



The molecules have been rotated to lie in the plane of the paper is not unreasonable, compared with $r_{\text{Na}^+} = 0.98 \text{ \AA}$. and $r_{\text{NH}_4^+} = 1.48 \text{ \AA}$.

(ii) If the molecules in the crystal really transfer electrons in this way, the extent of the transfer must be strongly linked with the precise lattice dimensions and must be sensitive to various factors such as pressure or thermal expansion. The case would be analogous with the sensitiveness of proton position to bond-length in Rochelle salt^{5,7}, and interesting electrical properties may be anticipated in the direction in which the bonds lie in the crystal. These are being investigated.

(iii) Although the above suggestion about the nature of the forces responsible for the short inter-molecular bond in *para*-nitro-aniline can only be put forward tentatively, the change from more or less complete electron transfer at low temperatures and close distances of approach to strong polarization with less and less complete transfer as the bond lengthens would present an extreme case of the donor bond originating from the aromatic nucleus, in compounds such as $\text{I}_2 \cdot \text{C}_6\text{H}_6$ ⁹, $\text{WCl}_6 \cdot \text{C}_6\text{H}_6$ ¹⁰, and the polarization bond in various complexes between nitro groups and aromatic hydrocarbons^{11,1}.

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A Characteristic Example of Re-trapping in Phosphorescence

THERE has been much discussion about the existence of re-trapping (electronic recapture) in phosphorescence¹. One of my experiments seems to demonstrate the existence of re-trapping: electrons leave the deep traps and get into the short-life traps. I used a calcium sulphide (bismuth activator) phosphor of very long afterglow. This sulphide was strongly excited by ultra-violet radiations of about 0.36μ from a mercury vapour arc; it was then

heated up to 135°C . until complete extinction was reached. When the sulphide had cooled down to room temperature, it was submitted to the infra-red radiations of a 300-W. electric lamp filtered by a black manganese-iron glass with transparent range of 0.8μ – 4μ with some peaks between 1μ and 4μ .

Stimulated by these infra-red radiations, the sulphide regains its emitting power. After a few seconds, its glow reaches a nearly constant value; and if the infra-red lamp is stopped, an afterglow is observed during a few minutes, the rate of decrease of this afterglow against time being given by the following figures:

Intensity (arbitrary units)	Under infra-red light	After 10 s.	20 s.	30 s.	40 s.	50 s.	60 s.	120 s.
	16	0.50	0.40	0.32	0.25	0.19	0.15	0.12

The phenomenon can be explained as follows: the heated sulphide still contains, trapped in deep traps, some electrons² which are slowly liberated by the infra-red radiations, thus producing an emission of visible light; but many of the electrons fall into short-life traps, whence they are emitted during a few minutes after the infra-red light has ceased, producing thus the afterglow.

I ascertained that the black filter allows no radiation having direct exciting power to pass by testing the action of the filtered radiation on various organic fluorescent powders. Further, if the infra-red radiation is allowed to act for an hour, the glow of the calcium sulphide phosphor is totally quenched. If, instead of putting the cooled phosphor under the infra-red lamp, it was heated quickly again at 135°C ., no emission was observed. Consequently, the short-lived phosphorescence described above cannot be ascribed to the heat generated in the sulphide by the infra-red light. Experiments made with some zinc sulphides gave similar results.

Note added in proof. I have just learned of a recent paper by Garlick and Mason³, in which they also describe experimental evidence of re-trapping.

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Exceptional Performance of a Nuclear Ignition Otto-cycle Engine using *n*-Pentane as Fuel

KNOCKING combustion (detonation) in Otto-cycle engines using hydrocarbon fuel is attributed by King¹ to the effect of finely divided carbon in igniting the unburned combustible mixture ahead of the flame front (the end gas). The carbon particles can, according to this view, be provided (a) by pyrolysis of the hydrocarbon at the high pressure and temperature attained by the end gas, or (b) by impingement of the flame on relatively cool surfaces in the combustion space, as in a method commonly used for procuring carbon black.