

ture toughness, has proved a difficult experimental problem in relation to propagation of fracture. Recent work on measurements of transient force against time in the Charpy (impact) test has indicated, however, that this test might well be capable of modification for the particular purpose. The examination of fracture surfaces for the detection of slip patterns, using suitable materials and etching and microscope techniques, has proved extremely fruitful in the study of fracture initiation. By causing the arrest of fracture in a Charpy test at an extremely early stage, a trigger mechanism has been revealed that appears in accord with Cottrell's hypothesis (*Trans. Amer. Inst. Met. Eng.*, 212, 192; 1958) of a crack resulting from the intersection of two mutually perpendicular slip bands (see *Nature*, 190, 432; 1961).

The third research section of the new laboratory of the Association is devoted to work on the resistance group of welding processes, namely, spot, projection, seam welding, etc. These methods are normally used in the quantity production of sheet metal components, in which field the problem of maintaining consistency of quality under rapid fabrication conditions often demands a critical examination of material and process control. The section is equipped with a range of modern welding machines and with ancillary

apparatus for the measurement of the important process variables. In addition, techniques have been developed for the direct measurement of temperatures during spot welding. The problem is complicated by reason of the fact that the generation of heat in the production of a spot weld takes place at the interface region of two overlapping sheets, and temperature gradients are severe. A considerable amount of work has been done by the Association to overcome the difficulty by using buried thermocouples, and the results will be of importance in extending the welding process to harder steels, for which a knowledge of heating and cooling conditions is of particular importance.

The investigations mentioned and those being conducted in other departments are described in the sixteenth annual report of the British Welding Research Association, which has just been issued. For the year under review, the Association's income was £265,379, an increase of £53,252 over the year 1959-60. This increase is, in itself, greater than the total income of the Association in the year when the research station was inaugurated, and is evidence of the rapid growth of the Association to a position in its field which is probably unequalled outside the U.S.S.R.

R. P. NEWMAN

THE NUFFIELD FOUNDATION

THE sixteenth annual report of the Nuffield Foundation*, covering the year ended March 31, 1961, in which grant allocations exceeded £2 million, comments on the extent to which the Foundation sometimes participates in the management of the programmes it supports, thus keeping closely abreast of present-day thought and discovery in its fields of interest. Sometimes its neutrality and independence enable it to take the initiative in bringing together many varied, and sometimes conflicting, interests. Again, it can also, as in the establishment with the Joseph Rowntree Memorial Fund of a National Institute for Social Work Training, or in planning a medical school for the University College of Rhodesia and Nyasaland, draw on its long and varied experience to render important advisory services. Furthermore, its activating role is illustrated by the promotion, at the invitation of the Colonial Office, of an informal but widely representative study of the problems associated with the provision of an adequate and proper supply of British television material to television stations overseas, particularly to those in the less-developed countries. Two conferences were convened for such a purpose by the Foundation, and the resulting document, summarizing the broad conclusions of the study, and making detailed and costed proposals for action, may result in the establishment of a special organization in Great Britain to promote the supply of British television material to overseas countries by all possible means.

Of the allocation of £165,000 for science, including technology, £50,000 went to the Madingley Field Station for the Study of Animal Behaviour, Cambridge, for new buildings and recurrent expenses up to ten years, and £36,000 over five years to the Department of Medical Biochemistry and

Pharmacology, Birmingham, for work under Prof. A. C. Frazer on the biological effects of oxidized fats. An additional grant of £3,500 a year for four years to the Department of Chemistry, King's College, Newcastle upon Tyne, in support of Prof. J. Baddiley's work on the structure of cell walls will enable investigations into the biochemical aspects of the cell wall and teichoic acids to be initiated, and a grant of £11,500 over three years is in support of the microbiological aspects of Prof. C. H. Hassall's work at the University College of Swansea on the biosynthesis of complex phenolic compounds; a grant of £4,950 to the Gatty Marine Laboratory, University of St. Andrews, will provide Dr. A. J. Matty with research assistance over three years in his investigations of the thyroids of lower vertebrates.

In technology, a grant of £3,250 for five years was made to the National Trades Technical Societies of Sheffield to assist the introduction of their organization and educational services for adult workers in industry to other industrial areas; £15,000 to the Loughborough College of Technology will provide four postgraduate studentships in ergonomics for each of the years 1961-64 in the newly created Department of Ergonomics and Cybernetics; £5,500 to the Department of Mathematics, Royal Technical College, Salford, is to finance an investigation of mathematics in the electrical engineering industry; and an additional £1,200 to the Department of Chemistry and Food Technology, Borough Polytechnic, will allow Mr. P. D. S. Wood to continue the work on lipids until Easter 1962.

Of grants totalling £600,000 for medical projects, £220,000 was to meet the capital cost of the Nuffield Institute of Nuclear Medicine and running costs in its early years, while, also at the Middlesex Hospital Medical School, up to £45,000 during its first seven years goes to the establishment of a new research unit

* The Nuffield Foundation. Report for the year ended 31 March 1961. Pp. xv+210. (London: The Nuffield Foundation, 1961.)

in biology as applied to medicine. £60,000 to the University of Manchester is to provide the Department of Audiology and Education of the Deaf with more accommodation for clinical and research work for the young deaf child, and a further grant of £29,350 over three years is to go to the audiology unit at the Royal Berkshire Hospital for work on hearing and deafness in early infancy. A capital grant of £70,000 has been made for an extension to the Liverpool School of Tropical Medicine to further co-operation with schools of tropical medicine and endemic disease in Ghana and Thailand, and a further £40,000 to the Zoological Society of London for building the Nuffield Institute of Comparative Medicine. A grant of £30,000 was made to the Central Council for Health Education for an investigation into the present patterns of sexual behaviour and attitudes towards sex and marriage among young people between the ages of thirteen and twenty, which is expected to take three years to complete; one of £6,600 over three years to cover the salary of a research biochemist to work under Prof. G. Belyavin at University College Hospital Medical School on the response of selected cell lines to infection with influenza virus; and another of £3,200 a year for two years to the Institute of Orthopaedics to enable Dr. C. H. Lack to expand his work on the role of plasmin and plasmin inhibitors in the breakdown of connective tissue matrix, especially that of cartilage.

A grant of £25,000 has been made to the London School of Hygiene and Tropical Medicine, mainly to cover the first year's cost of a training course in industrial hygiene under the direction of Prof. R. S. F. Schilling, head of the School's newly created Department of Occupational Health, and the Foundation has also set aside £250,000 specifically for the further development in Britain of practical schemes of co-operation in industrial health and occupational hygiene. Of this, £15,000 has been allocated to provide the Central Middlesex Industrial Health Service, Ltd., with a permanent clinic, and £20,000 on a tapering basis for the re-organization and re-constitution of the Slough Occupational Hygiene Service, on the understanding that the unit can be made self-supporting within five years.

From the £165,000 for social research and experiment, £12,500 for a period of four years went to the scheme for an experimental family welfare centre at Stevenage New Town to cover the salary of the organizer, rent, maintenance and administrative expenses; £2,000 for a study by Prof. T. Ferguson of Glasgow young people who have been in the statutory care of the local authority and particularly of their assimilation into the community; £20,000 over three years for an inquiry by the Nature Conservancy and the Department of Estate Management, University of Cambridge, into the management of common lands; £9,500 over three years to the Women's University Settlement for developments in the after-care of discharged prisoners; £7,600 to the University of Cambridge for an investigation by Mr. Z. A. Silberston into the economic impact of the patent system in Britain; £5,000 to the Institute of Strategic Studies for the development of the Institute's Library, and £5,000 over five years to the London School of Economics and Political Science to enable Prof. W. A. Robson's group to undertake a more comprehensive study of local government in Greater London.

Among grants totalling £220,000 in education, special attention is directed to two of the smallest:

£300 towards the cost of a five-day residential meeting at the Battersea College of Technology, arranged by Dr. L. R. B. Elton, to consider policy and future action in regard to the proposed revision of syllabuses and teaching methods for Ordinary- and Advanced-level physics for the General Certificate of Education; and £1,500 in support of experiments in the teaching of French at East Ham Grammar School for Boys and Talbot County Primary School, Leeds. Grants were made of £100,000 to the Royal National Institute for the Blind for the change-over of the Nuffield Talking-Book Library from records to long-playing tapes; £20,000 to the University College of North Staffordshire for provision of multiple copies of texts and other documentation for the foundation year with an additional £5,000 towards the cost of an assessment of the foundation year; £30,000 over five years to the University of Cambridge for the continuation of its aerial reconnaissance over the British Isles; £6,650 over two years to the Department of Extra-Mural Studies, University of Liverpool, for a Senior Research Fellow to undertake a review of the nature and extent of adult educational provision at the present time; £4,250 for a critical analysis by the Acton Society Trust of management education courses; and a capital grant of £5,000 to Westminster School to form the "Tizard Research Fund" to assist research activities by the science staff of the School. The grant to Prof. P. L. Krohn's gerontological research unit at the University of Birmingham has been renewed a third time at the rate of £7,000 for two years, and an additional £1,800 allocated for Mr. F. Le Gros Clark's studies of women of mature age in paid employment and of occupational opportunities for people in retirement.

Grants totalling £385,000 for the Commonwealth overseas, distributed in forty grants to fifteen different countries, include £85,000 to finance for the next ten years a scheme at the University of Cambridge for a Nuffield Unit of Tropical Animal Ecology; £35,000 over five years to the Plunkett Foundation for Co-operative Studies for training courses aimed at raising agricultural standards in Africa; £10,000 for a survey with the Colonial Office of the incidence of deafness in East and West Africa; £18,000 over six years to the Cotton Research Station, Namulonge, Uganda, for a study of soil fertility in East Africa; £29,000 over five years to the East African Institute of Malaria and Vector-Borne Diseases for study of the effects of malaria on African vital statistics; up to £20,000 for angio-cardiological research equipment for the University College Hospital, Ibadan; a further £16,400 over two years to the University of Edinburgh to continue the study under Dr. K. L. Little of urbanization and the effects of industrialization in Sierra Leone. A further £19,000 was offered to the University of New South Wales in support of the Nuffield research chair of mechanical engineering for an additional five years; £8,000 over three years to the University of Adelaide for Prof. D. Rowley's studies of natural immunity to infectious disease; and £10,000 to the Young Women's Christian Association, Belize, British Honduras, for repayment of a loan for a community centre and hostel for girls.

Allocations to fellowships and scholarship schemes totalled £205,000. United Kingdom awards in medicine included three Heinz fellowships of the British Paediatric Association, four scholarships at University College, Ibadan, two medical fellowships, and four scholarships and three fellowships in

dentistry. One scholarship and two bursaries in biology were awarded, and four senior awards made in sociology. Under the schemes for the Dominions and Colonies there were eleven awards in medicine, fourteen in natural science (including one in engineering) and seven in the humanities and social sciences, in addition to ten Canadian travel grants and twelve

farming scholarships (three for Africans). Two travelling fellowships were given to Indian Civil servants and fifteen Royal Society and Nuffield Foundation Commonwealth bursaries were awarded, while 124 grants were made from the Elizabeth Nuffield Educational Fund covering a wide range of projected careers.

EFFECTS OF IONIZING RADIATION ON ORGANIC AND BIOLOGICAL SOLIDS

THE Société de Chimie Physique and the British Biophysical Society combined during July 3-4, in the Laboratoire de Chimie Physique, 11 rue Pierre Curie, Paris, to hold an informal discussion on the effects of radiation on organic and biological solids.

Opening the meeting on the first day, Prof. R. L. Platzman (Argonne National Laboratory, Illinois) outlined very clearly the present state of the theory of primary processes, and the recent developments due to Prof. U. Fano. In systems containing strongly interacting atoms, interaction may influence the primary energy absorption. Molecular structure, and particularly the presence of π -electrons, may affect the proportion of energy absorbed by different components in the primary process. In simple molecules, for example, methane, there is no evidence for such selective mechanism. More information is needed, in particular about the influence of water molecules, before this theory can be applied to biological materials.

Prof. M. Magat (Laboratoire de Chimie Physique, Paris) reviewed reactions in the solid state, in particular low-temperature radiation-induced changes such as polymerization, radical transfer and aromatic ring-opening, which occur by free-radical mechanisms. Members of the Paris group dealt in detail with these reactions, for example, Dr. E. Migirdytsian and Dr. S. Leach showed that benzene, if irradiated in the solid state, de-cyclizes and adds on aliphatic groups derived from the ethanol with which it is mixed in solid solution. Similar ring-opening was reported by Dr. K. Hyashi and Dr. S. Okamura (Osaka Laboratories, Japanese Association for Radiation Research on Polymers, Osaka) in the case of lactones, when it is followed by linear polymerization, and favoured by a well-ordered crystalline state.

A feature of the meeting was the use of electron-spin resonance to identify and measure the free radicals produced by irradiation. Drs. R. Bensasson, C. Chachaty, M. Bodard and R. Marx (Laboratoire de Chimie Physique, Paris) used the technique to establish the free-radical nature of low-temperature radiopolymerization of such monomers as acrylonitrile, and Dr. H. Szwarc (Institut de Chimie Physique, Paris) used it effectively to demonstrate the rapid recombination of radicals which occurs on heating irradiated cyclohexane through its transition point at 186° K. However, other factors may be involved, apart from a phase-change, in facilitating radical reactions in the solid. Dr. E. Collinson and Prof. F. S. Dainton (University of Leeds), while demonstrating that scavenging of radicals is more effective in the solid and with aromatic compounds, conjectured that this could be due to the π -electron configuration of the phenyl groups. They also found

that a glassy solid behaves more like a liquid than a crystalline solid. The important distinction between aromatic and aliphatic compounds was further emphasized in work by Dr. R. Mason (Imperial College of Science and Technology, London) on post-irradiation thermo-luminescence, when the intensity of emission was found to be a thousand-fold greater in aromatic than in aliphatic amino-acids.

Prof. J. A. V. Butler (Chester Beatty Research Institute, London) introduced the second session by stressing the need for a re-appraisal of such terms as 'direct' and 'indirect' effect, 'target', etc., and emphasized that in living systems, the balance is dynamic, and that radiation need be damaging at only one of a large number of places.

A question of continuing interest is the role of oxygen in radiation damage, and a number of contributions dealt with this factor. Drs. A. Müller, G. Hotz, and K. G. Zimmer (Institute of Radio-biology, Nuclear Research Centre, Karlsruhe) found a modified electron-spin resonance signal when bacteriophage was pressed into pellets in such a way as to expel oxygen, and Dr. L. Ehrenberg (Institutionen för organisk kemi och biokemi, University of Stockholm) on irradiating *Agrostis stolonifera* seeds could distinguish two types of electron-spin resonance signal, one of which is closely correlated with oxygen, and is decreased by pre-heating, that is, when oxygen is expelled. Dr. E. L. Powers (Argonne National Laboratory, Illinois) described recent work on bacterial spores, which offer a convenient experimental system for radiation work. Part of the damage is toxic only in the presence of oxygen. This can be estimated directly, and it is also possible to observe the effect of heat by using high linear energy transfer radiation, when annealing occurs during irradiation. The heat generated during heavy-ion bombardment may be an important and neglected factor, and in the work of Dr. T. Brustad (Norsk Hydro Institute for Cancer Research, Oslo), to be mentioned later, may in part explain the apparent lack of effect of additives.

The nature of the increased damage brought about by oxygen is much under discussion, and whereas the signals observed by Dr. L. Ehrenberg are not characteristic of peroxy-formation, Prof. G. Stein, (Hebrew University, Jerusalem) found a signal when polymethylmethacrylate was irradiated in the presence of oxygen which appears to be peroxidic. This system, moreover, provides a convenient method of measuring rates of oxygen diffusion. In certain circumstances, the influence of oxygen may be minimized by limited diffusion; for example, A. B. Robins and Prof. Butler (Chester Beatty Research Institute, London) found that a high dose-rate can obscure the oxygen effect completely in the case of trypsin.