

*A-F*, giving the order *B, F, D, A, C* for the electrical, and *C, A, B, E, D* for the optical, method of excitation. Some confusion has, however, arisen, and it may be due to the fact that, when Sporer, Nordheim, Sklar and Teller<sup>3</sup> suggested their new basis for assignments in the ultra-violet spectra of benzene, they very properly changed Ingold and Wilson's labels. In any event, there appears to be no difference in the order of the intensities, which in both spectra agrees with the Boltzmann factors associated with the progressions.

The other supposed difference relates to the apparently shorter sequences in 160 cm.<sup>-1</sup> which appear in the electrically excited spectrum. However, the recognition of the nature and classification of the upper electronic state permits an assignment of fluorescence bands which avoids the assumed long sequences in 160 cm.<sup>-1</sup>; and it now appears that with either type of excitation the upper electronic state is able to settle to something like a true Boltzmann distribution with respect to vibration and rotation. These and related matters will be discussed *in extenso* elsewhere.

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<sup>1</sup> *Nature*, 156, 368 (1945).

<sup>2</sup> Ingold and Wilson, *J. Chem. Soc.*, 941, 955 and 1210 (1936).

<sup>3</sup> *J. Chem. Physics*, 7, 207 (1939).

### Spectra of Diatomic Oxides by the Method of Exploded Wire

DURING recent years we have developed the method of the exploded wire with the view of its application to the study of molecular spectra, but the circumstances of the German occupation have prevented us from publishing the results. A full account of our investigations by this method (as well as by the method of the aureole of an arc) of FeO, NiO, CoO, CuO and CaO spectra will be given later in the *Bull. Soc. Roy. Sci. Liège*.

*FeO*. We studied the spectrum of FeO in the yellow during 1940 in collaboration with A. Delsemme, and extended our investigation to the blue and the photographic infra-red during 1942 with L. Malet. Four systems can be represented by:

$$\begin{aligned} \nu &= \left\{ \begin{matrix} 17908 \\ 17808 \end{matrix} \right\} - 875 \nu'' + 5 \nu''^2 + \left\{ \begin{matrix} 667 \\ 660 \end{matrix} \right\} \nu' & \text{(System A)} \\ \nu &= 17267 - 875 \nu'' + 5 \nu''^2 + 825 \nu' & \text{(System B)} \\ \nu &= 22326 - 875 \nu'' + 5 \nu''^2 + 540 \nu' & \text{(System C)} \\ \nu &= 12900 - 955 \nu'' + 670 \nu' & \text{(System D)} \end{aligned}$$

Two short isolated band series ending on the same lower level as the *A, B* and *C* bands indicate the existence of FeO electronic terms at 12,150 and 14,650 cm.<sup>-1</sup> above this level, which is probably the ground-level of FeO. The classification of the yellow doublets is the same as that proposed by Gaydon and Pearse<sup>1</sup>.

*NiO*. We studied the spectra of NiO and CoO with L. Malet in 1942. For NiO nearly all the bands observed between 9,070 and 4,145 Å. can be fitted into six systems. The constants are given in Table 1.

TABLE 1.

System	$\nu_0$	$\omega''$	$\omega'$
System I	12655	615	475
System II	13638	590	460
System III	16420	615	560
System IV	19314	825	590
System V	19602	820	590
System VI	21135	825	570

The state with  $\omega'' = 615$  cm.<sup>-1</sup> is probably the ground-state of the molecule. The systems II, IV and V are established with less certainty than the others.

*CoO*. Bands are observed between 5,000 and 10,000 Å. The only characteristic frequency  $\omega'' = 840$  cm.<sup>-1</sup> can be attributed with great probability to the ground-state of the molecule.

*CuO*. The spectrum of CuO was investigated during 1942 in collaboration with J. M. Lejeune. The vibrational analysis of the red CuO bands showed that they can be represented by:

$$\nu = 16222 - 625 \nu'' + 3 \nu''^2 + 274 \nu' \text{ (System I)}$$

The green and blue bands observed previously by Hertenstein<sup>2</sup> can be represented by:

$$\begin{aligned} \nu &= 21570 - 625 \nu'' + 3 \nu''^2 & \text{(System II)} \\ \nu &= 21324 - 625 \nu'' + 3 \nu''^2 + 510 \nu' & \text{(System III)} \end{aligned}$$

The lower state with  $\omega'' = 625$  cm.<sup>-1</sup> is very probably the ground-state of the molecule.

*CaO*. This spectrum has been studied during 1942 and 1944 in collaboration with J. M. Lejeune. The main results are summarized in Table 2, which includes also the revised results of previous investigations on this spectrum.

TABLE 2.

	System $\alpha$	System $\beta$	System $\gamma$	System $\delta$	System $\epsilon$	System $\sigma$	System $\eta$
	(Meggers I)	(Meggers II)	(Orange bands)	(Green bands)			
$\nu_0$	9491	13679	15947	18260	25191	28054	29330
$\omega''$	637	711	640	780	711	711	
$\omega'$	674	694	711	670	575	550	825
$\nu''\omega''$	~7	~3.5	~5		~4	~4	
$\nu''\omega'$	~5	~5	~5				

The state with  $\omega'' = 640$  cm.<sup>-1</sup> is probably the ground-state of the CaO molecule.

All the proposed  $\omega''$ -values for the ground-states of the molecules studied are in accordance with the empirical laws governing the  $\omega''$ -values of diatomic oxides.

The results of our investigation on the AlO spectrum by the method of exploded wires, which enabled us to establish several new systems of AlO and to study in some detail the predissociation phenomenon in emission spectra, have already been published<sup>3,4</sup>.

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July 30.

<sup>1</sup> Gaydon, A. G., and Pearse, R. W. B., "Identification of Molecular Spectra".

<sup>2</sup> Hertenstein, H., *Z. wiss. Phot.*, 11, 69, 119 (1912).

<sup>3</sup> Coheur, F., and Rosen, B., *Bull. Soc. Roy. Sci. Liège*, 405 (1941).

<sup>4</sup> Rosen, B., *Bull. Soc. Roy. Sci. Liège*, 176 (1944).

### Chromatography of Two Solutes

WE regret that we cannot agree with the conclusions arrived at by Dr. Glückauf<sup>1</sup> and that even in the case of the Langmuir isotherm they seem scarcely plausible in the general case.

Our equations can be applied to any suitable adsorption isotherm. In the case of a single solute, the concentration in the developed band is given by our equation:

$$f'(c) = \frac{v}{x} \dots \dots \dots (1)$$

The corresponding equation for two solutes is:

$$\begin{vmatrix} f'_{c_1} - \frac{v}{x} & f'_{c_2} \\ g'_{c_1} & g'_{c_2} - \frac{v}{x} \end{vmatrix} = 0 \dots (2)$$