

organic radicals which contain oxygen and which are generated in aqueous solution by the titanous ion-hydroperoxide method of Dixon and Norman (*J. Chem. Soc.*, 3119; 1963). Spectral assignments to radicals obtained from aldehydes and related compounds were discussed together with the mechanisms by which the radicals were formed. Alkoxy radicals proved very elusive: it appeared, for example, that the *n*-propoxy radical ( $\text{CH}_3\text{CH}_2\text{CH}_2\text{O}\cdot$ ) escaped spectroscopic detection because of rapid rearrangement to  $\text{CH}_3\text{CH}_2\text{CHOH}\cdot$ . Radiolytic reactions of hydrated electrons and hydroxyl radicals in neutral and alkaline aqueous solution were discussed by D. F. Sangster, R. W. Matthews, and J. A. D. Stockdale (Australian Atomic Energy Commission). Rate constants have been determined for a number of electron-solute reactions relative to that of the analogous reaction with the monochloroacetate anion. The reaction with benzoate anion was sensitive to both pH and ionic strength and it was suggested that complexing of the anion with water molecules might influence the rate. Rates of hydroxyl radical reactions with organic and inorganic substrates have been determined using three reference systems—benzoate decarboxylation, salicylate fluorescence, and nitrobenzene hydroxylation. Kinetic salt effects which might have been expected from the presence of  $\text{O}^-$  were not observed in preliminary investigations. Two new photochemical syntheses based on aromatic compounds were described by P. J. Collin, H. Rottendorf, Dr. W. H. F. Sasse, Dr. H. Silberman and Mrs. Galina Sugowdz (all of the C.S.I.R.O. Division of Coal Research). Photo-oxidation of the Schiff's bases from 2-aminonaphthalene in aliphatic alcohols resulted in the incorporation of a  $\text{C}_2$  fragment, derived from the solvent, with the formation of appropriately substituted benzo(*f*)-quinolines. The second synthesis involved photo-addition of tolan(s) to naphthalenes to form highly reactive fused hydrocarbons containing 3, 4, 5 and 6 membered rings. Some fifteen adducts had been synthesized and the mechanism of the addition was discussed.

The final session was concerned specifically with atomic reactions. Investigations on low-pressure flames of active nitrogen with IBr and ICl were reported by M. R. Grigor and Prof. L. F. Phillips. The emission appeared to consist mainly of bands and continua of both molecular iodine and the interhalogens. Reaction mechanisms were similar to that of the reaction of active nitrogen with iodine and involved an intermediate excited nitrogen molecule which excited the emission. Rate data for the reaction of atomic nitrogen with halogens and interhalogens were reported and discussed. The reaction of oxygen atoms with sulphur dioxide was the subject of a paper by Dr. M. F. R. Mulcahy, J. R. Steven and Dr. J. C. Ward. The kinetics were studied in a stirred-flow system—electron spin resonance spectrometry being used to determine the concentrations of oxygen atoms at the entrance and exit of the reaction vessel. Rate constants determined for the reactions



at room temperature were considerably lower than expected on the basis of known rates of other reactions of atomic oxygen. Application of RRK theory suggested that this resulted from the formation of excited triplet  $\text{SO}_2$  molecules rather than the occurrence of a spin forbidden reaction to ground state  $\text{SO}_2$ . In the final paper an apparatus for investigating the kinetics of reactions of oxygen atoms in the absence of electronically excited molecular species was described by Dr. M. F. R. Mulcahy and D. J. Williams. The atoms were generated by pyrolysis of ozone (Kaufman and Kelso, *Disc. Farad. Soc.*, 37, 26; 1964) and passed to a stirred-flow reactor, the relative concentrations at the entrance and exit being determined continuously by the NO chemiluminescence method using a single photo-tube. Preliminary values of

rate constants for the reaction  $\text{O} + 2\text{O}_2 \rightarrow \text{O}_3 + \text{O}_2$  over the temperature range 195°–443° K were reported.

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R. A. DURIE

M. F. R. MULCAHY

## WHICH MATERIALS?

A SYMPOSIUM on "The Selection of Materials" was held at Brunel College, London, W.3, at the end of May, under the joint sponsorship of the metallurgy and chemistry departments. The first half of the meeting was concerned with a discussion of the problems in general, and the second half with specific applications and materials.

Dr. H. J. Sharp (Hoover, Ltd., Greenford) opened the proceedings and was followed by Mr. R. B. Selwyn (Materials Data, Ltd., Farnham), who described a punched card system for data material of total materials information. In this system, materials have been divided into seven groups, and so far the data of one group—non-ferrous alloys—have been fully collated. 1,600 data sheets describe the chief mechanical, physical and constructional properties of materials meeting British Standard General and Aircraft specifications and D.T.D specifications. Eventually the other six groups of materials will be dealt with.

Mr. T. S. Eyre (Brunel College, London) spoke on "The Effect of the Manufacturing Process on the Properties of Materials", and provoked a lively discussion in which both he and the previous speaker, Mr. S. Turner (I.C.I. Plastics Division, Welwyn Garden City), stressed the inadequacy of representing the properties of a material by a single datum point obtained by arbitrary tests. To use a material with confidence, its whole pattern of behaviour must be obtained.

The second half of the symposium was opened by Mr. B. K. Reeve (British Motor Corporation, Birmingham), who directed attention to the wastefulness of many metal forming processes, which is particularly serious in the automobile industry where material costs account for about 60 per cent of turnover.

The possibility of reducing some of the waste by replacement of metal body panels with plastic panels is now being considered by car manufacturers. Modification of car body design so that boot, bonnet, roof, outer wings and doors are unstressed will allow these to be produced from thermoplastics, probably by injection moulding, so reducing material waste and the costs of finishing and tooling.

Table 1. STRENGTH OF FIBRES

Material	Tensile strength (10 <sup>9</sup> lb./sq. in.)
Graphite whisker	3.5
SiC whisker	3.0
Si <sub>3</sub> N <sub>4</sub> whisker	2.0
Al <sub>2</sub> O <sub>3</sub> whisker	2.1
Fe whisker	1.9
Si whisker	1.1
Drawn high C steel wire	0.6
Drawn tungsten wire	0.5
Glass fibre	1.0
Cu whisker	0.5

The problem of the absorption of vehicle collision energy was raised in this context. There seems to be no certain knowledge available of the ability of plastics to absorb energy in collisions, and indeed automobile manufacturers have only recently turned their attention to the behaviour of metals at high rates of stress.

The symposium finished with a talk on composite materials by Prof. W. A. Holmes-Walker (Brunel College, London), in which some of the properties of fibre reinforced materials were described (Table 1). In these systems advantage is taken of the greater strength of fibres or whiskers compared with more massive forms of a material.

K. A. HODD