I131-003 **Room: 303** **Time: May 18 16:00-16:15**

Nucleation-controlled (N-type) post-spinel transformation and topography of the 660-km discontinuity by mantle flow

Tomoaki Kubo[1]; Masayuki Nishi[2]; Kouta Oshibuchi[1]; Akira Shimojuku[1]; Aiko Tominaga[2]; Takumi Kato[1]; Yuji Higo[3]; Ken-ichi Funakoshi[3]

[1] Kyushu Univ.; [2] Earth and Planetary Sci, Kyushu Univ; [3] JASRI

Topography of the 660-km seismic discontinuity has been observed in various horizontal and vertical scales. Origins of the topography generally have been interpreted as thermal anomalies and water-content anomalies based upon the equilibrium post-spinel transformation. On the other hand, the mass transfer across the 660-km discontinuity can also produce the topography if the transformation is delayed due to kinetic effects. In the present study, we have determined forward and backward reaction kinetics of the post-spinel transformation. Based on the experimental results, we discuss whether down-going and up-going flow across the upper and lower mantle boundary can produce the topography of the 660-km discontinuity.

The transformation kinetics was investigated by time-resolved X-ray diffraction measurements by energy dispersive method in BL04B1 at SPring-8. In case of the forward reaction, the annealed polycrystalline Mg_2SiO_4 ringwoodite (Rw) was transformed to $MgSiO_3$ perovskite (Pv) and MgO periclase (Pc) at overpressures of 0.4-5.4 GPa and temperatures of 860-1250C. The n-values of the Avrami rate equation increases with overpressures from 1.0 to 2.8. On the other hand, the annealed aggregate of Pv+Pc was transformed to Rw at overpressures of 1-3 GPa and temperatures of 1310-1575C in case of the backward reaction. The n-values of the Avrami rate equation increases with overpressures from 0.4 to 2.9. The systematic changes of the n-values with overpressures are derived from combination of different kinetics of nucleation and growth processes. We analyzed the transformation-time curves (time dependence of transformed volume fraction) obtained at various P-T conditions based on grain-boundary nucleation and growth model, and estimated P-T dependencies of nucleation and growth rates in each reactions. The rate of the forward reaction is much faster than that of the backward reaction mainly due to different growth mechanisms (lamellar growth and diffusion-controlled growth, respectively).

Based on kinetic parameters determined in the present study, we suggest that nucleation-controlled (N-type) post-spinel transformation is dominant for both the forward and backward reactions in down-going (700-1300C) and up-going (up to 1800C) flows across the 660-km discontinuity, respectively, in which the growth rate is fast enough compared to the flow speed but nucleation cannot occur resulting in the delay of the transformation. The overpressure needed for the nucleation, which corresponds to the magnitude of the discontinuity topography, is estimated to be at least 0.6-0.8 GPa (15-20 km depths) in case of the forward reaction. The overpressure needed for the backward reaction has not quantitatively determined yet, but probably larger than that for the forward reaction. Thus, both down-going and up-going mantle flows across the upper and lower mantle boundary are possibly inferred from the topography of the 660 km discontinuity taking the N-type post-spinel transformation into account.