

susceptibility of the CaS-Bi phosphor initially illuminated strongly. As the materials utilised in the preparation of the phosphor are all diamagnetic, the observed increase of diamagnetism while luminescent cannot be ascribed to a temperature effect. An independent test has shown that the temperature effect on the magnetism of the powder is inappreciable. According to the view put forward by Lenard,¹ the phosphorescent centre consists of the atom of the heavy metal (Bi) attached to a sulphur atom in the ringlike arrangement of the alkaline earth sulphide (CaS). The increase in the observed diamagnetism while luminescent is on this basis explicable as arising from the larger electron orbits which circumscribe the phosphorescent centre on irradiation; our results therefore lend support to Lenard's view regarding the mechanism of phosphorescence. The earlier results of Rupp² cannot however be reconciled with the expectations of the Lenard theory.

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April 11, 1940.

¹ Lenard, *Ann. der Physik*, 1910, 31, 641.

² Rupp, *ibid.*, 1925, 78, 505. (*Vide Physical Principles and Applications of Magnetochemistry* by Bhatnagar and Mathur, p. 158.)

A New Band λ 2963 of the OD Molecule

IN a previous letter¹ the rotational structure of the (2,1) band λ 2916 of the OD molecule has been reported. Further work on the emission band spectrum of heavy water has revealed the existence of a new band with its head at λ 2963, showing doublet P, Q, R branches, characteristic of the electronic transition $^2\Sigma^+ \rightarrow ^2\pi_{\text{inv}}$. The values of the rotational term differences and the calculated constants indicate that the band corresponds to the vibrational states $\nu' = 3$ and $\nu'' = 2$. Attempts are being made to detect the analogous (3,2) band of the OH molecule, which does not appear

to have been identified so far in spite of numerous investigations on the emission spectrum of ordinary water vapour.

The calculated constants for λ 2963 referred to above are $B_3' = 8.09$, $B_2'' = 9.31$.

The wave numbers of the lines $Q_1(1)$ and $P_1(1)$ are 33702.8 and 33686.9 cm^{-1} respectively. The analysis has led further to estimate the vibrational constants for the lower electronic state of the OD molecule. From the data for the bands (2,0), (2,1) and (3,1), (3,2) the intervals $\Delta\nu_{\frac{1}{2}}''$ and $\Delta\nu_{1\frac{1}{2}}''$ have been found to be 2632.0 and 2544.5 cm^{-1} respectively. Hence it is easy to deduce the following values for the vibrational constants,

$$\omega_e'' = 2719.5, x_e''\omega_e'' = 43.75.$$

The mass ratio of the hydrogen isotopes estimated from ω_e'' (OD) and ω_e'' (OH) is obtained as $\rho = 0.7281$.

Details of the rotational structure will be published shortly.

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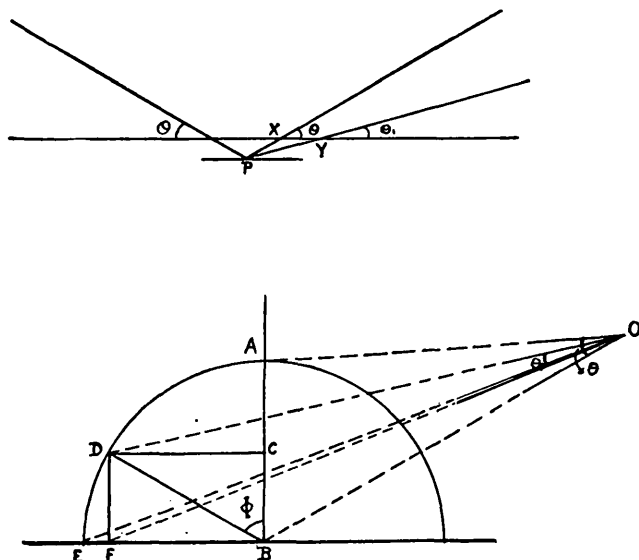
Andhra University,
Waltair,
April 8, 1940.

¹ *Curr. Sci.*, 1940, 4, 172.

Variation of Intensity along an Electron Reflection Ring

IN examining the structure of a polycrystalline surface by electron reflection, the patterns obtained consist of rings in the form of semi-circles. The reflected rays lie on a cone with the incident beam as the axis. The electrons reflected along a generator of this cone which lies in the plane of incidence, leave the material by the shortest path; while the electrons moving along any other generator have to travel over a longer distance. Those electrons which travel over a longer distance in the material are absorbed more than those which have a shorter path in it. Thus we can see that the intensity of a ring in a reflection pattern—which is merely the section of cones

of reflection—will be maximum along the planes of incidence, and will diminish as we go further and further away from this plane.



In the figure ADE is the ring, BAO the plane of incidence, DO any ray making an angle $\text{DBA} = \phi$, and the angle $\text{DOF} = \theta$, the angle of emergence of the ray OD. Since OA lies in the plane of incidence, the angle BOA, the angle of emergence of the ray OA is equal to the glancing angle θ . Further X and Y are the paths travelled respectively by the central ray OA and the ϕ -ray OD, after reflection at P within the material. If we assume that the reflecting block has a flat surface we get from the geometry of the figure

$$\sin \theta_1 = \sin \theta \cos \phi$$

$$\text{and } y = x \sec \phi.$$

It is quite natural to suppose that the electrons like X-rays obey an exponential law of absorption. On this supposition we get

$$I_\phi = I_{\phi_0} e^{-\mu x \text{ (see } \phi-1)}$$

where I_{ϕ_0} is the intensity for $\phi = 0$. For a definite specimen and a particular ring, x would be fixed and we may write $\mu x = A$, a constant.

In column two of the table are given the values of I_ϕ for different values of ϕ and A , these are calculated on the assumption that $I_{\phi_0} = 100$ in each case. Column three gives the relative intensities obtained with a microphotometer, here also for comparison the values are expressed with $I_{\phi_0} = 100$. The specimen used

TABLE

Angle	I_ϕ Calculated			I_ϕ Observed
	$A = 1$	$A = 3$	$A = 10$	
0°	100	100	100	100
1°	100	100	100	100
15°	97	90	70	98
30°	85	63	22	87
45°	66	29	2	68
60°	37	5	negligible	34
75°	6	negligible		5
80°	1			negligible
85°	negligible			

to produce the pattern was a polished piece of silver etched to give rings. In this case the best agreement between the observed and calculated values of I_ϕ is obtained for $A = 1$. A qualitative consideration of the penetrating power of the fast electrons also shows that A or μx should be of the order unity for 30 K.V. electrons.

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May 1, 1940.

The Mechanism of the Persulphate-Alkyl-Iodide Reaction

THE persulphate-alkyl-iodide reaction was found by us to be kinetically of the first order with respect to the alkyl iodide.¹ However, the reaction is not unimolecular, as varying the concentration of either of the reactants produces a corresponding variation in the reaction rates. The persulphate acts not only as an oxidising agent, but also as a catalyst, the potassium ions exerting a primary electrolyte effect.

This reaction cannot be analogous to the reaction between potassium persulphate and