

Density measurement of core forming Fe-Si liquids at high pressure

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Density of liquid Fe alloys is fundamental physical property in order to understand physical properties and the composition of the Earth's core. Compositional dependence on the density of liquid Fe-alloy under high pressure is closely related to the composition of the outer core. Silicon is one of the most plausible candidate of the light elements in the core due to its high cosmic abundance and depletion from the mantle compared to the chondritic abundance. In this study, we performed density measurement of Fe-Si liquid at 4 GPa and 1650 C using sink/float method and investigated the effect of Si content on the density. For sink/float method, we have used composite density marker which is composed of Pt disk core and alumina tube mantle. The experiment reveals that the addition of Si to liquid Fe decreases its density and this effect of Si content on the density become to be larger in the Si-rich composition. In other words, the density of liquid Fe-Si decreases nonlinearly with increasing Si content. The molar volume of Fe-Si calculated from the measured density gradually decreases with increasing Si content. It is note that the estimated molar volume is different from the ideal mixing between Fe and Si. This behavior is similar to Fe-S liquid. However, the excess molar volume of Fe-Si liquid is smaller than that of Fe-S liquid. The results of this study indicate that amount of Si is larger than the previously estimated value.