Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

SIT02-P02　会場:コンベンションホール　時間:5 月 22 日 17:15-18:30

高圧下でのフォルステライトとマグネシウムペロブスカイトのリキダスの熱力学計算
Thermodynamics and Melting of Forsterite and Mg-Perovskite at high pressure

井形 瑛梨 [1*], 上木 賢太 [2], 岩森 光 [1]
IGATA, Eri[1*], UEKI, Kenta[2], IWAMORI, Hikaru[1]

[1] 東京工業大学大学院理工学研究科地球惑星科学専攻, [2] 東京工業大学火山流体研究センター
[1]Department of Earth and Planetary Sciences, Tokyo Institute of Technology, [2]Volcanic Fluid Research Center, Tokyo Institute of Technology

Melting of rock forming minerals at high pressure and high temperature is critical to understand differentiation in the magma ocean and melting at the present-day deep Earth. Liquidus curves of minerals can constrain the maximum temperature and the depth range of the magma ocean. Moreover, liquidus curves can constrain location of the eutectic point of a multicomponent-multiple phase system. However, the melting curve of Mg-perovskite, Ca-perovskite and ferropericlase, which are the major minerals at the lower mantle, have not yet determined because of the experimental difficulty and lack of the thermodynamic data. Therefore, in this study, we calculated thermodynamically the liquidus curve of Mg-perovskite, which is a primary mineral end-component in the lower mantle. Thermodynamics can provide consistent relation between the phase relation and the properties of the phases. We determined the melting temperature at which the Gibbs free energy of liquid equals that of solid. First to test the applicability of equation of state for liquid at high pressure, the liquidus curve of forsterite is calculated up to 20 GPa. It has been revealed that the third-ordered Birch-Murnaghan equation of state (EOS) is appropriate to predict volumes of liquid and solid end-components at high pressure and high temperature. The liquidus curve of perovskite with the optimized thermodynamic parameters with Birch-Murnaghan EOS of liquid and solid reproduces the experimentally determined liquidus very well, including the properties of liquid at high pressure. The liquidus temperature of perovskite at CMB pressure is predicted to be 8500 K. Therefore, the composition of the eutectic point in Mg-perovskite and periclase system, which represents a composition of partial melt of the lower mantle, is supposed to be located on the MgSiO3 side, suggesting the liquid is likely to be less dense than the surrounding mantle.

キーワード: 熱力学, 高圧, マントル, 溶融, メルト
Keywords: Thermodynamics, high pressure, mantle, melting, melt