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高圧下における Fe-S-Si 系の融解：外核の温度への応用
Melting in the Fe-S-Si system at high pressure : Implication for the temperature in the outer core

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Based on seismological studies, it has been commonly accepted that the Earth's outer core is composed of molten iron-nickel alloy with light elements. S and Si are plausible candidates of the light elements. This is because Si is one of the most abundant elements in the Earth, iron sulfides are found universally in iron meteorite, and Si, S are depleted in mantle relative to C1 chondritic materials.

The temperature of the inner core boundary (ICB) is the melting temperature of the core material. Therefore, the melting relationship in the Fe-S-Si system at high pressure and high temperature is indispensable to estimate the thermal structure of the Earth's core.

The melting experiments in the Fe-S-Si system were performed by using a laser-heated diamond anvil cell and melting temperatures were determined based on following two procedures: (1) the change of laser heating efficiency, (2) textual observations of recovered samples using SEM.

The changes of heating efficiency were observed up to 60 GPa. The present data were fitted by the Simon's equation. Assuming that S and Si are the light elements in the Earth's core, the temperature at the ICB was estimated to be 4970(340) K from this study, and the temperature at the core-mantle boundary (CMB) was estimated to be 3800 K by considering the adiabatic temperature gradient in the outer core.

Keywords: Fe-S-Si, Earth's core, high pressure, LHDAC