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Density measurements of liquid FeS at high pressure

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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. There have been only a few studies of density measurements performed at high pressure. Density measurements of liquid Fe-S using sink/float method have been reported by Balog et al. (2003) and Nishida et al. (Submitted). Density measurements of liquid Fe-S (S = 10, 20, and 27 wt%) using X-ray absorption method were carried out in the pressure and temperature ranges of 1.5 - 6.2 GPa and 1500 - 1780 K, respectively (Sanloup et al. 2000). Chen et al. (2005) measured the density of liquid FeS at 4.2 GPa and 1573 K using X-ray absorption method from the radiography image. This technique is based on the linear conversion of X-ray intensity to radiograph brightness. 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 5 GPa and 1900 K. We have used two different X-ray absorption methods for density measurements. One is an X-ray absorption method from an X-ray intensity measurement using ion chambers developed by Katayama et al. (1993, 1996). The density of the liquid FeS was measured at 2 GPa and up to 1900 K at BL22XU beamline at SPring-8, Japan. The other method is an X-ray absorption from a radiography image developed by Chen et al. (2005). The density of liquid FeS was measured up to 5 GPa and 1900 K using this technique at BL14C2 beamline, KEK-PF, Japan. The density of the liquid FeS at 1.3 GPa and 1600 K is 4.23 g/cm^3. Isothermal bulk modulus (K_T) of the liquid FeS was obtained using the result at 1.3 GPa - 1600 K and the densities measured at 4.2 GPa -1573 K (Chen et al. 2005) and at ambient pressure and 1600 K (Kaiura et al. 1979). The obtained K_T ranges between 12.3 and 14.6 GPa, corresponding to K' values of 4 and 6 respectively.