The 412th Geodynamics Seminar

Growth kinetics of forsterite reaction rim at high-pressure

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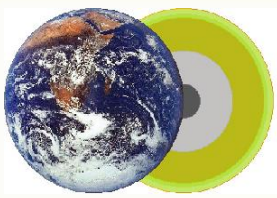

EHIME UNIVERSITY GRC GEODYNAMICS RESEARCH CENTER

Abstract

Since many transport properties, such as rheology, highly depend on grain-size of the constituent materials, knowledge of grain-growth is important for accurate understanding of dynamics in the Earth's mantle. Grain-growth in forsterite-enstatite two-phase system is known to be rate-limited by growth of secondary phase through Mg-O grain-boundary diffusion in primary phase. In this study, we have experimentally studied growth-kinetics of forsterite (Mg_2SiO_4) reaction rim at deep upper mantle conditions which is controlled by Mg-O grain-boundary diffusion in forsterite. A pair of MgO and $MgSiO_3$ were stuck and annealed at pressure of 3.0-11.1 GPa and temperature of 1473-1873 K for duration of 0-780 min under dry condition. The Pt marker, which was originally placed at MgO-$MgSiO_3$ boundary, was always on MgO-Mg_2SiO_4 boundary indicating that Mg-O diffusion in Mg_2SiO_4 is the rate-limiting process in the rim growth. $MgSiO_3$ inclusions were found in Mg_2SiO_4 grains suggesting the grain-boundary diffusion is rate-limiting. The activation energy and the activation volume for the Mg-O grain-boundary diffusion in forsterite were determined to be 379 kJ/mol and -1.9 cm^3/mol, respectively. Although reason for the small negative value of the activation volume is not quite clear, this may be due to successive structural change of grain-boundary. The results suggest that the grain-growth in the Earth's upper mantle is faster at deeper part.

詳細は当センターホームページ：http://www.grc.ehime-u.ac.jp/ をご覧ください
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