

Density of Fe³⁺-bearing magma at high pressure

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Previous studies indicate the high concentration of Fe₂O₃ in the lower mantle. Even though the partial molar volume of Fe₂O₃ has become essential for discussing the magma in the deep mantle, there is no data of partial molar volume of Fe₂O₃ at high pressure and temperature. This study is aimed to obtain partial molar volume of Fe₂O₃ in silicate melts under high pressure. Fe³⁺-rich starting material was compressed by a Kawai-type multi-anvil apparatus at high pressure of above 4 GPa and high-temperature of above 1800 °C. We determined the third-order Birch-Murnaghan equation of state of melts from results of sink-float method. By combining the compression curves of melts and the equation of state of silicate melts proposed in Wakabayashi and Funamori (2013), partial molar volumes were yielded between 8 and 22 GPa and 1800 °C. These results indicate that compressibility of Fe₂O₃ is much higher than that of FeO within the range of 8 GPa to 22 GPa.

Keywords: magma, partial molar volume, density, mantle, high pressure