furnish further information concerning the influence of density differences on the path of jets.

G. HORN
M. W. THRING
Department of Fuel Technology,
University of Sheffield.
Feb. 3.

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Fluorescent Centres in Uranium-activated Sodium Fluoride

THE sodium fluoride fusion method is commonly used for the determination of minute amounts of uranium[1]. The sample to be tested is fused in a platinum crucible with sodium fluoride, and the fluorescence is measured in a fluorimeter. By this method, amounts of uranium down to 10^{-10} gm. can be determined in 0·2 gm. of fluoride.

Sodium fluoride containing uranium has a bright yellow-green fluorescence when excited by long-wave ultra-violet radiation. Even at room temperature the emission consists of broad bands partially resolved into lines, and at 77° K. the spectrum consists of more than twenty lines (see Fig. 1). This emission has been described by Slattery[2], who concluded that the uranium is in solid solution with the fluoride. The fluorescence would then be attributed to a UF_6 group. Solid UF_6, however, has a bright violet fluorescence bearing little resemblance to the sodium fluoride (uranium) emission.

Another possibility which has been considered in the past is that the fluorescence belongs to a uranyl group. The fluorescence exhibits the right colour, but does not show the characteristic unresolved bands at room temperature or the repetition frequency of about 860 cm.$^{-1}$.

A consideration of the principle of localized charge compensation[3] has suggested another solution to this problem. Supposing a uranium ion in the hexavalent state replaces a sodium ion, then there will be an excess of five units of charge. This can be compensated either by positive ion vacancies or by divalent negative ions. As the samples are melted in air, and since the uranium is often present as a uranyl group, it is quite probable that charge compensation can occur by the entry of oxygen ions, five being necessary to give perfect compensation. The relative simplicity of the emission spectrum indicates a highly sym-

metrical arrangement, and in view of the known stability of octahedral UO_6 groups in alkaline-earth oxide[3] and uranate[4] phosphors, it is concluded that the six fluorines surrounding the uranium ion are replaced by oxygens. This hypothesis explains both the colour of the emission, which is characteristic of U—O bonding, and the repetition frequency of about 740 cm.$^{-1}$ characteristic of the UO_6 group[3].

The centre has now a net charge of minus one and can attract ions with an excess positive charge. In particular, a divalent ion in the nearest positive ion site will cause complete charge neutrality. This is especially significant, as it has been shown[5] that small quantities of divalent ions, for example, calcium or magnesium, can cause an anomalous enhancement of the fluorescence of uranium in alkali-metal carbonate fluxes containing sodium fluoride.

In the present investigation it has been found that there is a marked change in the line intensities of the spectra, when calcium, in this case as chloride, is added to sodium fluoride (uranium) (see Fig. 1). This occurs when the atomic percentage of both the uranium and calcium is less than 0·1; and it is difficult to see how the relative intensities of the principal lines can change, as shown, unless pairing of the uranium and calcium ions occurs.

This conclusion is in disagreement with that of previous authors[6], who based their argument on the observation that the percentage quenching of an impurity is independent of the concentration of uranium. This independence has not been fully verified by other workers[7], although the variation with uranium concentration is not great.

It is hoped to extend these preliminary observations and to publish a fuller account at a later date.

W. A. RUNCIMAN
Atomic Energy Research Establishment,
Harwell, Didcot, Berks.
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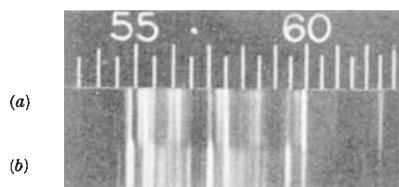[7] Walton, G. N., Hutton, G., and Dalziel, J. A. W., A.E.R.E. C/R 966 (1952).

A Method of measuring Stress in Dentures

THE high incidence of midline fracture in polymethyl methacrylate full upper dentures has prompted an investigation as to its cause.

During the course of the work, a simple technique for the analysis of the stress distribution over the surface of a denture has been developed. The method adopted uses a brittle lacquer ('Strainlac', manufactured by R. D. Walker, Vine Cottage, Corbridge, Northumberland) which has found industrial application as a tool of experimental stress analysis. Briefly, the technique is as follows. The lacquer is sprayed on to the outer surface of the denture and allowed to dry. The coating is 0·003–0·007 in. thick. The denture is then stressed in the mouth and cracks appear in the lacquer wherever the tension stress exceeds a certain value defined by the strain-sensitivity of the lacquer. The cracks may be shown up more clearly by brushing a dye etchant on to the lacquer surface. Fig. 1, a photomacrograph of the

(a)

(b)

Fig. 1. Fluorescence at 77° K. with 3650 A. excitation. (a) sodium fluoride (0·1 per cent uranium); (b) sodium fluoride (0·1 per cent uranium, 0·1 per cent calcium chloride). The spectra were obtained on an Astra III plate using a medium quartz spectrograph