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NOTE ON THE FIRST ORDER RAMAN SPECTRUM OF CuCl (1)

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Résumé. — Observation du spectre Raman de monocristaux. Comparaison avec les résultats antérieurs.

Abstract. — The Raman spectrum of single crystals is given and the results compared with those of previous experiments.

We have carried out preliminary photographic measurements of the first order Raman spectrum of CuCl at room temperature using a 10 milliwatt He-Ne laser as the source of the exciting radiation and a medium quartz Hilger spectrograph. The room temperature spectra which we have obtained closely resemble the spectra for zincblende obtained by Couture-Mathieu and Mathieu [1] in 1953. Thus, for the case where the incident and scattered radiation were both polarized in the plane of scattering, the intensity of the LO line is appreciably greater than that of the TO line. Our results which are still tentative yield \( \omega_L = 201 \text{ cm}^{-1} \) and \( \omega_T = 153 \text{ cm}^{-1} \). These values for the LO and TO frequencies are in good agreement with the corresponding values, \( \omega_L = 195 \text{ cm}^{-1} \) and \( \omega_T = 155 \text{ cm}^{-1} \) derived from oblique incidence transmission measurement on thin epitaxial films [2]. The infrared measurements indicate a dependence of \( \omega_L \) on mechanical strain, which may account for part of the difference in the measured values.

Our results for the fundamental optical vibration frequencies are at variance with those obtained by other investigators. Thus, Henninger, Morlot, and Hadni [3] report \( \omega_T = 172 \text{ cm}^{-1} \) based on normal incidence transmission measurements on thin films, and Mathieu, Poulet, and Tramer [4] report \( \omega_L = 290 \text{ cm}^{-1} \) based on Raman scattering measurements on compressed powders for which only one line was observed. Application of the Lyddane-Sachs-Teller relation to our infrared results, namely \( \varepsilon /\varepsilon_0 = \omega_L^2 /\omega_T^2 = 1.52 \) with \( \varepsilon_0 = 4.8 \) [5], yields \( \varepsilon_S = 7.4 \), in good agreement with the value \( (\varepsilon_S = 7.5) \) obtained at C-band frequencies [6]. This value for the static dielectric constant is appreciably smaller than the one \( (\varepsilon_S \approx 10) \) reported in the literature [7], which has been used to calculate \( \omega_L \) from \( \omega_T \). By combining the values for \( \varepsilon_S \), \( \omega_T \), and \( \omega_L \) we obtain \( \varepsilon_S = 0.51 \text{ e} \) for the Szigeti effective charge and \( \varepsilon_B = 1.15 \text{ e} \) for the Born effective charge, which are appreciably lower than the values derived from the earlier values of \( \varepsilon_S \) and \( \omega_T \) [7].

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REFERENCES