Sound velocity measurement of Fe-Ni-Si alloys at high pressure and high temperature

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The Earth's core has supposed to be constituted by iron-nickel alloys containing about 10% nickel as the main constituent and some light elements. The candidates of light element are sulfur, oxygen, carbon, hydrogen, and silicon. Among them, silicon is one of the most convincing light elements. The structure, physical properties and its chemical compositions of the Earth's core has been discussed with the seismic structure model of the Earth such as preliminary reference Earth model (PREM) based on seismic wave velocity observations. Constraints on the chemical composition of the Earth's core have been discussed by comparing the model with the physical properties of the Fe-Ni-X alloys that are candidates for the composition of the Earth's core. For the physical properties, a sound velocity and a density of materials are directly related to the knowledge obtained from seismic wave velocity observations. Therefore, the information of sound velocity and density for Fe-Ni-X system are important to understand the properties of the Earth's core and to restrict its chemical compositions. However, for the Fi-Ni-Si system, which is considered to be a promising candidate for the constituents of the Earth's core, were not well studied especially high pressure and high temperature conditions.
In this study, we measured the sound velocity and density of the Fi-Ni-Si system under high pressure and high temperature conditions, and discuss the composition of the Earth's core through comparison with the results and PREM.

Keywords: Fe-Ni-Si system, sound velocity, high pressure

