Reactions of Polynuclear Hydroxyaluminum Cations with Montmorillonite and the Formation of A 28-Å Pillared Complex[1]

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Abstract: Polynuclear hydroxy-Al cations were prepared by partially neutralizing dilute solutions of aluminum chloride. These cations were introduced in the interlayer space of montmorillonite by cation exchange, which formed heat-stable pillars between the silicate layers. Polynuclear hydroxy-Al was preferentially adsorbed on montmorillonite compared with monomer-Al; the maximum amount adsorbed was ~400 meq/100 g of montmorillonite. Of this amount 320 meq was non-exchangeable. The 001 X-ray powder diffraction reflection of the polynuclear hydroxy-Al-montmorillonite complex was at 27 Å, with four additional higher-order basal reflections, giving an average d(001) value of 28.4 Å. This complex was thermally stable to 700° C. An analysis of the basal reflections by the Fourier transform method indicated that the 28-Å complex had a relatively regular interstratified structure of 9.6- and 18.9-Å component layers with a mixing ratio of 0.46:0.54. This ratio implies that the hydroxy-Al pillars occupied every second layer. Considering the relatively small amount of Al adsorbed and the thermally stable nature of the structure, the hydroxy-Al pillars must have been sparsely but homogeneously distributed in the interlayer space.

Key Words: Fourier transform • Hydroxy-Al • Montmorillonite • Pillared interlayer complex • Thermal stability

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