

Thermodynamic analysis of density of Fe-Ni-S melts at high pressure

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Density of liquid Fe-alloy is one of the important physical properties to understand dynamics of planetary liquid core. However, we have only limited information on the pressure, temperature and composition dependency of density of liquid Fe-alloy. We have focused on Fe-Ni-S alloy, which are thought to be universally present as core constituents of planets and satellites, and measured their densities at high-temperatures and pressures by X-ray absorption technique. Here we report the results of thermodynamic analysis of the density of liquid Fe-Ni-S alloy. Density (molar volume) of liquid Fe-Ni-S alloy measured at 3 GPa was analyzed by associated solution model assuming the associated compounds, Fe, FeS, NiS and Ni. We evaluated the molar volume and the thermal expansivity of each associated compound as well as the interaction parameters between associated compounds. As a result, we can express the temperature and composition dependence of the density of liquid Fe-Ni-S alloy at 3 GPa. We found a negative excess volume between Fe-FeS and FeS-NiS and a positive excess volume between Ni-NiS. We will also discuss the pressure evolution of the phase relationships of the Fe-FeS.

キーワード：密度、モル体積、熱膨張、液体鉄合金

Keywords: density, molar volume, thermal expansion, liquid Fe alloy