

attributed to a re-liberation or 'mobilization' of some of the secondarily adsorbed H^+ ions by strong fields of force which operate as the individual double layers overlap. The formation of some sort of a structure in the system is indicated. The viscosity of the sol has been found to increase rapidly with the concentration, and the system becomes thixotropic (the sol sets in about three hours) at approximately the same concentration at which the sharp rise in the H^+ ion concentration occurs.

The potentiometric titration curve of the sol with sodium hydroxide has a weak monobasic acid character and shows a marked inflexion at pH 8.5. The amount of the acid (T) neutralized at the inflexion point increases from 81.0 to 103.0 m.e. per 100 gm. of the oven-dried hydrogen bentonite as the concentration increases from 0.25 to 8.8 per cent. T increases with C at a much smaller rate than C_{H^+} , especially in the range of concentrations where the inflexion in the $C_{H^+} - C$ curve is observed. The increase in T with C is due to factors other than those responsible for the variations in the base-exchange capacity of hydrogen clays which have been observed when the sols are titrated with different bases, and in the presence and absence of salts^{9,10}. Assuming that aggregation or structure formation in the concentrated sols causes a decrease in the available surface, a decrease instead of an increase in T would be expected at the higher concentrations if the interaction with the base were confined to the outer surface of the particles.

This work has been carried out with the aid of a grant from the Imperial Council of Agricultural Research, India.

J. N. MUKHERJEE.
R. P. MITRA.
S. S. MANDAL.

Physical Chemistry Laboratory,
University College of Science,
92 Upper Circular Road,
Calcutta.

by a more modern design. The tests I carried out were also made under particular conditions, that is, using a $\frac{1}{2}$ mm. diameter cylindrical collimator and a rotating single crystal. I have since had the opportunity of repeating these and other tests using a more modern (just pre-war) Philips tube and other commercial tubes; and I find that, in the same exposure time, the Shearer tube still gives the most intense single-crystal photograph using copper K radiation, but the difference is smaller.

The gas-tube focus is (as used in projection, and under our running conditions) about 2 mm. \times 1 mm., and a $\frac{1}{2}$ mm. cylindrical slit therefore wastes at least seven-eighths of the tube output in the required direction. If a still finer slit were to be used for crystals having large unit cells and therefore requiring high resolution of reflexions on the photographs, the wastage of output would be even greater; but for powder spectroscopy, for which a 2 mm. \times $\frac{1}{2}$ mm. straight slit could be used, it would be much less.

I strongly agree with Sir Lawrence Bragg that manufacturers should give some 'figure of merit', which should indicate both focal spot size and comparative output of the various tubes now made. The principal advantages of the gas-tube are the purity of its radiation even after long running, the low input (about 400 watts) and the very low initial cost of the whole outfit, when an induction coil and electrolytic interrupter are used. These factors ought also, of course, to be considered in connexion with any standards of comparison that might be adopted. The cost is particularly important, because the price of apparatus is, unfortunately, a serious and sometimes crippling consideration with research workers in general.

KATHLEEN LONSDALE.

Royal Institution,
Albemarle Street,
London, W.1.

¹ "X-Ray Equipment for Crystallography", *Nature*, 155, 244 (1945).

¹ Mitra, *Ind. J. Agric. Sci.*, 6, 555 (1936).

² Mukherjee Mitra and Mukherjee, *Trans. Nat. Inst. Sci. Ind.*, 1, No. 10, 227 (1937).

³ Mukherjee and Mitra, *Ind. J. Agric. Sci.*, 12, 433 (1942).

⁴ Wiegner and Pallmann, *Ver. Zwei. Komm. Alkali-subcomm. Internat. Bod. Ges.*, B, 92 (1929).

⁵ Unpublished work of S. N. Bagchi.

⁶ Sanders, *Ind. Eng. Chem., Anal. Ed.*, 10, 274 (1938).

⁷ Mukherjee and Sen Gupta, *Nature*, 145, 971 (1940).

⁸ Mukherjee, *Kolloid Z.*, 62, 257 (1933).

⁹ Mitra, Mukherjee, S., and Bagchi, *Ind. J. Agric. Sci.*, 10, 303 (1940).

¹⁰ Mukherjee, Mitra, Chatterjee and Mukherjee, S., *Ind. J. Agric. Sci.*, 12, 86 (1942).

'Figure of Merit' of X-Ray Tubes

At the Leeds meeting of the X-Ray Analysis Group of the Institute of Physics¹ I gave certain figures for the comparative speeds of photographs using a Philips tube, a Shearer gas-tube and the 5 kW. filament tube at the Davy Faraday Laboratory.

In justice to the commercial tube makers, I ought to make it clear, as I hoped I had made it clear at the meeting, that the Philips tube I had used for purposes of comparison (the only one available to me at the time) was already eleven years old and had, in fact, since 'died'. The Shearer tube was just as old, but demountable tubes never die, they only fade away, when it becomes desirable to replace them

The Cool-Flame and Two-Stage Ignition Systems in Ether - Air Mixtures at Room Temperature

THE normal and cool-flame systems in diethyl ether - air, etc., mixtures have been defined by means of diagrams showing the influence of pressure on their respective ranges of inflammability¹. Whereas the normal flame range centres upon approximately the theoretical mixture or that capable of developing the highest flame temperature and consequent flame speed, the cool-flame range appears to centre upon the mixture giving rise to the fastest reaction in slow combustion. High-tension sparks are employed for igniting the normal flames, but a suitably heated element must be used for the cool flames. If the experimental pressures in the cool-flame range be increased, pressure-composition limits may also be defined for the initiation of a second-stage 'blue' flame in the cool-flame products; this arises from the autogenous decomposition of peroxidic material formed in these products. This two-stage phenomenon is identical with that occurring in media *spontaneously* ignited at suitable temperatures and pressures², the essential difference being that with artificial ignition in cold media, the limiting pressures are much higher.