Melting relation of Fe-O-S alloy at the outer core condition

Hidenori Terasaki, Seiji Kamada, Takeshi Sakai, Eiji Ohtani, Naohisa Hirao, Yasuo Ohishi

Dept. Earth Materils Sci., Tohoku Univ., Japan Radiation Research Institute

The Earth’s core consists of the liquid outer core and the solid inner core, which suggests that the temperature at a boundary of the inner/outer core (ICB) corresponds to the melting temperature of the core material. Thus, the melting temperature of the Fe-alloy under high pressure is important in order to clarify the thermal structure of the Earth’s core. However, solidus and liquidus temperatures of Fe-alloys have never yet been measured simultaneously in the megabar pressure range.

In this study, the solidus and liquidus temperatures of the Fe75O5S20 alloy are determined up to 157 GPa using a laser-heated diamond anvil cell combined with in situ X-ray diffraction technique.

The liquidus temperature is 260-670 K lower than the melting temperature of pure Fe because of the alloying effect of S and O on the melting temperature of Fe. Based on our results, we estimated the temperatures at the core/mantle boundary and at the boundary of the inner/outer core.

Keywords: Liquidus, Solidus, Earth’s core, high pressure