Fig. 1. Electroluminescent crystal of zinc sulphide activated with copper. (a) Between crossed nicols ; (b) electroluminescence under 10 kc./s. Magnification, × 60

with a high degree of stacking disorder, as revealed by diffuseness in certain X-ray powder reflexions, and by single-crystal photographs of the constituent crystallites.

These observations may be explained by a non-uniform distribution of emitting centres or by a non-uniform electric field. In either case, the non-uniformity could be due to disordered regions, possibly because activator atoms diffuse readily along disorder boundaries. In this connexion it may be noted that some of the crystals which displayed blue electroluminescent streaks also luminesce under ultra-violet excitation. The ultra-violet luminescence is apparently distributed evenly throughout the body of the crystal, so that the centres involved are uniformly distributed. This perhaps supports the second possibility, although it is not certain that the luminescence originates at the same centres in the two cases.

Although disorder may not be a necessary condition for electroluminescence, particularly as both cubic and hexagonal electroluminescent zinc sulphide phosphors have been reported[2], these results suggest that a suitable environment of copper activator, such as is provided by boundaries between ordered regions of zinc sulphide, can provide conditions particularly favourable for electroluminescence.

It is perhaps significant that silicon carbide also possesses the dual properties of electroluminescence[2] and one-dimensional disorder[1].

The work is being continued and further results should help to assess the influence of crystal structure on the solid-state properties of zinc sulphide.

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Empirical Relationship between the Excitation Energy of the F-band and Physical Constants for Alkali Halides

THE excitation energy for a $1s - 2p$ transition in an electron associated with a hydrogen-type impurity embedded in a dielectric medium with high-frequency constant K_0 is

$$\frac{3}{8} \frac{e^2}{K_0 R} \qquad (1)$$

where R is the Bohr radius, $0 \cdot 529$ A.

If R is taken as the radius of cation instead of the Bohr radius, then it is found empirically that the ratio of the excitation energy of the F-band to the expression (1) is close to unity for a large number of alkali halides containing F-centres.

The values of this ratio for various alkali halides are given in Table 1.

Table 1

Salt	LiF	LiCl	NaF	NaCl	NaBr	NaI
Ratio	1·0	1·0	1·12	1·06	1·06	1·08

Salt	KF	KCl	KBr	KI	RbCl	RbBr	CsCl
Ratio	1·24	1·16	1·13	1·17	1·20	1·15	1·64

The reason that the CsCl ratio differs from the other twelve ratios might well be due to its different crystal structure.

Values of R have been taken from Pauling, L., J. Amer. Chem. Soc., 49, 765 (1927), and those of K_0 from Hojendahl, K., K. Danske Vidensk. Selskab, 16, No. 2 (1938).

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Deformation Characteristics of Hafnium

BECAUSE of its high nuclear cross-section, high melting point and good resistance to corrosion and oxidation, hafnium is being considered for practical application in the nuclear engineering field. Appreciable quantities of the material are being produced as a by-product of the production of pure zirconium.

Using small samples sectioned longitudinally from the periphery of hafnium crystal bar, the deformation characteristics of the material were studied. Cracking appeared when the metal was cold rolled 25–30 per cent total reduction. In spite of such precautions as previous vacuum annealing and small passes—1 per cent or less—30 per cent total deformation appeared to be the top limit which could be expected by cold rolling without intermediate annealing. Slightly elevated temperatures, however, seemed to make the material much more plastic. At 500° C., approximately 200° below the recrystallization temperature, the reduction by rolling was found to proceed to almost any practical reduction without cracking. Compression deformation was found to be possible to 90 per cent total reduction at 300° C.

Using a reflexion integrating pole-figure goniometer technique, the orientation of the deformed material after severe etching was studied, and on the basis of preliminary determinations was found to be very similar to the preferred orientations previously reported for titanium[1].