THE NUFFIELD FOUNDATION

SCHOLARSHIPS IN FOOD SCIENCE

THE Nuffield Foundation has become increasingly interested in the field of food science, with special regard to what it sees as a need for more fundamental research and for more people capable of carrying it out (see also p. 1 of this issue). Simplification and labour saving in the preparation and storage of food involves the greater use of food additives and of various processing techniques, and toxic risks may therefore be increasing. The Foundation, guided on these matters by an advisory committee, is aware of considerable gaps in knowledge in this field; limitation of knowledge of the pathology of test animals appears to be a basic deficiency.

While there appears to be a reasonably satisfactory position in the training and supply of food scientists and technologists to carry out standard procedures, the numbers available for fundamental research are entirely inadequate; in particular, among pathologists and pharmacologists with toxicological interests and experience, and among food scientists with postgraduate qualifications who have adequate training and experience in more than one discipline.

The Foundation is anxious to encourage entry into this field by means of a scholarship scheme. It is hoped that these awards may attract science and medical graduates who might not otherwise contemplate a career in food science research. Career prospects in this branch of science are now good; official and public interest in the field, as with academic and industrial interest, is quickening and the demand for highly trained scientists will continue to grow. The recent setting up of the British Industrial Biological Research Association is a practical expression and measure of this quickening interest.

At a later date the Foundation may be able to give further support to this developing career structure by the offer to selected post-doctoral candidates of senior research fellowships.

With the aim of helping to advance research into the more important problems of food science the Nuffield Foundation is prepared to offer annually up to five research scholarships for science graduates and up to three research scholarships for medically qualified graduates.

The awards, which may be held for periods of up to four years if necessary, are intended to provide suitable experience and knowledge to qualify graduates in science and medicine for subsequent research in food science.

Science graduates will be able to receive, as necessary, a year of more or less formal training in selected subjects and to study for the Ph.D. degree in the field of food science and toxicology. The value of the awards will be between £650 and £900 per annum if taxable, or the equivalent tax-free, according to age, qualifications, and experience, and subject within these limits to annual increments of £50. The value will be supplemented by the amount of fees, an allowance of £50 per annum if married, and a further £50 per annum for each child up to the first two. Additional expenses likely to arise in connexion with a scholar's research programme, other than normal bench fees, which will be automatically covered, will be sympathetically discussed on an *ad hoc* basis.

Graduates in human or veterinary medicine will be able to receive, as necessary, a year of more or less formal training in selected subjects and to study for a Ph.D. degree in pathology or toxicology or other higher degree approved by the Foundation. The value of the awards will be between £800 and £1,200 per annum if taxable, or the equivalent tax-free, supplemented and subject to the same conditions as for science graduates.

The scholarships will be open to men or women preferably under the age of thirty-five, who hold a science, medical or veterinary degree of a United Kingdom or other Commonwealth university, who are of high merit and whose ability and inclinations fit them for a career in food science research. A candidate for a scholarship must be recommended by an appropriate professor or other authority of the university where the candidate graduated, and of the university or other institution at which the candidate would wish to receive training.

Scholarships will not normally be tenable for longer than four years.

If a scholar is allowed to spend part of his period of study abroad or to travel in Britain in connexion with his work, travelling expenses will be paid.

A scholar may not hold any other award concurrently with his scholarship, nor undertake other work, paid or unpaid, without the permission of the Nuffield Foundation.

Both the programme of work and training, and the institute at which it is to be carried out, must be approved by the Foundation.

Should the Foundation at any time find that a scholar neglects or has neglected the obligations of his appointment, it shall have power immediately to terminate his scholarship.

Selection for scholarships is to be made twice a year. Forms of application are obtainable from the Director of the Nuffield Foundation, Nuffield Lodge, Regent's Park, London, N.W.1.

SPECIAL CERAMICS

THE development of new technologies and the increasing tendency to seek greater operating efficiencies at higher temperatures create a rapidly growing demand for special ceramics, to withstand conditions too severe for metals or traditional ceramics. Nuclear engineering and the supply of power at microwave frequencies are two fields where progress in design and construction now requires the development of new high-performance materials. The engineer looks to the ceramist to provide these materials. The impetus of this demand is reflected in the growth of the small group working on special ceramics at the British Ceramic Research Association of the ceramic industries into a major division of the

Association in but a few years. The terms of reference of this group are wide, covering the preparation and testing of new materials, mostly non-oxides, for specialized electrical, nuclear and high-temperature applications, including rocket nozzles, and the assessment of existing materials as potential valve components; its research is carried out in close co-operation with various Service departments and industrial concerns. The first symposium on special ceramics, held by the British Ceramic Research Association in 1959, received enthusiastic support, and the proceedings were edited by P. Popper and published by Heywood and Company in 1960 under the title *Special Ceramics*. Its success led to the holding of a second symposium, under the same heading, at the Association's Laboratories during July 11–13, 1962. This was attended by 170 delegates from seven countries, representing universities, Government departments, research associations and industrial concerns. The twenty-five papers contributed were grouped into sessions under the headings: preparation and properties of non-oxides; oxides; pyrolytics; measurement; techniques; applications of ceramics.

Dr. N. F. Astbury, director of the British Ceramic Research Association, opened the symposium and welcomed the delegates.

The research described in the opening paper, read by Dr. E. D. Lynch (Argonne National Laboratory) on behalf of his colleagues J. H. Handwerk, P. D. Shalek and G. D. White, was stimulated by the need for new nuclear fuels to give greater reactor operating efficiencies. Refractory uranium compounds other than oxides were being investigated, with emphasis on uranium monosulphide and uranium monocarbide, their preparation and their properties. The closely related paper by M. C. Regan and J. W. Isaacs (Atomic Energy Research Establishment, Harwell), read by H. J. Hedger, described the effect of various additions of uranium monocarbide, uranium dicarbide, uranium metal and plutonium monocarbide on the reaction-sintering behaviour of uranium/carbon mixtures and on the density of the monocarbide produced.

The synthesis, purification and hot pressing of silicon hexaboride and silicon tetraboride and the assessment of their mechanical, thermal and electrical properties and resistance to oxidation were described by R. S. Feigelson and Prof. W. D. Kingery (Massachusetts Institute of Technology). Both borides were reported as semiconductors with high resistance to oxidation. Aluminium nitride is a highly refractory non-oxide which, like silicon nitride, is chemically inert and should prove a useful material, especially for applications in contact with molten aluminium. The preparation of pure aluminium nitride by levitating aluminium in a radio-frequency field in an atmosphere of nitrogen was described by Drs. C. F. Cooper, C. M. George and S. W. J. Hopkins (Morganite Research and Development, Ltd.), who also showed that its oxidation was controlled by the rate of diffusion of aluminium ions through the oxide layer. The appearance of profuse whisker growths on aluminium nitride was described by Dr. P. E. Evans (Manchester College of Technology) in the discussion.

The formation of protective coatings on graphite to improve its oxidation and erosion resistance is to-day the subject of considerable study and, in a combined paper, A. E. S. White, Dr. R. F. Deacon, J. Chown and Dr. N. Singer (Morganite Research and Development, Ltd.) described two methods of coating graphite with silicon carbide, composite coatings containing zirconium diboride, and the testing of these in an oxidation furnace, at 2,300° C in a high-temperature flame and in a liquid oxygen/kerosene rocket motor. In the discussion F. C. Carpenter (S. Smith and Sons, Ltd.) pointed out the usefulness of a fluidized bed technique in building up coatings on sharp edges of articles. Beryllium oxide is another material of interest for nuclear power applications. The sintering characteristics of various beryllium oxide powders, the effects of particle size and impurities, and the conditions that must be satisfied if high density is to be achieved were detailed by A. W. Hey and Dr. D. T. Livey (Atomic Energy Research Establishment, Harwell).

Pyrolytic decomposition is sometimes the only means of producing a pure, dense material in bulk form, since many refractories do not sinter and can be hot-pressed only by the incorporation of additives. It is often used to form dense coatings on a heated substrate: good, adherent coatings require that the thermal expansion coefficients of coating and substrate should match closely. The session on pyrolytics opened with a description by P. Popper (British Ceramic Research Association) of the preparation of silicon carbide and the nitrides of aluminium, boron, phosphorus and silicon by pyrolysis, from gases or vapours containing the constituent elements in the correct proportion. Pyrolytic carbon was discussed in two contributions. The first, by Dr. K. W. Carley-Macauly and M. Mackenzie (Atomic Energy Research Establishment, Harwell), indicated the development of new types of very low permeability carbons and graphite for high-temperature gas-cooled nuclear reactors, by impregnation of a porous bed in which a large temperature-gradient is maintained. The second, by Drs. J. Harvey, D. Clark and J. N. Eastabrook (Royal Aircraft Establishment, Farnborough), considered how the structure and crystallographic orientation of pyrolytic carbon varied with the temperature of deposition, surface roughness and graphitization. There was a considerable discussion of the mechanism of growth of the observed cones in the layers.

The electrical properties of rutile, with particular reference to its anisotropy and breakdown, were discussed by M. G. Harwood (Mullard, Ltd.), who showed that the conductivity along the *c*-axis could increase without affecting that in the perpendicular direction and that small filamentary regions carrying high current were present. The frictional properties and deformation of refractory borides and carbides at high temperature were discussed by C. A. Brookes (University of Cambridge), with reference to the adhesion theory of friction. Slip was observed along (111) planes of titanium carbide single crystals and the mechanism of deformation of polycrystals was considered.

In the session on measurement and techniques, measurements of the thermal conductivity of pyrolytic graphite at temperatures up to 2,100° C were reported by W. Johnson and W. Watt (Royal Aircraft Establishment, Farnborough). The accurate measurement of thermal conductivity is always very tedious, and great interest was shown in the report by Dr. R. W. Powell and R. P. Tye (National Physical Laboratory) of measurements made very rapidly with a new, direct-reading form of thermal comparator and agreeing well with other methods. An automatic dilatometer for the measurement of thermal expansion up to 1,500° C in controlled atmospheres was

described by K. N. Preece (Morganite Research and Development, Ltd.).

Dr. S. Scholz (Philips, Aachen) discussed the rate of densification of refractories during hot-pressing and the effect on this of activating impurities, such as iron in tantalum carbide. A. W. Moore and Dr. D. A. Young (Imperial College of Science and Technology, London) showed how the anisotropy of electrical and thermal conductivity of well-oriented graphite had been utilized in the design of susceptors for induction heating, in the attainment of temperatures up to 3,400° C. The radial pressure produced in a powder during its compaction in a die and its relation to compacted density were discussed by W. M. Long (Atomic Weapons Research Establishment, Aldermaston). The application of the electron microscope to ceramics, in the study of grain structure and surface texture, in the identification of crystalline fibres and fine particles by electron diffraction, and in following reactions, including the nitridation of silicon, was considered by Dr. S. N. Ruddlesden (British Ceramic Research Association).

The final session of the symposium was devoted to the applications of ceramics. Dr. A. J. Moulson and P. Popper (British Ceramic Research Association) first outlined the physical properties required of a ceramic for use as valve envelopes and windows, and the methods of measuring these properties in order to assess the suitability of a ceramic for valve applications. J. Free and Dr. D. Walsh (University of Oxford) described new uses of ceramics at ultra-high frequencies (cm and mm wave-lengths). Ceramics of low dielectric loss could be used as reflectors of microwave power, with the reflexion exceeding that of a pure silver surface, and experiments using titania were discussed. With non-linear dielectric materials it is theoretically possible to generate microwave power. The succeeding paper, by Dr. K. H. Kreuchen (Electrical and Musical Industries, Ltd.), considered the special ceramic problems arising with the growing use of very-high-power valves in the transmitters of television stations, radar systems and particle accelerators, including the need for low surface resistivity to avoid charge build-up from the plasma, new shapes for wave-guide windows to achieve broad-band performance, and secondary emission qualities. T. D. Davidson and J. Watkins (Morganite Research and Development, Ltd.) described the preparation of high-power microwave absorbing loads from silicon carbide and the variation of its semiconducting properties by the addition of silicon.

The theoretical and practical advantages of using ceramics in microwave tubes for particle accelerators and amplifiers, and the impressive performance obtained on a laboratory scale, were demonstrated by J. Free (University of Oxford), who stressed the need for the commercial development of new materials and predicted that accelerators using ceramics would eventually outclass those of conventional type, on a cost basis, offering higher efficiencies and higher operating frequencies. In the magneto-hydrodynamic generation of electricity, materials are subjected to unusually severe conditions at temperatures above 2,000° C. Dr. E. G. Wolff (Central Electricity Research Laboratories, Leatherhead) described the preparation and testing of some refractory borides, carbides, oxides and silicides as possible electrode and duct materials for such generators. The session closed with an illustration by W. F. Gibbons (Ferranti, Ltd.) of the ceramic-to-metal sealing technique and its application to problems in the field of nuclear engineering.

At the conclusion of the symposium the visitors toured the laboratories of the British Ceramic Research Association. The proceedings of the symposium will be published by the Academic Press in due course.

S. N. Ruddlesden

SCIENTIFIC RESEARCH IN BELGIUM

THE annual report of the Institute for the Encouragement of Scientific Research in Industry and Agriculture, Brussels, for 1961 records 65 grants totalling some 244·5 million francs distributed to some 229 investigators and 423 technicians*. A new grant of 21·5 million francs went to the Committee for Establishing the Soil and Vegetation Map of Belgium for its systematic study of the pedological character of the soil and completion of the pedological map of the kingdom. The Committee for the Study of the Solid State received a grant of 11·69 million francs towards research in progress in Prof. Dekeyser's laboratory at the University of Ghent on semiconductors, in the Laboratory of the Electrical Construction Works at Charleroi on the study of magnetic steel sheets, and in Prof. Brasseur's laboratory at the Gevaert factory on the improvement of photographic supports by perfecting the method of acetylation; a further grant of 2·15 million francs was for continuation of the Committee's work on the welding of resinous materials, 1,787,500 francs for research on the preparation of hard magnetic materials, and one of 9 million francs for continuation of research on the mechanism of photographic processes and for work on new photographic processes. The Carbochemical Society of Tertre received a grant of 3·9 million francs for continuation of work on textile colours, and the Gevaert Photo Products Society 7·225 million francs for the study of photographic dyes and processes of colour photography.

A grant of 10·19 million francs went to the Committee on the Application of Isotopic Methods in Agronomic Research for research on the utilization of radioisotopes, and one of 9 million francs to the Research Centre of Gorsem for continuation of work on diseases and insect pests of various cultivated fruits with the view of a system of control, and also of research on the maturation and conservation of fruit and the influence of insecticides and fungicides on the physiology of the vegetables to which they are applied. The Technical and Scientific Centre of the Belgian Glass Industry received some 8·5 million francs for its research on the properties and homogeneity of glass, the mechanism of action of abrasives and on enamels for glass, while a grant of 7,886,000 francs to the National Centre for Metallurgical Research was for analytical research by spectro-

* Institut pour l'Encouragement de la Recherche Scientifique dans l'Industrie et l'Agriculture, Bruxelles. Rapport Annuel-Exercice 1961. Pp. 266. (Bruxelles: Institut pour l'Encouragement de la Recherche Scientifique dans l'Industrie et l'Agriculture, 1962.)