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The effect of pressure on the intercalation of an ordered kaolinite

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Abstract

Intercalation of an ordered kaolinite with potassium acetate (KCH_3COO) under a pressure of 20 bars and 220 °C, induced new Raman bands at 3590, 3603, and 3609 cm^{-1} in addition to the normal kaolinite bands. These bands are attributed to the inner surface hydroxyls hydrogen bonded to the acetate. It is proposed that the intercalation under 20 bars pressure at 220 °C caused the differentiation of the inner surface hydroxyl groups, resulting in the appearance of these additional bands. Diffuse reflectance infrared spectra of the potassium acetate intercalated kaolinite that was formed at 20 bars and at 220 °C showed new bands at 3595 and 3605 cm^{-1}. Upon formation of the intercalate at 2 bars and at 120 °C additional infrared (IR) bands were found at 3592, 3600, and 3606 cm^{-1}. These IR bands correspond well with the observed Raman spectra. It is proposed that the effect of intercalation of the highly ordered kaolinite under pressure caused the kaolinite to become disordered and this disordering was dependent on the temperature of intercalation. It is suggested that when pressure is applied to the kaolinite crystal in the presence of an intercalating agent, the hydrogen bonds between adjacent layers are broken to create space for the intercalating agent between the layers. A direct result is that the order of the kaolinite crystals shows a decrease resulting in more defect structures. This is evidenced by the additional spectroscopic bands in both the Raman and IR spectra.