The Influence of the Christiansen Effect on I.R. Spectra of Powders

R. Prost

Institut National de la Recherche Agronomique, Route de Saint-Cyr, 78, Versailles, France

Abstract: The Christiansen effect appears in the i.r. spectrum of powders embedded in a solid, liquid or air matrix as an apparently anomalous transmittance (Christiansen peak) of the incident electromagnetic radiations. The peak appears at wavelengths for which the refractive index of the sample and the refractive index of the matrix are equal (Christiansen wavelength: λ_{Chr}).

On account of the great variation of the sample refractive index in the immediate neighborhood of the absorption bands (anomalous dispersion curve), one often observes the occurrence of a transmittance peak or of a band deformation in this spectral range. A change in the position of this transmission peak with the value of the matrix refractive index is indicative of the Christiansen effect.

The equality of the refractive indices of the sample and of the matrix for λ_{Chr} has been used to determine some points of the anomalous dispersion curve in the neighborhood of the hydroxyl stretching band (3678 cm^{-1}).

Spectral distortions caused by the Christiansen effect can be reduced by preparing the sample in such a manner that the width at half-maximum ($\Delta\nu_{1/2}$) of the Christiansen peak is several times greater than this of the absorption band itself. Clarke's theoretical formula, which gives an estimation of $\Delta\nu_{1/2}$, has been qualitatively verified and thus gives an appropriate guide in the choice of the parameters which one can optimize during the sample preparation. One can reduce the Christiansen effect spectral modifications, without running the risk of modifying the sample itself, particularly by overly severe grinding.

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