Characterization of Adsorbed Iron in Montmorillonite by Mössbauer Spectroscopy[1]

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Abstract: The Mössbauer effect of Fe^{57} was used to probe and characterize iron ions adsorbed on the interlayer surfaces of montmorillonite. Measurements were performed with Fe- and Ca-saturated montmorillonites. At 210 ° K the intensity of the Fe^{2+} line was greatly reduced, apparently due to the melting of interlayer water. Neither the structural Fe^{2+} in Ca-montmorillonite nor the adsorbed Fe^{3+} in Fe-montmorillonite were affected by the melting process. From the temperature dependence of the absorption intensity, the effective Debye temperature of all the iron species appears to be approximately the same (θ_D = 189 ± 5 ° K). This result allowed for an accurate determination of the population of Fe^{2+}/Fe^{3+} in various samples.

Key Words: Debye temperature • Iron • Montmorillonite • Mössbauer spectroscopy • Water

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