Density measurement for MORB melts by X-ray absorption method

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Density of silicate melts at high pressure is one of the most important properties to understand magma migration in the planetary interior and the differentiation of the terrestrial planets. The density measurements of silicate melts have been carried out by several methods (shock compression experiments and sink-float method in static experiments, etc.). However, since these methods have difficulties in acquisition of data at a desired pressure and temperature, the density of the silicate melt have been measured under only a few conditions. Recently a new density measurement was developed by the X-ray absorption method. Advantage of this method is to measure density of liquids at a desired pressure and temperature. In the present study we measured the density of MORB melt by X-ray absorption method. Experiments were carried out at the BL22XU beamline at SPring-8. A DIA-type cubic anvil apparatus was used for generation of high pressure and temperature. We used tungsten carbide anvils with the edge-length of 6 mm. The energy of monochromateized X-ray beam was 23 keV. The intensities of incident and transmitted X-ray were measured by ion chambers. The density of the melt was calculated on the basis of Beer-Lambert law. The starting material was a glass with the MORB composition. Experiments were made from 1 atm to 4 GPa, from 300 to 2200 K. We compared the density of MORB melt with the compression curve of the melt in previous works. The density measured by this study is lower than that expected from the compression curve determined at higher pressures by the sink-float method. Structural change of the MORB melt with increasing pressure might be attributed to this discrepancy.