
Infrared Spectroscopic Analyses on the Nature of Water in Montmorillonite

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Abstract: Interlayer cations and moisture content greatly influence the molecular vibrations of H₂O in montmorillonite as shown through reflectance spectroscopy in the infrared. The absorptions due to H₂O have been studied in montmorillonites exchanged with H, Na, Ca, Mg and Fe³⁺ interlayer cations under variable moisture environments. Band assignments have been made for absorptions in the 3 μm region due to structural OH vibrations, symmetric and asymmetric H₂O stretching vibrations and the H₂O bending overtone. Changes in the energies of the absorptions due to H₂O stretching vibrations were observed as the samples were dehydrated by reducing the atmospheric pressure. Absorptions near 3620 cm⁻¹ and 3550 cm⁻¹ have been assigned to water bound directly to cations (inner sphere) and surface-bonded H₂O and absorptions near 3450 cm⁻¹ and 3350 cm⁻¹ have been assigned to additional adsorbed water molecules. Band assignments have been made for combination bands in the near-infrared as well. Absorptions near 1.41 μm and 1.91 μm are assigned to bound H₂O combination bands, while the shoulders near 1.46 μm and 1.91 μm are assigned to combinations of additional H₂O molecules adsorbed in the interlayer regions and along grain surfaces.

Key Words: Montmorillonite • Spectroscopy • Water

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