

## The kinetics of pyroxene-garnet transformation in the mantle

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### 1. Introduction

Nonequilibrium phases of minerals are believed to exist in the mantle, especially at low temperatures in the subducting slab. Measurement of the transformation kinetics by high-pressure experiment can contribute to understanding of the mantle dynamics. Pyroxene and garnet are the second major mantle minerals, in the Earth's upper mantle, and in the transition zone, pyroxene-garnet transformation occurs with increasing pressure, mainly at interval 14-16GPa. Single-phase of aluminum-deficient garnet (majorite) becomes stable above 16GPa. In order to clarify the kinetics of pyroxene-garnet transformation, we performed in situ X-ray diffraction experiments.

### 2. Experimental methods

#### 2-1 Synthesis of pyroxene-garnet polycrystalline

We made synthesis of px-gt polycrystalline as starting crystals from a glass with CaO-MgO-Al<sub>2</sub>O<sub>3</sub>-SiO<sub>2</sub> composition, corresponding to the simplified mantle pyrolite minus olivine component. We kept the starting glass material at 3.5GPa and 1373K, made the polycrystalline by using MAX-90 multi-anvil high-pressure apparatus installed at Kyushu University.

#### 2-2 Reaction experiment

The reaction experiment was performed by using a MAX-III multi-anvil high-pressure apparatus installed at KEK, Japan. The sample assembly of the reaction experiment is composed of (Mg, Co)O pressure medium, LaCrO<sub>3</sub> heater, Mo and Cu electrode, and graphite capsule. The starting material and pressure marker (MgO and Au) were enclosed in a capsule with a 30 micron graphite separation disk. We pressurized the starting material in the single-phase stability field garnet and collected the transformation kinetic data from the comparison of their peak intensities during heating.

### 3. Results

Four reaction experiments have been performed. (1) At 14.2 GPa and 1573K for 5 minutes heating, any significant changing of peak intensity was not observed. (2) At 16.4 GPa and 1823K for 60 minutes heating, garnet was observed to increase and the chemical analysis of the recovered sampled showed the slight decrease of Al. However, most volume of pyroxene remained unreacted. (3) At 18.1 GPa and 1593K for 80 minutes heating, and (4) At 20.1GPa and 1873K for 60 minutes heating, preliminary results show that pyroxene decomposed to stishovite and the other high pressure minerals suggesting faster decomposition reaction of pyroxene than its solution into garnet.