

concentration of its ions according to the Nernst theory should have been $N/10,000$, it was actually found by direct chemical analysis to be less than $N/100,000$.

Attempted generalisation of whole position. When there is no sensible concentration of the ions of a metal electrode in a solution, and the electrode is not covered by an oxide film, its potential is determined by pH if its hydrogen overvoltage is positive to the deposition potential which it would have in a solution of the order $N/1000$ in its own ions. When this is not the case, the potential is controlled by anion concentration, probably acting through a film of electrolyte in contact with the metal with a concentration of electrode metal ions of the order of $N/10,000$.

It is hoped later to investigate further the reason for the reproducible potential attained by high overvoltage metals, but for the present it is intended to study aerated conditions, and for this reason it has been thought well to summarise previous work in which air was strictly excluded.

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¹ McAulay and Bastow, *J.C.S.*, p. 85, 1929. McAulay and White, *J.C.S.*, p. 94, 1930.

Raman Spectra of Pinene.

IN a series of researches to be published in full shortly on the Raman spectra of *d*- and *l*-pinene in the liquid condition, we have observed near the line $\nu = 23257$ (corresponding to the Raman $\nu = 1454$ excited by the line $\lambda = 404.6$ of mercury) a series of

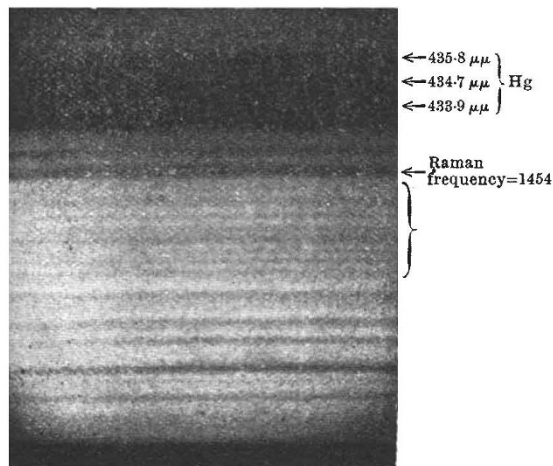


FIG. 1.—Raman spectrum of pinene.

eight lines, very weak, sensibly at the same distance, and the distances of which from the Raman line above mentioned can be represented to a good approximation by the relation $\Delta\nu = B(4m + 4)$,¹ which, as is well known, corresponds to the series of Raman frequencies of rotation relative to the rotator with fixed axis. By putting $B = 6.15$, the mean differences between calculated and observed values amount to ± 0.017 per cent. The value of m should corre-

spond to the even series, namely, 2, 4, 6, 8, etc. Supposing the rotator composed by two atoms of H of one CH_2 rotating round the carbon atom (considering that the Raman frequency $\nu = 1454$ is attributed² to the transverse oscillations of the two H atoms in the group CH_2), we calculate, from the value of B , that the distance between the atoms of hydrogen and carbon in the CH_2 group is 1.16×10^{-8} cm., in good accordance with the values published by Mecke,³ namely, 1.13×10^{-8} cm. In view, however, of the difficulty of obtaining good vibration and rotation spectra in liquids with complex molecules, we merely direct attention to the coincidence observed (working with a spectrograph with small dispersion); we intend to repeat the work with higher dispersion, before giving a definite interpretation to the results.

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¹ V. P. Pringsheim, "Ramanspektren". "Handb. der Physik", Bd. 21, p. 629; and Schrödinger, *Ann. der Phys.* (4), 79, p. 520; 1926.
² Dadiou u. Kohlrausch, *Ber. Deut. Chem. Ges.*, 63, p. 262; 1930.
³ Mecke u. Hedfeld, *Zeits. f. Phys.*, 64, p. 161, note.

The Wave-length of X-Rays.

IT is well known that determinations of the wave-length, λ , of X-ray spectral lines, which have recently been made by means of line gratings, do not agree with those found by crystals, the crystal values being 0.1 to 0.3 per cent less than the line grating values. In this use of line gratings the angles of incidence and diffraction have been small and have proved difficult to measure, but the accuracy attained in some of the observations of λ (for example, that of Backlin for aluminium $K\alpha$) is probably not less than 1 in 1000. In the crystal method, relations of the form $n\lambda = 2d \sin \theta$ and $d^3 = eM/\rho F$ (e , electronic charge; F , faraday; M , molecular mass; and ρ the density of the crystal) are used to find λ , and the angle of reflection θ has been measured with high accuracy. Since M , ρ , and F are subject to smaller errors than e , the disagreement in the values of λ found by the two methods is usually attributed to an error of 0.3 to 0.9 per cent in the accepted value of e . If the precision of the grating method could be increased, these relations would be available to find the electronic charge more accurately than it is known at present.

The precision with which the wave-lengths of the lines of the spectrum in the optical region are known has enabled many problems in physics to be solved, and it is probable that improvement in the absolute accuracy of X-ray wave-lengths will prove of similar value.

In X-ray spectrometry up to the present the grating appears always to have been used to measure wave-lengths not relatively but absolutely, and this involves the precise determination of small angles. In the light of experiments we have performed, it would appear to be possible to use Rowland's method of the coincidence of lines in different orders of the grating spectrum over the whole spectral region from the optical to X-rays. It should be noted that the absolute errors in Rowland's wave-length tables do not imply any failure of this method, and from Kayser's comparison of Rowland's values of λ with interferometer values it appears that the method has a precision of one in a million in relative determinations in the optical region.

One of the difficulties to be anticipated in extending the methods to the X-ray region is that, owing to the small angle at which X-rays are reflected at the surface of a solid, the method would fail in that region. Using