Intracrystalline Swelling of Montmorillonites in Water-Dimethylsulfoxide Systems

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Abstract: The basal spacings of montmorillonites with Li, Na, K, Cs, Mg, Ca, St, Ba, and Pb interlayer cations were measured after immersion in dimethylsulfoxide (DMSO) and in water-DMSO mixtures. In DMSO alone, the spacings were in the range 18.3 – 19.3 Å and fell on or near a single curve when plotted against ionic field strength, q/r^2, where q = valence and r = ionic radius. These spacings correspond to double layers of DMSO molecules between the silicate layers. Water had practically no effect on the spacings when the mole fraction of DMSO exceeded about 35 – 45%. Osmotic swelling of Li-, Na-, and K-montmorillonite occurred up to mole percentages of DMSO 45%, 30%, and 10%, respectively. K- and Cs-montmorillonite formed single-layer complexes in appropriate water-DMSO mixtures with spacings of 14.3 Å prior to development of double-layer complexes when the mole fraction of DMSO exceeded 35% and 15%, respectively.

Key Words: Dimethylsulfoxide • Interlayer • Montmorillonite • Swelling • Water

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