
The I.R. Spectra of Dimethyl Sulfoxide Adsorbed on Several Cation-Substituted Montmorillonites*

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Abstract: The i.r. spectra ($4000\text{--}1200\text{ cm}^{-1}$) are obtained for several homoionic montmorillonite films on which various amounts of dimethyl sulfoxide (DMSO) were adsorbed. Analyses of these spectra indicate that H- and natural-montmorillonite-DMSO complexes contain an intercalated layer of physisorbed DMSO while transition metal cation substituted-montmorillonite-DMSO complexes possess both physi- and chemisorbed DMSO in their interlamellar spaces. The latter species involve coordination of DMSO molecules with the exchangeable cations by their oxygen atoms. Most of the interlamellar water is replaced by DMSO as the latter molecules penetrate the interlamellar spaces. Heat-treating transition metal cation substituted-montmorillonite-DMSO complexes at 120° C for 48 hr results in both the desorption of physisorbed DMSO and the retention of intercalated monolayers involving DMSO-transition metal cation coordination. A water-sensitive, reversible color change (tan to light purple) is produced by either desiccating over P_2O_5 or heat-treating at 120° C the cobalt-montmorillonite-DMSO complex. Interpretation of the visible spectra suggests that Co^{2+} -cations undergo changes from octahedral to tetrahedral coordination during desiccation or heating. Band assignments are made for the clay complexes using the assignments for related gases, liquids, and crystals.

Key Words: Chemisorption • Dimethylsulfoxide • Montmorillonite • Physisorption

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