
Transformation Mechanisms and Interstratification in Conversion of Smectite to Kaolinite: An HRTEM Study

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Abstract: The transformation of smectite into kaolinite and kaolinite-smectite interstratification were studied in samples belonging to the Argiles Plastiques formation of the Paris basin, by high-resolution transmission electron microscopy (HRTEM). Two original smectite phases, 1) beidellite with 1-nm-thick layers, and 2) beidellite—montmorillonite with 1.25-nm-thick layers, are progressively transformed into kaolinite—smectite mixed-layer minerals, and into kaolinite. As the percentage of kaolinite layers increases in the interlayered minerals, the kaolinite—smectite layer sequences, initially disordered, become locally more ordered, with the presence of KS and KKS units repeated 2 to 4 times (K = kaolinite layer, S = smectite layer). Two solid-state mechanisms seem to be responsible for the formation of kaolinite: 1) the transformation of 1 smectite layer into 1 kaolinite layer, denoted $S \rightarrow K$, by stripping of a tetrahedral sheet and the adjacent interlayer region; 2) the intercalation of 1 kaolinite layer into smectite, denoted 0 (zero) $\rightarrow K$. Structural and chemical incidences of these mechanisms are discussed.

Key Words: HRTEM • Interstratification • Kaolinite • Smectite • Transformation Mechanisms

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