

populations on the 50% and 5% level of significance respectively, which gave us $(l+1)$ C.C.'s which are not numerically less than r_1 in m random C.C.'s. These values will help the forecaster in forming a rough estimate of the amount of reliability he can place in his forecasts. As already mentioned above, more details will be given elsewhere.

S. R. SAVUR.

Meteorological Office,
Poona 5,
September 14, 1934.

Rectification Phenomenon in Pyrolusite Crystal.

IN the course of our investigations on the crystal-and-point rectification, we found that when ordinary mineral pyrolusite (MnO_2) crystal was dipped into mercury, alternating current was rectified to a great extent. The source of the alternating current was a 1000 cycle alternator (microphone hummer). When tested with steady voltages, the current-voltage characteristic curve showed a marked asymmetry. A typical characteristic curve is shown in Fig 1. The resistances as calculated from the curve for different positive and negative voltages are also illustrated in the same figure. The rectification ratio which is taken as the ratio of the difference of the currents in the two opposite directions to the larger value of the current is also shown. The ratio decreased in this particular experiment with the applied voltage. The value was 50% for 2 volts.

The mercury used was cleaned after shaking it with dilute nitric acid in a mechanically shaking machine for eight hours. After subsequently washing it in running distilled water, the pyrolusite crystal on drying was mounted so as to dip into the clean mercury. The crystals such as galena (PbS), iron pyrites (FeS_2), bornite (Cu_2S , CuS , FeS), magnetite (Fe_3O_4), molybdenite (MoS_2) did not, however, show any such rectification effect, when similar experiments were performed under similar conditions.

It should be made clear that the rectification generally observed with these crystals in combination with a pointed metal is reduced to zero, when the contact area is large. The pyrolusite crystal dipped into mercury had, in our experiments, a very large contact area so that the effect observed could not be attributed to the ordinary crystal-and-point rectification. When the

same pyrolusite crystal was held between two electrodes of large area, there was no such rectification effect.

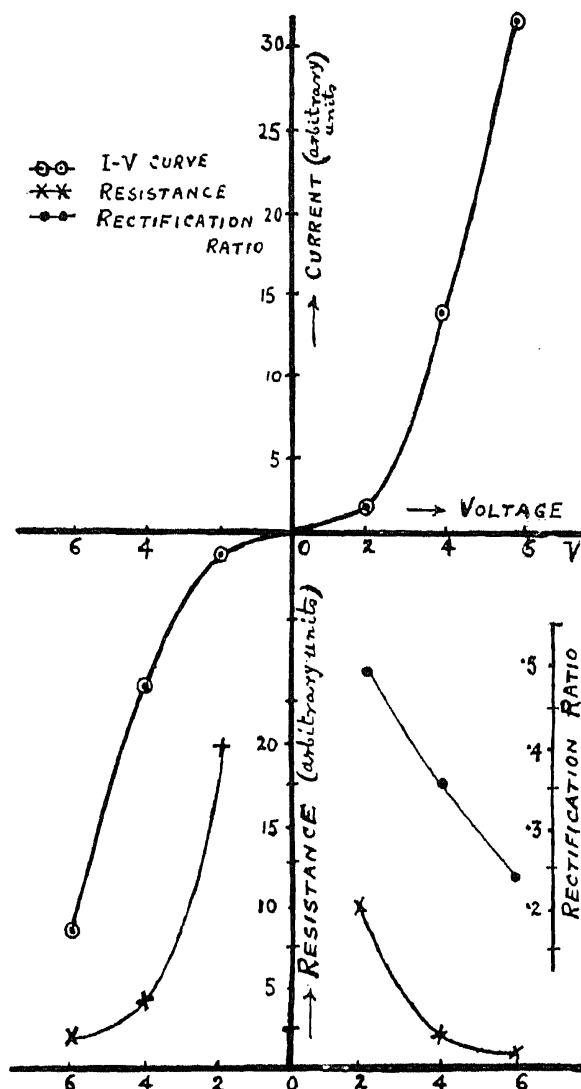


Fig. 1.

The cause of this rectification seems to be associated with the layer of air between the surface of the crystal and mercury. This is yet a subject of further investigation. Whatever be the cause, this promises to be of great practical use.

S. R. KHASTGIR.

ANIL KUMAR DAS GUPTA.

Physics Laboratory,
Dacca University,
September 23, 1934.

The Band Systems of $CaCl_2$.

THE spectrum of the carbon arc fed with $CaCl_2$ has been measured on plates taken in the first order of a 21 ft. grating. These data together with those of Hedfeld* are utilised in analysing the bands. While

* *Zeit. für. Phys.*, 1931, 68, 610.

there is excellent agreement between the data of Hedfeld and the present measurements. Some of the bands measured by him do not really belong to the CaCl_2 molecule.

The bands consist of two systems one of which, the red system, is clearly due to the transition ${}^2\Pi \rightarrow {}^2\Sigma$. These involve two P and two Q heads and the system comprises only the $\Delta v=0$ and -1 sequences. The equation representing the Q_1 heads is:—

$$v = 16094.6 + (363.76 v' - 1.16 v'^2 + 0.0012 v'^3) - (360.81 v'' - 1.01 v''^2 - 0.001 v''^3).$$

The heats of dissociation for the ${}^2\Pi$ and ${}^2\Sigma$ states are found to be 4.60 and 3.46 volts respectively. This indicates that in the ${}^2\Pi$ state of the molecule is involved the anomalous $(4p) {}^3P$ term of the Ca atom. The ${}^2\Sigma$ state arises out of the $(4s 4p) {}^3P^o$ term of the Ca atom.

The other, orange system, involves evidently a $\Sigma - \Sigma$ transition. The final level of this system does not at all correspond to the final level of the red system. These bands degrade towards the shorter waves but the sequences degrade to the longer waves. Only two, $\Delta v=0$ and $+1$ sequences are developed. The following equation represents the heads:—

$$v = 16847.6 + (361.38 v' - 1.68 v'^2 - 0.015 v'^3) - (364.51 v'' - 1.46 v''^2 - 0.02 v''^3).$$

This gives for the heats of dissociation of the upper and lower states, 1.53 and 1.52 volts respectively. It can be shown that the upper Σ state arises out of the $(4s 5s) {}^3S$ term of the Ca atom and the lower from $(4s 4p) {}^3P^o$ term of the Ca atom. This latter level should apparently be identical with the ${}^2\Sigma$ state of the red system. However, the discrepancy not only in the vibrational constants but also in the heats of dissociation points to a different Σ level for the final state of the orange system. The ultra-violet system has not been dealt with.

Details will be published elsewhere.

R. K. ASUNDI.

Physics Research Laboratories,
Muslim University,
Aligarh,
September 27, 1934.

Additional Bands in the Band System of Sulphur.

On measuring my plates of the emission bands of sulphur produced in a discharge tube containing sulphur vapour in the presence of Argon, a few bands not previously recorded, have been observed. No

bands could be traced to wave-lengths higher than 6612.3 Å. All bands from this wave length down till 4136 Å possess in the main, three heads, the strongest of them agreeing in wave-lengths with those of such of the bands as are also recorded by Fowler and Vaidya.* The following newly recorded bands fit in the scheme of vibrational analysis given by these authors and thus form part of the already known system of the S_2 molecule:

$(v'v'')$	$\lambda_{\text{air}} (\text{int})$	$\nu (\text{vac})$
9,32	6612.3 (8)	15119
8,31	6545.0 (7)	15275
7,30	6476.3 (5)	15437
9,31	6382.7 (10)	15663
8,30	6316.7 (9)	15827
7,29	6251.5 (8)	15993

R. K. ASUNDI.

Physics Research Laboratories,
Muslim University,
Aligarh,
September 27, 1934.

Influence of Dissolved Electrolytes on the Constitution of Water.

RAMAKRISHNA RAO¹ has recently suggested that the changes with temperature in the distribution of the intensity of the three components of the Raman band of water at 3610 cm.^{-1} , 3413 cm.^{-1} and 3195 cm.^{-1} may be explained on the hypothesis that water consists of three types of molecules represented by (H_2O) , $(\text{H}_2\text{O})_2$ and $(\text{H}_2\text{O})_3$, to which are attributed the above three components, and the changes in the relative proportions of which bring about the above intensity changes. He also suggested that the effect of dissolved electrolytes on water may also result in the formation of hydrates by the association of the molecules of water with the ions of the solute.

The above hypothesis was put forward on the basis of work with only a few electrolytes at a few concentrations. With a view to investigate how far this is applicable in general to all electrolytes at a large number

* Proc. Roy. Soc., 1931, 132A, 310.

¹ Proc. Roy. Soc., 1931, 130A, 489.