Infrared spectroscopic study of antigorite under high pressure and temperature

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1.Introduction

Serpentine minerals are hydrous phyllosilicates and play the role for water carriers to Earth's interior in subduction zones. In particular, antigorite has the largest stability field in the serpentine minerals under high pressure (HP) conditions [1]. To investigate the behavior of OH bonds in antigorite under HP-HT conditions is important for understanding the crystal structural stability under the conditions. Infrared spectroscopy is a proper method to observe OH bonds in a mineral. We have carried out infrared absorption measurements of antigorite at HP-HT conditions in order to obtain insights about behavior of the OH bonds.

2.Experimental

The infrared absorption measurements were carried out under the IR microscope of BL43IR at SPring-8 [2]. The lever-type and eternally heating DAC was used to generating pressure and temperature. Powdered natural antigorite (Miyadzu, Kyoto, Japan) is loaded in the sample chamber of the DAC with a powdered KBr of pressure-transmitting medium. The pressure and temperature in the sample chamber were determined by two-sensor fluorescence technique using SrB_4O_7:Sm^{2+} and ruby [3]. Reference spectra were measured at the empty place in the sample chamber. Two series of experiments were carried out at room temperature and at 473 K.

3.Results and discussion

Infrared spectra of antigorite up to 16 GPa at 473 K and up to 21 GPa at room temperature were measured. The absorption bands due to stretching modes of the outer OH bonds (brucite-like) and inner OH bonds (talc-like) are shown in each spectrum. Abrupt changes of shapes of the OH bands do not occurred in the spectra at the pressure above the stability field of antigorite. It indicates that dramatic changes such as phase transition and amorphization have not occurred at the experimental conditions. The OH bands were shifted towards higher wavenumber with increasing pressure. Such the blue-shifts of OH bands show the hydrogen bonding in antigorite is not enhanced at the HP-HT conditions.

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