
Stepwise Hydration of High-Quality Synthetic Smectite with Various Cations

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Abstract: Smectites synthesized from experiments at 5.5 GPa and 1500° C are of high quality, crystals are large at >10 μm, and the 2:1 layers may have a homogeneous charge distribution. Smectite was exchanged with various cations (Na⁺, Li⁺, K⁺, Ca²⁺, and Mg²⁺) and the hydration behavior of each sample was observed by an *in situ* powder X-ray diffraction method under precisely controlled relative humidity (RH). The smectite showed distinct stepwise (discontinuous) hydration versus RH. During the transition between two hydration states, the coexistence of the two states was observed. Randomly interstratified structures with one and two planes of H₂O are time-dependent phenomena and relate to hydration and dehydration processes.

Key Words: Crystalline Swelling • Hydration • Interlayer Cation • Smectite

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