

arc and photographed simultaneously. The gross intensity measurements of all the bands in the two systems have been made by the methods of photographic spectral photometry by comparison with a standard source of known energy distribution. On the assumption of a Boltzmann distribution of vibrational energy in the initial state, temperatures have been calculated. These are shown below and compared with the results from the rotational energy distribution of previous authors for the same molecules examined in the carbon arc.

Band systems	Vibration temperatures (T. and T.)	Rotation temperatures (Ornstein and Brinkman)
CN, $B^2\Sigma \rightarrow x^2\Sigma$	6200° K.	6500° K.
AlO, $^2\Sigma \rightarrow ^2\Sigma$	3450° K.	3275° K.*

* This is taken as the mean of two temperatures from 0,0 and 1,0 bands of AlO

It may be noted that the effective vibration temperatures of column 2 above agree fairly closely with the rotation temperatures of Ornstein and Brinkman. They are an indication of temperature equilibrium in the source (carbon arc) examined, as the values are supposed to be in the neighbourhood of the true temperatures for the zones concerned, for the CN bands are emitted from the inner violet part and AlO bands from the outer green halo.

The details of the investigation are being published elsewhere in a separate paper.

N. R. TAWDE.
S. A. TRIVEDI.

Physics Laboratory,
Royal Institute of Science,
Bombay.
August 5.

Z. Phys., **64**, 443 (1930); **67**, 590 (1931).

² *Z. Phys.*, **59**, 313 (1930).

³ *Proc. K. Acad. Amsterdam*, **34**, 498 (1931).

Intensity and Structure Changes of the $L\alpha$ Emission Lines of Cu and Fe on Intense Cooling of their Anticathodes

THE only previous experiments on the effects of temperature of the anticathode on the changes in the character of X-ray lines either in absorption or emission, are those of H. S. Read¹, J. H. Purks² and F. C. Chalklin³. These investigations, as also those of J. D. Hanawalt⁴, who studied changes in the fine structure of X-ray absorption spectra dependent on the physical and chemical nature of the absorber and temperature, were all concerned with the effects of high temperature alone. So far as we are aware, except for the experiment of Swedenborg and Claesson⁵, whose results were published while our experiments were in progress, there seems to be no record of any experimental investigations of the effect on the character of the X-ray lines emitted of intensely cooling an anticathode.

For effectively cooling the target, we had recourse to rapid evaporation of liquid oxygen from a specially designed anticathode tube. A plane grating spectrograph of the type devised by Siegbahn and Magnusson and constructed by Messrs. Adam Hilger, Ltd., was employed; while a molecular pump supplied by Leybold Nachfolger backed by a suitable oil pump was used for exhausting the apparatus. The grating used was ruled at Uppsala and had 900 lines in a space of 3 mm. Exposures were made first with liquid oxygen evaporating and then with tap

water circulating through the anticathode tube, on the same photographic plate. The time of exposure, bombarding electronic current (70 ma.) and the accelerating potential (4.8 kV.) were all kept constant during the two exposures. Although the grating used did not possess sufficient dispersion to resolve the L lines clearly, making quantitative measurements difficult, yet microphotometric studies of the photographs obtained have yielded the following interesting preliminary results:

(a) The line-curves of Cu and Fe L -lines possess considerable spread on the long-wave side but are steeper on the short-wave side at both the liquid oxygen temperature ($-183^\circ\text{C}.$) and room temperature ($25^\circ\text{C}.$) of the targets.

(b) The intensity of the Cu $L\alpha$ -line at the liquid oxygen temperature of the target is only 70 per cent of that from the target at room temperature. The corresponding figure for Fe is about 60 per cent.

(c) Although L -lines are not clearly resolved by the spectrograph used, which has a dispersion only of 4.95 Å. per mm., there is unmistakable evidence of their shift relatively to one another with the temperature change of the target.

(d) Some changes in the widths of the lines are also suggested with the change of temperature of the target.

The experiment is being repeated with a new plane grating possessing double the dispersion of the former, the experimental arrangements remaining more or less the same. It is hoped that it will be possible, on the conclusion of the experiments now in progress, to give definite quantitative results of measurements.

K. PROSAD.
A. T. MAITRA.

Physics Department,
Science College,
Patna, Bihar.
July 17.

¹ Read, H. S., *Phys. Rev.*, **27**, 373 (1926).

² Purks, J. H., *Phys. Rev.*, **29**, 352 (1927).

³ Chalklin, F. C., *Proc. Roy. Soc.*, **A**, **155**, 366 (1936).

⁴ Hanawalt, J. D., *Phys. Rev.*, **37**, 715 (1931); **41**, 399 (1932).

⁵ Swedenborg, H., and Claesson, M., *Ann. Phys.*, **28**, 159 (1937).

Surface Tension of Strong Electrolytes

Jones and Ray¹ have recently found that on adding a salt to water the surface tension at first decreases, then passes through a minimum and finally at concentrations above about 0.001 N increases with increase of concentration. The interionic attraction theory of surface tension developed by Wagner² and Onsager³ on the basis of the Debye solution theory and the principles of electrostatics requires, however, the slope of the surface tension - concentration curve always to be positive and greater at the lower concentrations. The accurate results of Jones and Ray are thus seen to be in complete disagreement with theory.

By postulating that the surface structure of water is such that there is a small number of surface locations where negative ions can become adsorbed from the interior of the solution with a large diminution of potential energy, it is possible to derive statistically the following equation for the number of moles of an ion kind adsorbed per sq. cm.

$$\Gamma_i = ckv_i \left[\frac{a - \{b - ck \sum v_i\} e^{-W/RT} - ckv_-}{(b - ck \sum v_i) e^{-W/RT} + ckv_-} \right] \quad (1)$$