
Exchange and Selective Surface Uptake of Cations by Layered Silicates Using X-ray Photoelectron Spectroscopy (XPS)

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Abstract: The cation-exchange capacities (CEC) of a previously well-characterized beidellite have been estimated nondestructively from X-ray photoelectron spectroscopy (XPS) data following exchange by various cations. The CEC obtained as an atomic ratio to silicon from Na- and Ca-clays are close to that derived chemically, i.e., 0.10(2), and 0.10(1), respectively, compared with 0.12(1). However, the apparent CEC obtained following K-, Pb-, and Ba-exchange are all about 50% greater. These measurements are complemented by XPS studies of clay exchanged in a solution containing both Ca and Ba ions where XPS gave a total apparent exchange capacity relative to Si of 0.16, with 0.10 from Ca and 0.06 from Ba. Bulk chemical analysis has, however, shown that the true Ba value is only 0.01. It is concluded that the cation excess detected by XPS—a technique with a total sampling depth of only about 100 Å—is concentrated at the surfaces of the clay particles.

Key Words: Beidellite • Cation Exchange • Surface Exchange • X-ray Photoelectron Spectroscopy

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