

Predissociation in the Third Positive Group of CO

IN a former communication¹ we recorded the discovery of a predissociation in the upper level ($B^1\Sigma$) of the Angström bands. For the energy of the dissociation state responsible for this predissociation, we found a value of 11.08 volts above the normal state of the molecule.

In their investigation of the third positive group of CO, Dieke and Mauchly² noticed that these bands, the common initial level of which is the O-vibrational state of $b^3\Sigma$, can be traced to $K = 54$, $K = 55$, $K = 56$ for the R-, P-, and Q-lines respectively. Examining the $0 \rightarrow 1$ band of this system on my own plates, it appeared to me that, at these rotational quantum numbers, a disappearance (or at least a very strong decrease in intensity) of the band lines occurs. This points to a predissociation in the $b^3\Sigma$ -level at $K = 55$ caused by a dissociation level with an energy of 11.08 ± 0.01 volt above the normal state. This is obviously the same dissociation state as that which causes predissociation in the $B^1\Sigma$ level of the Angström bands referred to above.

F. BRONS.

Natuurkundig Laboratorium
der Rijks-Universiteit,
Groningen.
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¹ NATURE, 133, 140; 1934. *Physica*, 1, 634; 1934.
² G. H. Dieke and J. W. Mauchly, *Phys. Rev.*, 43, 12; 1933.

Stark Splitting of the 6S Level of the Manganous Ion in Crystalline Fields

IN recent papers, Kramers, Bethe and Van Vleck¹ have discussed theoretically the possibility of a weak Stark splitting of the 6S levels of Mn^{++} and Fe^{+++} ions in crystalline fields. As Van Vleck has shown, such a splitting would lead to two important consequences in the magnetic behaviour of these ions in crystals: (1) it would produce a feeble magnetic anisotropy in the crystal; (2) the temperature dependence of the three principal susceptibilities of the crystal would not exactly conform to the simple Curie law. The first effect, namely, the magnetic anisotropy, can be measured accurately, and can indeed be used, as Van Vleck has pointed out, as a means of calculating indirectly the magnitude of the Stark separation.

Using the special experimental arrangement designed by us for measuring feeble anisotropies², we have recently measured the anisotropies of a number of manganous salts of the Tutton series, $MnSO_4 \cdot A_2SO_4 \cdot 6H_2O$, where $A = NH_4, Rb, Cs, Tl$; $MnSeO_4 \cdot A_2SeO_4 \cdot 6H_2O$, where $A = NH_4, Rb, Tl$. The differences $\Delta\chi$ between the maximum and the minimum gram molecular susceptibilities of these crystals at about 25° C. range from 11.4×10^{-6} (C.G.S. E.M.U.) in manganous ammonium sulphate to 7.0×10^{-6} in manganous caesium sulphate. For all the crystals the mean of the three principal susceptibilities is about $14,000 \times 10^{-6}$.

Part of this anisotropy must be attributed to that of the *diamagnetism* of the crystal. This may be taken, to a first approximation, to be the same as the anisotropy of the corresponding diamagnetic Tutton salt obtained by replacing Mn by Mg. (The anisotropies of the latter salts are found to range from 2.5 to 0.9×10^{-6} .) A further correction is

also necessary for the anisotropy arising from the mutual influence of the magnetic moments of neighbouring Mn^{++} ions, which are not arranged in a cubic lattice.

After making these corrections, we find that the residual anisotropies of the manganous salts correspond to a Stark separation of the 6S levels of only a small fraction of a cm^{-1} .

K. S. KRISHNAN.
S. BANERJEE.

210 Bowbazar Street,
Calcutta.
Feb. 18.

¹ *Phil. Mag.*, 17, 961; 1934.

² *Phil. Trans.*, A, 232, 99; 1933.

Raman Spectrum of 1.3.Cyclohexadiene

WE published in May last year¹ an account of the Raman spectrum of 1.3.cyclohexadiene (obtained by the Harries-Willstätter method). Another method for the preparation of that compound is that of Crossley². However, Harries³ first and Willstätter and Hatt⁴ afterwards stated that the 1.3.cyclohexadiene prepared in accordance with Crossley's method was very impure as regards cyclohexene, bromocyclohexene and benzene. On the other hand, Willstätter⁴ stated that a pure 1.3.cyclohexadiene can be obtained with his method. In Fig. 1 we give the position of the Raman lines of the two samples of 1.3.cyclohexadiene prepared by us using these two methods.

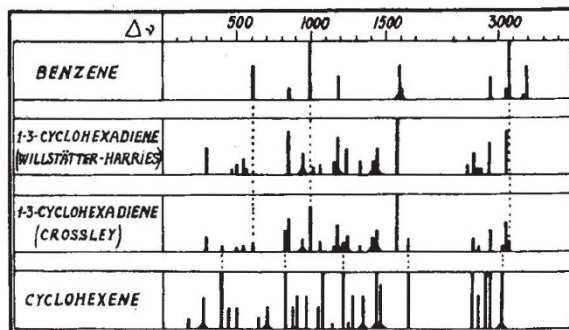


FIG. 1.

1.3.cyclohexadiene (prepared by the Harries-Willstätter's method): 292($2\frac{1}{2}$); 468(0); 501(1); 553($1\frac{1}{2}$); 568($\frac{1}{2}$); 843(4); 940(2b); 1010($\frac{1}{2}$); 1053(1); 1145($1\frac{1}{2}$); 1171($3\frac{1}{2}b$); 1235($2\frac{1}{2}$); 1321($1\frac{1}{2}$); 1408($1\frac{1}{2}b$); 1432($2\frac{1}{2}b$); 1574(10); 2789(1); 2829(2); 2860($\frac{1}{2}$); 2879($\frac{1}{2}$); 2946(3); 3051(4).

1.3.cyclohexadiene (prepared by Crossley's method): 292($1\frac{1}{2}$); 389($\frac{1}{2}$); 498(0); 548($\frac{1}{2}$); 605($\frac{1}{2}$); 822(2); 846(3); 940($1\frac{1}{2}b$); 992(4); 1056(1); 1148($\frac{1}{2}$); 1174($2\frac{1}{2}b$); 1220(1); 1235($1\frac{1}{2}$); 1321($\frac{1}{2}$); 1408($1\frac{1}{2}b$); 1431(2b); 1574(10); 1648($1\frac{1}{2}$); 2827($1\frac{1}{2}$); 2872(1); 2940(2); 3029($\frac{1}{2}$); 3049(3); 3067(1).

It can be seen from Fig. 1 (as can likewise be inferred from examination of the published values) that some of the extra lines given by the sample prepared by Crossley's method, belong to the Raman spectrum of benzene, and others to the Raman spectrum of cyclohexene. Hence Willstätter's observation is confirmed, namely, that the 1.3.cyclohexadiene when prepared by Crossley's method has many impurities, amongst which are benzene and cyclohexene.