase

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The equation of state of periclase (magnesium oxide) is important for the understanding equation of state for rocky compounds and the simulation of space impact phenomena and planets interiors. Periclase properties at high pressure, including shock Hugoniot and Hugoniot temperature previously were studied experimentally at the laser facilities Omega, LULI and Gekko, the Z-machine facility and various gas-gun installations. Also, few ab initio studies were published. Despite this, the understanding of coexistence line of B1–B2 polymorphic transition and melting line, important for planetary science, is poor.

In this work, impedance matching technique and fast optical pyrometery were used to measure the shock compressibility and temperature of shocked single crystal MgO samples. Cumulative explosive generators allowed to reach pressure up to 1 TPa. Shock Hugoniot data is in a good agreement with Z-machine data, except a region of B1–B2 transition. Together with temperature data, it allow to explain the position of MgO Hugoniot at T–P diagram along with melting curve and B1–B2 structural transition boundary in high pressure.