Density of Fe-FeS binary melts at high pressures

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Magnetism of small planetary bodies such as Mercury and Ganymede is thought to be originated from core dynamo driven by chemical convection, which is connected with Fe-snowing in the liquid core. Fe snowing phenomenon is governed by both the adiabat in the liquid core and the melting slope of the constituent substance of the core. Thus, it is fundamental to study the density and thermal expansivity of liquid iron alloy under pressure to understand Fe-snowing phenomenon. Sulfur is thought to be a primary lightening element in the metallic core of the small planets, satellites and planetesimals. Here we report the results of density measurements of Fe-FeS binary melts at high pressure by means of X-ray absorption technique. Experiments were conducted at BL22XU of SPring-8, at which the cubic-type multi-anvil press is equipped and the highly brilliant monochromatic X-ray is available. We determined the densities and the thermal expansivities of Fe-S liquids at about 3.5 GPa and 1500-2000 K. Density of Fe-S liquid increases with Fe content and the mixing of Fe and FeS liquids does not deviate much from the ideal solution. Our new data would contribute to understand compression behavior as well as thermochemical properties of Fe-S liquids alloys under pressure.

Keywords: planetary core, Fe-S liquids, density, thermal expansivity

