
Structure-Composition Relationships in Trioctahedral Chlorites: A Vibrational Spectroscopy Study

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Abstract: Raman and Fourier-transformed infrared spectra of natural trioctahedral chlorites of polytype IIb were obtained for a series of samples characterized by distinct Fe/(Fe + Mg) and Si/Al ratios ranging, respectively, from 0.04 to 0.94 and from 5.18 to 1.86. All samples were characterized by X-ray powder diffraction, and quantitative electron microprobe analysis. In the 3683-3610-cm⁻¹ spectral range, the wave number of the OH-stretching band from the 2:1 layer (band I) decreased with an increase of iron content at constant Al(IV) content. The more intense bands II and III at about 3600 cm⁻¹ and 3500 cm⁻¹, were assigned to hydroxyl groups involved in hydrogen bonds: (SiSi)O ... HO, with the hydrogen bonds being roughly perpendicular to the basal plane, and (SiAl)O ... HO, respectively. At higher tetrahedral Al and octahedral Fe contents, spectra exhibited OH-bands II and III, respectively, at a lower frequency. Band III intensity increased and band II was enlarged for chlorites displaying higher Al(IV) contents.

In the 1300– 1350-cm⁻¹ spectral range, most infrared spectra displayed intense bands at 1090, 1050, 990, and 960 cm⁻¹, which were assigned to T-O stretching of symmetry species Al and El. The second type of bands observed both in Raman and infrared spectra were at about 650– 800 cm⁻¹; they were assigned to OH vibrations and were strongly dependent on the composition of the interlayer octahedral sheet, especially on the Fe content.

Key Words: Chlorite • Hydroxyl • Infrared spectroscopy • Raman spectroscopy • Structure

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