

no part in the biological effects. E. L. Powers (Argonne, U.S.A.) used the electron spin resonance method to good effect to confirm the presence of a number of different types of trapped free radicals which remain in the dry spore after irradiation. He observed that post-irradiation treatments with hydrogen sulphide and nitric oxide reduced the number of spores rendered non-viable, while exposure to oxygen enhanced damage. Electron spin resonance measurements indicated that these effects were due

to reaction with trapped radicals. In swollen systems, such as vegetative cells, radicals have only a very short lifetime, and to be detected a 'flash radiolysis' technique has to be used. L. H. Gray described some results obtained in this way. Mrs. B. Holmes (Cambridge) described experiments of J. S. Mitchell which revealed the existence in irradiated mammalian tissues of relatively long-lived excited molecules that emit ultra-violet light after irradiation.

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COKE RESEARCH

NOT all annual reports of technical, or even non-technical, activities provide an absorbing story of events of interest to others than the specialist. The sixteenth annual report of the British Coke Research Association, however, is noteworthy for a new feature in the form of a very clearly expressed appendix, in which an attempt is made to clarify the objectives of the programme of research*. Any likely developments that may point to the future importance of coal should be of interest to many engineers and technologists, and indeed to quite a number of laymen engaged in pursuits perhaps of greater philosophical calm. Particularly so must be the situation at the present time, when one hears so much of the potentialities of oil and nuclear fuels, and when hoping that the price of coal was tending to find a stable keel, one is startled by new economic storms. In a refreshing and lucid manner the research objectives of an important industry on which the future of steel and coal must depend to a substantial measure are set out in a manner that brings conviction of the care and thought given to their preparation.

The interested reader will learn that 40 per cent of the research effort of the British Coke Research Association is devoted to the improvement in quality and yield of metallurgical coke, and that a further 28 per cent is devoted to work designed to throw light on phenomena and factors that govern the efficiency of use of all types of coke.

The modern blast furnace requires a coke of consistent quality in respect of its physical and chemical properties. The Coke Research Centre at Wingerworth has its small experimental ovens and the industrial scale 10-ton oven in which the various factors may be worked out to enable the optimum conditions to be arrived at for the carbonization of a 'standard' coal. At the same time, attention is devoted to the yields and nature of the by-products from the point of view of the efficiency and economy of the coke-oven process in general.

In the scientific work on coke the more advanced techniques of physical science such as X-ray diffraction have long been used. The latest techniques, that are now finding a place in the elucidation of a workable understanding of the structure of carbon and the texture of coke, are concerned with magnetic susceptibility and microwave absorption. Perhaps the lessons of the value of the more abstruse techniques necessary in fundamental investigations are not lost in these days on the comprehension of the

layman, even if the mysteries of the techniques themselves seem to provide rather heavy going. In the present instance the ultimate answer may well be the means of production of cokes, capable of superior performance in use, from supplies of coal of unexpected suitability.

In the programme of research two other broad fields of interest are considered: first, the magnitude and complexity of the coke oven effluent and atmospheric pollution problems; and secondly, new methods of making blast furnace coke. In the former, the problem becomes an issue common with many other industries, and it is thus only a part of a larger national issue being considered by the Department of Scientific and Industrial Research. In the latter the matter is at the design-study stage where the fundamental requirements of the problem have to be analysed, the estimates of the chances and conditions of success determined, and some practical course of research devised.

The report of the achievements of the year covers not only the work on the new full-scale test plant but also that of the fundamental and applied studies laboratories at Wingerworth, and the progress achieved by work in the universities, notably at King's College, Newcastle upon Tyne. In this last case the technique of electron resonance absorption has been used to follow in the course of coke formation the development of reactive centres, described as 'free radicals'. They are formed in coke at temperatures up to 800° C., and play a part in the fixation of sulphur as organic sulphur in coke. At the University of Leeds work on the flow of heat in the coke oven during carbonization has been prosecuted with the application of a digital computer. This work constitutes a further proof of the potentialities of the use in this manner of the unsteady heat conduction equation in the solution of practical problems.

Also of specific interest to scientist and technologist alike is the correlation found, almost to a surprising degree, between the results of the performance in carbonization from a 5-cwt., a 10-ton oven, and even a commercial battery. Practical trials on cupolas have settled the question of the effect of coke size in iron melting, and have shown that a 3-1 in. coke size may be used successfully in hot-blast cupolas.

A very wise decision has been not to allocate 15 per cent of the effort of the Association to any strictly defined objective. For is there not force in the argument that on the border of the unknown there is needed the keener search? Alike, as in diagnosis, the less definite the symptoms the greater the need for the sensitive touch!

* British Coke Research Association. Sixteenth Annual Report for the year 1959. Pp. 40. (Chesterfield: British Coke Research Association, 1960.)