Synthesis and CO_2 Adsorption Features of a Hydrotalcite-Like Compound of the Mg^{2+}-Al^{3+}-$Fe(CN)_6^{4-}$ System with High Layer-Charge Density

Gang Mao, Masamichi Tsuji and Yutaka Tamaura

Department of Chemistry, Research Center for Carbon Recycling & Utilization Tokyo Institute of Technology, 2-12-1, O-okayama, Meguro-ku, Tokyo 152, Japan

Abstract: Hydrotalcite-like compounds (HT) with 24% – 48% Al^{3+}-substitution have been synthesized in the Mg^{2+}-Al^{3+}-$Fe(CN)_6^{4-}$ system. Conditioning of the synthesized and air-dried compound with $K_4Fe(CN)_6^{4-}$ solution at 80 ° C was essential to obtain the 80% – 90% pure ionic $Fe(CN)_6^{4-}$ form on an equivalent basis. A linear decrease in a_o with an increase in the mole ratio of $R = Al^{3+}/(Mg^{2+} + Al^{3+})$ was extended to R = 0.48. The formation of highly Al^{3+}-substituted HTs has been corroborated by the decrease in the hexagonal lattice constant a_o down to 3.016 Å. The a_o value was independent of the interlayer anions. The CO_2 adsorption profiles were dependent upon both the Al^{3+}-substitution and the interlayer distance. The isosteric heat of CO_2 adsorption was 43.3 kJ mol^{-1} in the range of adsorption of 20 to 40 cm^3 g^{-1} at 298 K and 0.1 MPa.

Key Words: Al^{3+}-substitution • CO_2 adsorption • Hydrotalcite-like compound • Ion exchange

Clays and Clay Minerals; December 1993 v. 41; no. 6; p. 731-737; DOI: 10.1346/CCMN.1993.0410612