The stability of Topaz-OH II in the mantle transition zone

*Ryota Abe[1], Akio Suzuki[1], Yuki Shibazaki[1], Shin Ozawa[1], Itaru Ohira[1], Eiji Ohtani[1]

1.Department of Earth and Planetary Material Science, Graduate School of Science, Tohoku University

Topaz-OH is one of the hydrous phases which would exist in the sedimentary layer of subducting slab. Kanzaki (2010) showed that Topaz-OH transforms to a high-pressure phase, Topaz-OH II, which was reported to be stable at least 13-14 GPa and 1300-1500 ℃. However, the stable conditions of Topaz-OH II are not determined well. Here, we report on the results of high-pressure and high-temperature experiments on the stability field of Topaz-OH II.
The starting material was prepared in the MgO-Al_2O_3-SiO_2-H_2O system with the bulk composition of 4.27 wt.% MgO, 52.95 wt.% Al_2O_3, 28.47 wt.% SiO_2 and 14.30 wt.% H_2O. Experiments were carried out using a 1000-ton Kawai type multi-anvil press at Tohoku University. Semisinterd zirconia and platinum were used as pressure medium and sample container, respectively. The pressure was calibrated by the β-γ phase boundary of Mg_2SiO_4. In order to identify synthesized phases, X-ray diffraction measurements and Micro-Raman spectroscopy measurements were carried out at the Photon Factory in KEK, Tsukuba, Japan and at Tohoku University, respectively. Compositions of the recovered samples were determined using an electron probe microanalyzer (EPMA) at Tohoku University.
We found that hydrous phases of δ-AlOOH and phase egg were stable in the pressure range of 18-20 GPa and the temperature range of 1000-1300 ℃. Topaz-OH II was stable at 18 GPa and 1400 ℃, which is higher-pressure and -temperature condition than that reported previously. The composition of Topaz-OH II was 2.23(7) wt.% MgO, 55.24(13) wt.% Al_2O_3 and 31.46(21) wt.% SiO_2, (88.93(23) wt.% total) and its Al / Si ratio was 2.50(4). The lattice parameters of Topaz-OH II at ambient condition was a= 4.719(9) Å, b= 8.922(23) Å, c= 2.777(6) Å, and V_0=116.7(5) $Å^3$, which is consistent with the parameters reported by Kanzaki (2010).
Our results indicate that Topaz-OH II would be a potential candidate of the water carrier at the middle of the mantle transitions zone.

Keywords: Topaz, synchrotron X-ray diffraction, mantle transition zone, subducting slab

