The precise determination of the reaction from spinel to perovskite and periclase in Mg_2SiO_4-Fe_2SiO_4

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Irifune et al. (1998) reported that the reaction boundary from Mg_2SiO_4 spinel to $MgSiO_3$ perovskite and MgO periclase is located at pressure *ca.* 2 GPa lower than that of 660 km seismic discontinuity in the Earth's mantle. They implied that the 660 km discontinuity might not be attributed to this reaction. In order to examine this result, we are also conducting in situ high-pressure and high-temperature X-ray observation of this reaction in a 6-8 type multianvil press.

The cell assembly of the high-pressure experiment is shown in Fig. 1. The trucated edge length of the anvil is 3.0 mm. The MgO+5%Cr_2O_3 octahedrons with edge length of 9.4 mm are used for pressure media. The furnace is cylindrical $LaCrO_3$ with outer and inner diameters of 2.5 and 1.8 ϕ. The sample is the mixture of Mg_2SiO_4, $MgSiO_3$ and Au with weight ratio of 4:4:1, which is stored in 0.8 ϕ Ta tube. The Au is pressure marker. The $MgSiO_3$ is mixed with Mg2SiO4 in order to prevent the grain growth. The $W_{97}Re_3$-$W_{75}Re_{25}$ thermocouple with diameter of 0.0762 ϕ is used for temperature measurement, which monitors temperature outside of the sample. The thermocouple is insulated with MgO tube with inner and outer diameters of 0.6 and 0.2 ϕ.

The experiment is conducted at pressures of 22-23 GPa and temperatures of 300-2000 K (Fig. 2). At all the investigated physical conditions, Mg_2SiO_4 spinel was stable.

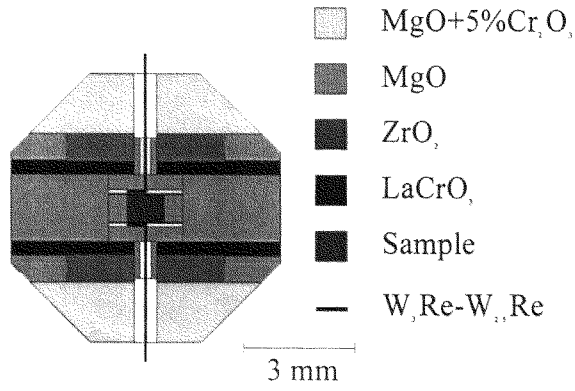

Fig. 1. Schematic drawing of the sample assembly.

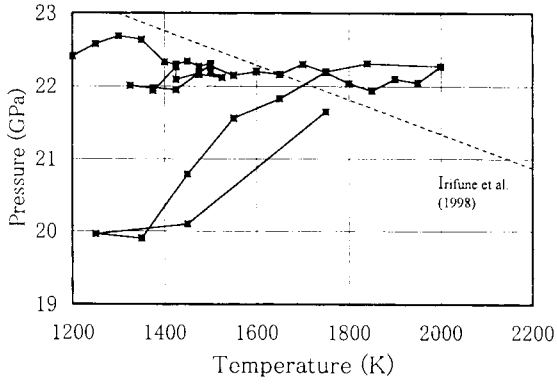

Fig. 2. The P-T path of Run #S070. The solid squares denote observation of spinel phase.