Shock induced melting of corundum and periclase

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Knowledge of the thermophysical properties of oxides at high pressures is required to both understanding the interiors of rocky planets and simulation of cosmic impact phenomena. Corundum and periclase are the important components of earth low mantle, lunar regolith, meteoroids, etc. The transition of the substance from a crystalline to a liquid state is accompanied by a radical change in its properties, such as density and specific value of internal energy, entropy and heat capacity. Information about thigh-pressure melting curve of corundum is completely insufficient. Periclase is better studied, although the assumptions about it's melting curve strongly varying.
The proposed method for calculation the melting curves of crystalline bodies is based on the Debye model of heat capacity and the Lindemann melting rule. Hugoniot shock adiabate, determined in dynamic experiments and thermophysical characteristics of the substance under normal conditions are used as input data. The Hugoniot temperature is also obtained. Mathematically, the calculation of the melting curve is reduced to the Cauchy problem for a system of ordinary differential equations.
Experiments on shock compression of samples were performed, using a Mach-type cumulative explosive generators. The temperature of shock front was registered by fast optical pyrometer together with shock velocity. Particle velocity and pressure were obtained by impedance match with quartz reference. Shock compressibility obtained for both substances is in good agreement with literature data. Temperature data allows to define the melting regions at Hugoniot curve. Our model calculations is in a satisfactory agreement with both Hugoniot and melting experimental temperatures.