Infrared Absorption Spectrometry in Clay Studies

V. C. Farmer and J. D. Russell

Department of Spectrochemistry, The Macaulay Institute for Soil Research, Aberdeen, Scotland

Abstract: The relationships between spectrum and structure in layer-silicates are reviewed, and applied in the study of structural changes occurring during the heating of montmorillonites up to dehydroxylation, and their subsequent rehydroxylation. Information given by infrared spectroscopy on the binding of water in expanding layer silicates is presented, and the physical and chemical processes associated with entry of basic, neutral and acidic molecules into the interlayer space of these minerals are illustrated for ammonia, ethylamine, pyridine, nitrobenzene, and benzoic acid. Problems associated with the study of soil clays, which are often complex mixtures including poorly ordered and amorphous constituents, frequently firmly combined with organic matter, are discussed.

New evidence is presented concerning the environment of the two types of hydroxyl group in beidellite. The thermal stabilities of NH_4^+ and lattice OH in montmorillonite and beidellite, and the properties of their dehydroxylates, are contrasted. The nature of the collapsed phase formed in Li-, Mg-, and NH_4-montmorillonite at $300-500\ ^\circ$ C is discussed. The presence of weak hydrogen bonds between lattice oxygens and interlayer water is established, although it is shown that the strength of hydrogen bonds formed between NH_4^+ and lattice oxygens is dependent on the sites of substitution in the layer lattice.

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