

ions in aqueous solutions. This difference in decay rates is considered to be caused, in part, by an increase in ionic strength of the solution, affecting the decay rate of the reaction  $\text{SO}_3^- + \text{SO}_3^- \rightarrow \text{products}$ , and to the reproducibility obtained with these systems. We therefore conclude that the optical spectrum given in Fig. 1 is due to the  $\text{SO}_3^-$  radical produced from the rupture of the S—S bond in  $\text{S}_2\text{O}_6^{2-}$  ions.

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## Disruption of Glassy Carbon in Potassium Vapour

It is well known that potassium atoms lodge themselves between the basal planes of the graphite lattice to produce intercalation compounds in many different forms of graphite<sup>1</sup>. Glassy carbon is a very defective, randomly oriented polycrystalline form for which the 0002, 10 $\bar{1}$ 0 and 1120 lines are very diffuse but clearly present. Intercalation compounds in such a material would seem to be improbable and, indeed, glassy carbon is inert to most molten metals.

We have found that when in contact with potassium vapour at 400° C large pieces of different types of glassy carbon shatter explosively into smaller pieces around 1 mm in size. We therefore presumed that some process of chemical attack must have been present. In order to study this process, glassy carbon previously heat-treated to 2,500° C was ground into a size suitable for powder X-ray analysis and exposed to potassium vapour at 400° C in a closed system for 2 h. Rüdorff *et al.*<sup>2</sup> indicate that in such conditions the maximum degree (stage I) of intercalation between every pair of carbon layers is possible in single crystals. We have found that these conditions are sufficient to produce maximum intercalation even in soft cokes treated to only 1,200° C. The reaction with the powder was much more subdued than for the larger pieces and no further disruption occurred. X-ray analysis of the powder maintained *in vacuo* showed that no change occurred in the 10 $\bar{1}$ 0 and 1120 lines, indicating that the graphite layer planes were preserved. The 0002 line, however, disappeared and was replaced by lines at 2.9 and 8.8 Å. A line in sequence with these two and presumed to be in the region of 4.4 Å was obscured by diffuse scattering from the 'Pyrex' container. These lines can be removed by heating *in vacuo* at 500° C, when the 0002 line reappears.

We infer from these observations that a degree of intercalation does occur in glassy carbon in the presence of potassium vapour, producing compounds with potassium inserted between alternate pairs of graphite layers. This is equivalent to stage II in the Rüdorff scheme<sup>2</sup> and not stage I as would be expected in single crystals. Fischbach<sup>3</sup> suggests that glassy carbon contains appreciable non-trigonal bonding and strong bonding between layer plane edges of neighbouring crystallites and between layers within crystallites. It would seem that such bonding imposes precise limitations on the extent of intercalation.

Glassy carbon is made by the slow pyrolysis of aromatic thermo-setting resins. High locked-in internal stresses are inevitable because of the large shrinkage accompanying

such pyrolysis. It would seem that extra stresses produced by intercalation in such a tightly knit structure are sufficient to shatter pieces above a certain critical size. Similar disruptive effects have been observed by us in calcined anthracite but with very much less violence.

Work is proceeding on this topic because it throws light both on the nature of intercalation and on the structure of glassy carbons. The work is supported by the Steel Company of Wales and General Refractories, Ltd.

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## Dimeric and Tetrameric Complexes of Copper(O): a Correction

RECENTLY<sup>1</sup> we reported that treatment of *tris*(triphenylphosphine)chloro copper (I) with hydrazine in alkaline alcoholic solution yielded a compound of empirical formula  $\text{Cu}(\text{PPh}_3)_2$ . Analytical data (Table 1) were consistent with this formulation, the standard method for the detection of chlorine having proved negative. Further study has shown that some chlorine is indeed present and furthermore, by chance, analysis for C, H and P does not distinguish this compound from the starting material  $[\text{Cu}(\text{PPh}_3)_2\text{Cl}]^*$ .

Table 1. ANALYTICAL AND OTHER DATA FOR THE COMPLEXES

Complex	Per cent C	Per cent H	Per cent P	Per cent Cu	Per cent Cl	m.p.	Mol. wt.
$\text{CuCl}(\text{Ph}_3\text{P})_2$	73.1	5.1	10.5	7.2	4.0	180	885
$[\text{Cu}(\text{Ph}_3\text{P})_2]_2$	73.5	5.1	10.5	10.8	0	—	1,176
Found	73.3	5.1	10.2	11.2	0	160	652*

\* Concentration dependent.

The product obtained when this material is heated, thereby losing triphenylphosphine, has now also been shown to contain chloride and we can no longer claim that this is  $[\text{Cu}(\text{PPh}_3)]_2$ . Its precise nature is being further investigated, but meanwhile we wish to ensure that our earlier note does not lead to inconvenience for others interested in this subject.

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## BIOLOGICAL SCIENCES

### Electron Microscopy of Muscle Phosphorylase Molecules: Significance of a Rhombic Shape

MUSCULAR energy comes from the breakdown of glycogen. This is not, however, the only reason for interest in the enzyme, muscle phosphorylase, which catalyses the first step in the reaction. The enzyme also provides one of the clearest examples of the way activity is related to change