Density measurement of liquid FeS using X-ray absorption image up to 10 GPa

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Density of liquid Fe-alloy is a basic physical property in order to understand the composition and dynamics of the cores of planetary bodies. However, there has been only a limited number of studies of the density measurements of core forming molten iron alloys performed at high pressure. Chen et al. (2005) measured the density of liquid FeS at 4.2 GPa and 1300 ^{o}C using X-ray absorption method from the radiography image. A two-dimensional variation in transmitted X-ray intensity of the sample was obtained on an exposure. In this study, the density of liquid FeS was measured up to 10 GPa using X-ray absorption image. Pressure was generated by the KAWAI-type 6-8 double stage system using the high-pressure apparatus, MAX-III, installed at beamline BL14C2, KEK-PF. Cylindrical sapphire single crystal and boron nitride was used as a sample container and the composite material of BN+TiB_2 was used as the heating substance. Temperature was monitored using a W97Re3-W75Re25 thermocouple. X-ray diffractions of the sample and pressure markers (NaCl) were measured using imaging plate. Starting material was a FeS powder. The radiography system consists of a YAG:Ce crystal as a fluorescent screen and a cooled CCD camera (Bitran BS-40). The energy of the monochromatic X-ray beam was 30-40 keV. X-ray absorption images are based on the linear conversion from X-ray intensity to image brightness and the Beer-Lambert law. The obtained density of the liquid FeS at 8(1) GPa and 1500 ^{o}C is 5.29 (15) g/cm^3. The present density of liquid FeS is consistent with Chen et al. (2005).