

LETTER

High-pressure behavior of synthetic antigorite in the MgO-SiO₂-H₂O system from Raman spectroscopy

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ABSTRACT

The pure synthetic end-member of antigorite was studied by in-situ Raman spectroscopy in a diamond anvil cell. It can be metastably compressed up to 10 GPa at room temperature without occurrence of phase transition or amorphization. The spectrum in the OH region is simpler than in natural antigorite, allowing identification and assignment of the two observed bands at 3672 and 3698 cm⁻¹ to the in-phase stretching modes of the outer O3-H3 bonds (brucite-like) and to the stretching mode of the inner O4-H4 bonds (talc-like), respectively. A broad weak shoulder on the low frequency side of the OH bands near 3650 cm⁻¹ is better resolved above 7 GPa and assigned to the out-of-phase stretching mode of the outer OH. The two strong OH peaks have small positive pressure dependences (average of 2.3 cm⁻¹/GPa), indicating no enhancement of hydrogen bonding at high pressure. One broad OH band at about 3670 ± 20 cm⁻¹ has a large pressure-induced shift (10 ± 2 cm⁻¹). It could be related to structural defects. The specific behavior of OH bands in serpentines can influence the high pressure D/H partitioning with respect to other hydrated minerals.

Keywords: Antigorite, serpentines, hydroxyl in serpentine, stability of antigorite, Raman spectroscopy, high-pressure studies