

Synthesis and crystal-chemistry of $\text{Na}(\text{NaMg})\text{Mg}_5\text{Si}_8\text{O}_{22}(\text{OH})_2$, a $P2_1/m$ amphibole

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ABSTRACT

In the present work, we characterize the amphibole $\text{Na}(\text{NaMg})\text{Mg}_5\text{Si}_8\text{O}_{22}(\text{OH})_2$ synthesized at 0.4 GPa and 750, 800, and 850 °C, and 0.5 GPa, 900 °C. Experiments at 800 and 900 °C yielded crystals suitable for single-crystal data collection. Structure refinement shows that synthetic $\text{Na}(\text{NaMg})\text{Mg}_5\text{Si}_8\text{O}_{22}(\text{OH})_2$ has $P2_1/m$ symmetry at room T . The two non-equivalent tetrahedral double-chains differ in their degree of stretching and kinking. The infrared spectrum of synthetic $\text{Na}(\text{NaMg})\text{Mg}_5\text{Si}_8\text{O}_{22}(\text{OH})_2$ has two well-defined absorption bands at 3742 and 3715 cm^{-1} which can be assigned to O-H bands associated with the two independent anion sites (O3A and O3B) in the structure. The higher frequency band is assigned to the shorter O3B-H2 bond, and the lower frequency band is assigned to the longer O3A-H1 bond. The broader shape of the 3743 cm^{-1} band is consistent with a stronger interaction of the H2 atom with ^ANa, which is confirmed by structure refinement. Increasing T of synthesis causes a progressive departure from the ideal stoichiometry via the $^{\text{A}}\square_1^{\text{B}}\text{Mg}_1^{\text{A}}\text{Na}_{-1}^{\text{B}}\text{Na}_{-1}$ substitution, as confirmed by EMPA, structure refinement, and FTIR spectroscopy.