Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SMP44-04 会場:102A 時間:5 月 20 日 09:45-10:00

温度勾配場におけるマントルオリビンの化学的不均質形成
Chemical heterogeneity in mantle olivine by temperature gradient

安居 俊紀 [1*], 近藤 忠 [1]
Toshinori Yasui[1*], Tadashi Kondo[1]

[1] 大阪大学大学院理学研究科
[1]Graduate School of Science, Osaka Univ

Laser-heated diamond anvil cell (LHDAC) has been used as a major method to generate high temperature and pressure conditions of the Earth's interior. In the laser heating experiments,only a local region can be raised to high temperature with a strong temperature gradient in the sample. The Soret effect is known as a phenomenon of chemical diffusion induced by temperature gradient, which causes a change of homogeneous material to heterogeneous chemistry. While the Soret diffusion in liquids has been popularly studied, that in solids and its pressure dependence have not been studied well because the Soret effect is relatively slow and more complex in solids than in liquids. The previous experiments using LHDAC (Heinz & Jeanloz 1987, Sinmyo & Hirose 2010, etc.) reported that a steep temperature gradient makes a large difference of element concentration between the laser-heated spot and its edge, however, the Soret effect in LHDAC have not been quantitatively analyzed.

In this study, we studied the material experienced a steep temperature gradient using LHDAC. Single-crystal or powdered San Carlos olivine with the composition of $(Mg_{0.89},Fe_{0.11})_2SiO_4$ was used as the starting material. The single-crystal experiments were conducted with NaCl as a pressure medium, while we loaded no pressure medium in powder experiments. Each sample was heated using a Nd:YAG laser without moving laser spot and kept the same temperature gradient. Temperature profile was measured by a spectroradiometric method. The recovered samples were analyzed using Field Emission-Scanning Electron Microscope (FE-SEM) and Electron Probe Microanalysis (EPMA). Experimental pressure and temperature were 10-30GPa and 1000-2000K, heating duration was 10-120 minutes. Various chemical heterogeneity formation was observed in different experimental conditions such as temperature gradient, heating duration and phase transition. We will report the details of these results on the Soret diffusion.

キーワード: レーザー加熱型ダイヤモンドアンビルセル, ソーレ効果, 固体内拡散
Keywords: LHDAC, Soret effect, diffusion in solid