middle of these yellow regions zirconium oxide appeared to have formed.

(2) The underside of the filter paper in contact with the negative electrode was coloured mauve-red, the typical colour given by solutions of zirconium salts with this reagent.

(3) There was some corrosion of the metal surfaces, with what appeared to be oxide formation on the positive surface.

In the light of these facts, the following tentative explanation is proposed suggesting that it is the anions (oxygen ions) which move in zirconium under the action of an applied field at room temperature.

Oxygen ions migrate from the negative electrode towards the positive electrode. Dependent upon the relative efficiencies between yielding oxygen gas at the positive electrode (anode) and adsorption of the oxygen as ions for film growth on the anode, some of the oxygen ions will give up their ·electrons and become nascent oxygen reacting with the alizarin-S to give a yellow colour.

It seems plausible that the sintered oxide compact contains a non-stoichiometric excess of oxygen which will account for both processes occurring at the anode.

At the negative electrode (the cathode) a deficiency of oxygen ions is created by their migration into the compact. The cathodic zirconium surface is thus enriched in zirconium ions which are absorbed by the alizarin-S to give the typical red colour.

It has been established that these reactions do not occur in the absence of an electric field.

Preliminary results have been obtained on other materials, and further experiments are in progress to establish the mechanism with greater certainty. At high fields it is possible that the zirconium ions will move faster than the oxygen ions in zirconia, due to the higher charge on the zirconium ions. It is hoped to report these results in the near future.

We wish to acknowledge the helpful interest shown by Dr. H. M. Finniston and Dr. P. J. Anderson in this work.

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An Infra-red Photocell based on the Photoelectromagnetic Effect in Indium Antimonide

THE photoelectromagnetic effect has been studied in germanium[1], silicon[2] and lead sulphide[3] as a means of measuring life-time and velocity of surface recom-

bination. In indium antimonide the effect can be applied not only for this purpose[4], but it can also provide the basis for a useful photocell. The arrangement for this is illustrated in Fig. 1. The sensitive element consists of a rectangular slice (A) of pure single-crystal material of dimensions 2 mm. × 1 mm. and ap-
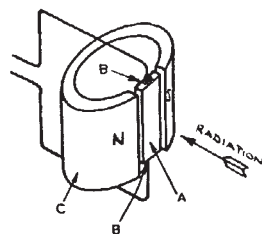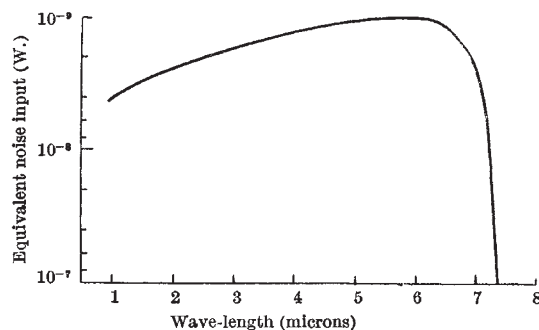

Fig. 2. Spectral sensitivity of indium antimonide photoelectromagnetic cell

proximately 0·1 mm. thickness, with a pair of electrodes (B) connected to the top and bottom faces. The element is immersed in a magnetic field of about 10,000 gauss provided by the ring magnet (C). Radiation of suitable wave-length falling on the front face of the element generates hole-electron pairs near the surface ; these diffuse inwards, and in so doing become separated vertically by the magnetic field, giving rise to an e.m.f. between the electrodes. If the radiation is chopped by a rotating toothed disk, in the usual way, an interrupted output is obtained, which can be fed to a conventional a.c. amplifier through a matching transformer.

The spectral sensitivity of a typical cell of this type is plotted in Fig. 2, showing at each wave-length the energy required to give a signal-power equal to the average noise-power in a frequency interval of 1 c./s. centred at the chopping frequency. The response shown was measured at room temperature ; a considerable increase in signal/noise ratio is obtained by cooling, but this has not yet been studied quantitatively.

The variation of response as a function of chopping frequency (not illustrated) shows that the time constant of the cell is of the order of 1 μsec. or less, which is consistent with the known short life-time of excess carriers in indium antimonide[4].

Acknowledgment is made to the Admiralty for permission to publish this communication.

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The Benzotrifluoride–Nitryl Fluoride–Boron Trifluoride Complex

IN two earlier communications[1] we have reported the isolation of the stable hydrogen fluoride–, deuterium fluoride–, alkyl fluoride– and formyl fluoride–boron trifluoride complexes of the methylbenzenes. We have tried now by the same methods to investigate the complex formation during the reaction of nitryl fluoride with aromatics, catalysed by boron trifluoride.

The nitryl fluoride, as the acid fluoride of nitric acid, reacts in the same fashion in Friedel–Crafts