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Equation of state of liquid FeS at high pressure and high temperature

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Density of liquid Fe-alloy is a fundamental physical property in order to understand the composition and dynamics of the cores of planetary bodies. However, there have been only a limited number of studies of the density measurements of core forming molten iron alloys performed at high pressure. Sanloup et al. (2000) measured the density of Fe-S (S = 10, 20, and 2 7 wt%) at 1.5 - 6.2 GPa and 1500 - 1780 K using X-ray absorption method and showed the effect of sulfur content on the isothermal bulk modulus (K_T) of liquid iron. Chen et al. (2005) measured density of liquid FeS at 4.1 GPa and 1573 K using X-ray absorption method from the radiography image. However, the effect of pressure on the density, i.e., bulk modulus K_T, and its pressure derivative $(dK_0/dP)_T$of liquid FeS have never been reported to date. In this study, we measured the density of liquid FeS up to 11.7 GPa and 2073 K using X-ray absorption image and determined the equation of state of the liquid. The compression curve of the liquid can be fitted by Vinet equation of state. Isothermal bulk modulus, its temperature and pressure derivatives were determined by a non-linear least squares fit. Parameter sets determined are K_{0T}= 4.2(2) GPa at T = 1500 K, $(dK_0/dT)_P$= -0.0030(1) GPa/K, and $(dK_0/dP)_T$= 16.7(5).

Keywords: Density, Equation of state, FeS, High pressure, liquid, X-ray absorption method