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LETTER

Synchrotron infrared spectroscopy of synthetic $Na(NaMg)Mg_5Si_8O_{22}(OH)_2$ up to 30 GPa: Insight on a new high-pressure amphibole polymorph

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ABSTRACT

This paper describes a high-pressure synchrotron infrared (IR) spectroscopy study of the synthetic amphibole $Na(NaMg)Mg_5Si_8O_{22}(OH)_2$. This compound has $P2_1/m$ symmetry at room conditions; its IR OH-stretching spectrum consists of two main bands at 3743 and 3715 cm^{-1}, which are assigned to the two symmetrically independent O-H groups in the *P* structure (sample 403, Iezzi et al. 2004a). For increasing pressure, both bands shift toward higher frequency, suggesting a shortening of the O-H bond. In addition, the two bands progressively merge to give a single, symmetric and broad absorption band at 20–22 GPa. This behavior suggests that at 20–22 GPa there is a unique O-H group in the structure, indicative of a *C*-lattice type. The IR data thus show that the examined sample undergoes a $P2_1/m \leftrightarrow C2/m$ phase-transition at that pressure. Upon release of pressure, the initial two-band pattern is immediately recovered indicating that the pressure-induced phase-transition is reversible, as already observed for the same kind of transition induced by temperature. By analogy with structurally related pyroxenes, and taking into account the possible crystal structural topologies of amphiboles, we suggest that the $C2/m$ polymorph stable at high pressure is characterized by fully kinked double-chains.

Keywords: Amphibole, synthesis, IR spectroscopy, high-pressure, phase-transition