
Infrared Study of the Intercalation of Potassium Halides in Kaolinite

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Abstract: KCl-, KBr-, and KI-kaolinite intercalation complexes were synthesized by gradually heating potassium-halide discs of the dimethylsulfoxide (DMSO)-kaolinite intermediate at temperatures to 330° C. Two types of complexes were identified by infrared spectroscopy: almost non-hydrous, obtained during thermal treatment of the DMSO complex; and hydrated, produced by regrinding the disc in air. The former showed basal spacings with integral series of 00l reflections indicating ordered stacking of parallel 1:1 layers. Grinding resulted in delamination and formation of a disordered "card-house" type structure. The frequencies of the kaolinite OH bands show that the strength of the hydrogen bond between the intercalated halide and the inner-surface hydroxyl group decreases as Cl > Br > I. The positions of the H₂O bands imply that halide-H₂O interaction decreases in the same order. Consequently, the strength of the hydrogen bond between H₂O and the oxygen atom plane increases in the opposite sequence.

In the non-hydrous KCl-kaolinite complex the inner hydroxyl band of kaolinite at 3620 cm⁻¹ is replaced by a new feature at 3562 cm⁻¹, indicating that these OH groups are perturbed. It is suggested that Cl ions penetrate through the ditrigonal hole and form hydrogen bonds with the inner OH groups. In contrast, Br and I ions are too large to pass into the ditrigonal holes and do not form hydrogen bonds with the inner hydroxyls.

Key Words: CMS Clay KGa-1 • Infrared Spectra • Intercalation Complexes • Kaolinite • Potassium Halide-Kaolinite Complexes • X-ray Diffractograms

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