Oral | Symbol S (Solid Earth Sciences) | S-MP Mineralogy & Petrology

[S-MP47_1PM1]Physics and Chemistry of Minerals

Convener:*Hiroki Okudera(School of Natural System, College of Science and Engineering), Atsushi Kyono(Graduate School of Life and Environmental Sciences, University of Tsukuba), Chair:Hiroki Okudera(School of Natural System, College of Science and Engineering), Hiroshi Kojitani(Department of Chemistry, Faculty of Science, Gakushuin University)

Thu. May 1, 2014 2:15 PM - 4:00 PM 422 (4F)

In this session, we discuss about Earth and planetary materials (including amorphous and melts) with the results obtained from various experimental methods such as X-ray, FT-IR, Raman, computer simulation and so on.

3:45 PM - 4:00 PM

[SMP47-P06_PG]Experimental determination of post-spinel transition boundary in Fe_2SiO_4

3-min talk in an oral session

*Taisuke MATSUZAWA[1], Hiroshi KOJITANI[1], Masaki AKAOGI[1] (1.Department of Chemistry, Gakushuin University)

Keywords:Fe_2SiO_4, post-spinel, spinel, high-pressure

It is widely accepted that $(Mg,Fe)_2SiO_4$ ringwoodite is the most abundant mineral in the mantle transition zone. Because spinel-type Fe_2SiO_4 is the endmember of $(Mg,Fe)_2SiO_4$ ringwoodite, many investigators have been studied on phase transitions of Fe_2SiO_4 spinel (Kawada 1977, Ohtani 1979, Morooka 1992, Katsura et al. 1998). Spinel-type Fe_2SiO_4 decomposes into $2Fe_xO+SiO_2$(stishovite)+2(1-x)Fe above about 18GPa. However, the dissociation boundary has not yet been established well due in part to difficulty in oxygen fugacity control. In this study, we determined the post-spinel phase boundary in Fe_2SiO_4 by high-pressure experiments controlling oxygen fugacity with the Fe-FeO buffer.A starting material of high-pressure experiments was a mixture of Fe_2SiO_4 (fayalite), Fe_xO and Fe with molar ratios of 10:2:1, and it was packed in a Fe capsule. Oxygen fugacity of the sample at high pressure and high temperature was controlled by the Fe-FeO buffer. The high-pressure experiments were performed using a Kawai-type 6-8-type multi-anvil apparatus at 16-20GPa and 1000-1400℃. The starting samples were heated at the desired conditions for 3-6 hours, and then quenched and decompressed to ambient conditions. Recovered samples were identified by using powder XRD method and SEM-EDS, and then lattice parameters of FexO were determined by using powder XRD. The x values in Fe_xO were estimated from the composition-lattice parameter relationship of Fe_xO by McCammon (1993).The post-spinel transition boundary in Fe_2SiO_4 was determined to be P(GPa) = -0.0021T(℃) + 20.0 in the temperature range of 1000-1400 ℃. The phase boundary has a negative slope. Our boundary is almost consistent with those of Ohtani (1979) and Katsura et al. (1998). Katsura et al. (1998) interpreted that the negative slope of the boundary in the previous studies was apparent which was caused by slow kinetics of spinel decomposition. Because our study indicated that the decomposition of Fe_2SiO_4 spinel completed in the runs for 3 hours at 1000℃ and that x values of Fe_xO in the run products for 3 and 6 hours at the 1000℃ were approximately equal, we conclude that heating at 1000℃ for at least 3 hours was enough to reach the equilibrium. Because our transition boundary was determined by the runs for 6 hours at 1000℃, 3 hours at 1200℃, and 3 hours at 1400℃, we suggest that the negative slope of the post-spinel transition boundary in Fe_2SiO_4 is not apparent but the essential feature.