
Characterization of Untreated and Alkylammonium Ion Exchanged Illite/Smectite by High Resolution Transmission Electron Microscopy

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Abstract: High resolution transmission electron microscopy (HRTEM) have been performed on dispersed portions of one R > 1 and two R3 illite/smectite (I/S) samples from Silurian K-bentonites. R > 1 sample was studied by HRTEM before and after alkylammonium ion treatment and R3 samples were studied only after alkylammonium ion treatment. The HRTEM images of the chemically untreated R > 1 sample were predominated by lattice fringe contrast with 20– 40 Å periods, interpreted to represent various ordered I/S units. HRTEM images of the three alkylammonium-treated samples displayed very small, dispersed particles composed of illite packets separated by alkylammonium expanded interlayers. In the R > 1 sample, illite packets were mostly 20 Å to 40 Å thick whereas in R3 samples they were predominantly over 40 Å. Although a good degree of dispersion of the bulk samples was achieved, dispersed particles recorded on images were thicker than the fundamental particles postulated by Nadeau and coworkers. Alkylammonium ion-expanded interlayer thicknesses point out a trend toward a higher charge in the expandable interlayers (i.e., illite particle surfaces) with increasing illite content from the R > 1 sample to the R3 samples. In the R3 samples, the interlayer charge is sufficiently high to be vermiculitic.

Key Words: Alkylammonium • Clays • Diagenesis • Illite • Interstratification • Smectite • Transmission Electron Microscopy

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