National Park, Uganda; up to £12,000 for the production of a film illustrating the work on teacher training in the Kilimanjaro district of Northern Tanganyika; a further £7,500 for investigations in terrestrial ecology jointly by the University College of Rhodesia and Nyasaland and the University of Witwatersrand; and £3,800 over three years for research into the vegetation of swamps by Makerere College, University of East Africa. A grant of £80,000 was made to the Walter and Eliza Hall Institute of Medical Research, Melbourne, for extensions for immunological research, a similar grant to enable the Sydney Church of England Homes for Aged Persons to obtain a site and erect the Nuffield Garden Village, and £2,640 over three years for investigations by the Department of Biochemistry, University of Adelaide, into the association of deoxyribonucleic acid and the yeast cytochrome b_2 from which it is isolated and of the way in which deoxyribonucleic acid controls the behaviour of yeast. The University of Hong Kong received a grant of £26,650 over three years towards research in the Department of Zoology into the level of adrenocorticosteroids at cellular level, and one of £15,000 was made to the British Solomon Islands Protectorate for training college accommodation for women students.

As an experiment, the Foundation offered a special award for a medical fellowship to be held in Ibadan, Makerere, Vellore or the University of the West Indies, but although there was keen competition for the ordinary fellowships, of which four were awarded, only one candidate applied for the special fellowship, and as he did not wish to follow an academic career in medicine no award was made. One medical research fellowship was awarded, four fellowships, three assistantships for general practitioners, and 24 scholarships in tropical medicine, enabling senior students to spend three months attached to a Commonwealth medical school in the tropics. One research fellowship, five fellowships and three scholarships in dentistry were awarded, and the first six awards were made under the new scheme for food science. Two scholarships were awarded under the new scheme for sociological awards, and awards under the schemes for the Dominions and Colonies included 20 Dominion fellowships (six in medicine, eight in science, six in the humanities and social sciences) for graduates from Australia, Ceylon, India, Pakistan and New Zealand; three travelling fellowships for Canadian public officials and two for trade unionists; and nine short-term travel grants for senior Canadian scholars (one in medicine, five in science, three in the humanities and the social sciences). Two fellowships were awarded to Civil Servants from Pakistan; and under the scheme for training Africans in agriculture, a scholarship was awarded to a farmer from Kenya. The Foundation's grant to the joint scheme with the Royal Society for Commonwealth Bursaries was renewed for a further, final period of five years at £5,000 a year, and 24 awards were made.

COMBUSTION

THE tenth International Symposium on Combustion was held in the Department of Physical Chemistry, University of Cambridge, during August 16–21, 1964. Nearly 700 chemists, physicists and engineers from 25 countries attended. Among the overseas visitors were Dr. Bernard Lewis (President of the Combustion Institute) and Profs. Kistiakowsky, Kondratiev, Laffitte, Jost and Von Elbe.

The Plenary Lecture, entitled "The Study of Combustion by Photochemical Methods", was delivered by Prof. R. G. W. Norrish (Cambridge), who gave a broad survey of the development of understanding of the basic processes of combustion over the past forty years, with particular reference to the contributions made by kinetic spectroscopy and flash photolysis. The lecture was preceded by a short inaugural meeting and the presentation of the Combustion Institute Awards: the Sir Alfred Egerton Medal to Prof. P. Laffitte (Paris), the Bernard Lewis Medal to Prof. R. G. W. Norrish, and the Silver Combustion Medal, for the best paper presented at the ninth Symposium, to N. M. Howe, jun., C. W. Shipman and A. Vranos.

The papers in the discussion under the title "Elementary Combustion Reactions" fell into two groups—sixteen concerned with neutral species and nine with charged species. The review paper in the first group, "Elementary Combustion Reactions", was given by Prof. Ashmore (Manchester). The papers which followed centred round several topics. F. J. Wright (Esso Research) spoke on the nature of initial attack by oxygen atoms; C. F. Cullis, A. Fish and J. F. Gibson (Imperial College of Science and Technology) on the mechanism of spontaneous ignition of hydrocarbon mixtures; R. V. Blundell *et al.* (Dundee) on methane oxidation; G. B. Kistiakowsky and colleagues (Harvard) on methane and acetylene oxidation in shock waves; R. R. Baldwin and colleagues (Hull) on the use of the H_2—O_2 reaction for investigating the reactions between H and O atoms and OH and HO_2 radicals and hydrocarbons. G. Dixon-Lewis, M. M. Sutton and A. Williams (Leeds) reported measurements made in H_2—O_2 flames on the reaction rates of H atoms with O_2, D_2O and CO_2. P. Gray (Leeds) and J. C. J. Thynne (Edinburgh) discussed the kinetics of H atom abstraction by methyl radicals from substances containing the N—H bond, and L. Phillips and R. Shaw (Explosives Research and Development Establishment) discussed the reactions of methyl and methoxy radicals with NO and NO_2. The effect of SO_2 on H_2—O_2 explosion limits was considered by P. Webster and A. D. Walsh (Dundee). Several authors discussed atom and radical recombination: F. S. Larkin and B. A. Thrush (Cambridge), H atoms; K. L. Wray (Avco-Everett Research Laboratories), O atoms; C. P. Fenimore and G. W. Jones (General Electric Research Laboratories), radical recombination and heat release. J. R. Airey, J. C. Polanyi and D. R. Snelling (Toronto) considered hydrogen–halogen chain reactions. Carbon formation in premixed hydrocarbon–oxygen flames at reduced pressure was the subject of a paper by U. Bonne, K. H. Homann and H. Gg. Wagner (Göttingen), in which evidence was presented suggesting a correlation between the formation of poly-acetylenes in the reaction zone and the appearance and growth of soot particles. (Soot formation was also considered by K. S. Narasimhan and P. J. Foster in the General Session.) An interesting paper by A. A. Westenberg and R. M. Fristrom (Johns Hopkins) discussed a promising method of measuring free radical concentrations in flames by electron spin resonance. With probe sampling of flame gases combined with standard electron spin resonance techniques and using O_2 as a reference gas, they obtained absolute O and H atom profiles in hydrocarbon–oxygen flames at reduced pressure.

The second group of papers, concerned with ions, was preceded by a review, "Charged Species", by Dr. T. M. Sugden ('Shell' Research). Several papers in this section discussed the mechanism of chemionization in flames. In contrast to the ninth Symposium, where there appeared to be general agreement about the $CH + O \rightarrow CHO$ mechanism, there was no such agreement here. Prof. Kistiakowsky and colleagues (Harvard), on the basis of shock tube experiments, revived an earlier suggestion of Knewstubb and Sugden (later dismissed by them) that

$C_3H_3^+$ was the primary ion, formed by the reaction $CH^* + C_2H_2 \rightarrow C_3H_3^+$, CHO^+ having no importance; while A. Fontijn, W. J. Miller and J. M. Hogan, and H. F. Calcote, S. C. Kurzius and W. J. Miller (Aerochem. Research Lab., Inc.), from flow system and atomic flame experiments, and from a study of low-pressure flames, respectively, suggested that both CHO^+ and $C_3H_3^+$ were primary ions, which could predominate under different conditions.

J. L. Franklin and M. S. B. Munson (Humble Oil Co.) produced data on positive ions in crossed-beam experiments with methane and acetylene and oxygen. K. Schofield and T. M. Sugden (Cambridge) discussed observations on the ionization of alkali and alkaline earth metals and their compounds in hydrogen flames and proposed mechanisms for the formation of the positive ions known to be present. Two papers, by H. F. Calcote, S. C. Kurzius and W. J. Miller (Aerochem. Research Lab. Inc.) and by A. Feugier and A. Van Tiggelen (Louvain), provided data on negative ions in flames, but there appeared to be little agreement between them on the relative importance of the species observed. A. V. Phelps and J. L. Pack (Westinghouse Research Lab.) and M. A. Biondi and co-workers (Pittsburgh) reported results obtained with relatively simple plasmas, which might contribute to the understanding of more complicated flame systems. The former dealt with electron attachment and detachment in O_2 and in O_2—CO_2 and O_2—H_2O mixtures, and the latter with positive ion (Ne_2^+, N_2^+, O_2^+ and NO^+)-electron recombinations.

The discussion "Electrical Properties of Flames" centred round twelve papers. Three were concerned with the measurement of ionization. A. J. Borgers (Utrecht) described the application of the high-frequency resonance method to the measurement of electron concentrations in flames. B. E. L. Travers and H. Williams (Rocket Propulsion Establishment) discussed the use of probes for the measurement of positive ion densities in flames and suggested that double-probe measurements are more reliable, particularly when electron temperatures are required, and G. Wortberg (Aachen) reported some ion concentration measurements on flat, atmospheric pressure flames. G. N. Spokes and B. E. Evans (Stanford Research Institute) considered various factors which may influence the results when ions are sampled from chemical plasmas in mass-spectrometric work. U. W. Balwanz (U.S. Naval Research Lab.) reported on ionization in rocket exhausts. D. L. Turcotte and W. Friedman (Cornell) discussed the interaction between seeded combustion products and cold electrodes, and S. L. Soo and R. C. Dimick (Illinois) that between an ionized gas and solid particles. F. J. Weinberg and co-workers (Imperial College of Science and Technology) read papers on flames augmented with electric discharges and on the effect of electric fields on droplets and particles in an ionized gas. R. M. Davies (Gas Council) described heat transfer measurements in electrically boosted flames. N. I. Yushchenkova and S. I. Kosterin (U.S.S.R.) dealt with ionization in seeded air on supersonic expansion; R. Friedman (Atlantic Research Corporation) described a method of producing electron-rich gases from a solid fuel mixture burning to CO, N_2 and Cs.

Twelve papers were grouped under the heading "Flame Chemistry". Several of these were devoted to various problems connected with the experimental determination of the composition of flame gases: K. N. Bascombe (Explosives Research and Development Establishment) described the measurement of H-atom concentrations in fuel-rich, highly diluted H_2—O_2 flames; W. G. Agnew and J. T. Agnew (General Motors), the mass spectrometric determination of composition profiles for two-stage flat diethyl ether–air flames; N. Bradley *et al.* (Liverpool), a mass-spectrometric examination of cool flames of aldehydes. The behaviour of cool flames of hydrocarbons was investigated by B. H. Bonner and C. F. H. Tipper (Liverpool); monopropyl pentaborane flames by W. G. Berl and co-workers (Johns Hopkins); hydrogen azide decomposition flame by P. Laffitte, I. Hajal and J. Combourieu (Paris); the kinetics of H_2—Cl_2 flames by R. Corbeels and K. Scheller (U.S.A.F. Aerospace Research Lab.); the inhibition of CH_4—O_2 flames by CH_3Br by W. E. Wilson, jun. (Johns Hopkins); and the reactions of alkali metals in fuel-lean H_2—O_2—N_2 flames by W. E. Kaskan (General Electric). Two papers, by P. H. Kydd and W. I. Foss (General Electric) and H. C. Hottel and colleagues (Massachusetts Institute of Technology), were concerned with the processes occurring in stirred reactors (the more practical aspects of stirred reactors were considered in the discussion on aerodynamics in combustion), and two with non-thermal emission from flames—H. G. Wolfhard (Institute for Defense Analyses) and collaborators (Thiokol Chem. Corp.) OH radicals in low-pressure flames, and P. J. Th. Zeegers (Utrecht) OH radicals and K atoms.

Of the twelve papers under the heading "Reaction Kinetics", five dealt with various aspects of the H_2—O_2 reaction. T. Asaba, W. C. Gardiner, jun., and R. F. Stubbeman (Texas), and V. V. Voevodsky and R. L. Soloukhin (U.S.S.R.), described shock wave investigations. Problems associated with the induction period were discussed by F. E. Belles and M. R. Lauver (N.A.S.A., Lewis Research Center); ignition kinetics by R. S. Brokaw (N.A.S.A., Lewis Research Center); inhibition of the second limit by HBr and HCl by D. R. Blackmore, G. O'Donnell and R. L. Simmons (Manchester). M. A. A. Clyne (Cambridge) discussed the reactions of the HNO molecule; V. N. Kondratiev (U.S.S.R.), thermal cracking of methane; A. Martinengo, J. Melczer and E. Schlimme (Göttingen), the analysis of stable reaction products from the adiabatic compression of hydrocarbon–air mixtures; J. Hay, J. H. Knox and J. M. C. Turner (Edinburgh), homogeneous and heterogeneous processes in the gas-phase oxidation of isobutane and isobutene. Three contributions in this section were devoted to hydrazine: pyrolysis kinetics, on the basis of a shock tube investigation, were considered by E. T. McHale, B. E. Knox and H. B. Palmer (Pennsylvania State); pyrolysis and oxidation by K. W. Michel and H. Gg. Wagner (Göttingen); and decomposition of hydrazine and its methyl derivatives by I. J. Eberstein and I. Glassman (Princeton).

The "Flame Spectroscopy" section comprised seven papers; two of these were concerned with the determination of the properties of hot gases by spectroscopic means: C. C. Ferriso, C. B. Ludwig and F. P. Boynton (General Dynamics) described an infra-red method of determining the CO_2/H_2O ratio and the flame temperature, and G. J. Penzias (Warner and Swasey Co.) discussed the CO_2 concentration. U. P. Oppenheim and A. Goldman (Israel Institute of Technology) presented data on the infra-red emissivity of water vapour, and S. H. Bauer (Cornell) and J. H. Jaffé (Weizmann Institute, Israel) on the collision broadening of infra-red emission lines of OH. S. Tsuchiya and K. Kuratani (Tokyo) considered the excitation and quenching of Na atoms behind a shock wave. Results of investigations on molecular radiative transfer in non-isothermal gases (such as a rocket exhaust plume) were presented by F. S. Simmons (Michigan). Problems connected with mass spectrometric sampling of flame gases at atmospheric pressure were discussed by T. A. Milne and F. T. Greene (Midwest Research Unit).

The seven papers in the "General" group contained no obvious unifying factor and appeared to be an 'overflow' from the Flame Chemistry and Reactions Kinetics sections.

The thermal ignition theory in autocatalytic reaction was considered by P. G. Ashmore and T. A. B. Wesley (Manchester), ignition of gases at a hot surface under non-steady state conditions by G. Adomeit (Aachen), the explosive decomposition of azomethane by N. Y. Gerri and F. Kaufman (Ballistic Research Laboratories). R. H.

Atalla and K. W. Wohl (Delaware) dealt with the effect of added N_2 on the light emission from butane–oxygen flames. Radiation processes connected with high-pressure H_2—O_2 combustion were considered by M. C. Barrows (NASA, Lewis Research Center), and supersonic firings into H_2—O_2 and H_2–air mixtures by H. Behrens, W. Struth and F. Wecken (Inst. Franco-Allemand). Results on soot formation on introducing CH_4 into burnt flame gases were presented by K. S. Narasimhan and P. J. Foster (Sheffield).

There were twenty-two papers grouped in the discussion "Aerodynamics in Combustion"; eight of these were placed under the heading "Free Burning Fires". The fundamental problems of free-burning fires were discussed by H. W. Emmons (Harvard). The influence of various factors on such fires was considered by a number of authors; the effect of irradiation, humidity and air velocity on the spreading of fire over controlled fuel beds by H. C. Hottel, G. C. Williams and F. Steward (Massachusetts Institute of Technology) and by H. E. Anderson and R. C. Rothermel (U.S. Forest Service), the effect of cross-winds on turbulent diffusion flames of gas by A. A. Putnam (Battelle Memorial Inst.). Some theoretical aspects of buoyant fire plumes were discussed by H. J. Nielson and L. N. Tao and by B. R. Morton (Illinois Institute of Technology); measurements on buoyant diffusion flames were reported by P. H. Thomas, R. Baldwin and A. J. M. Heselden (Fire Research Station, U.K.). C. Sandches Tarifa, P. Perez del Notario and F. Garcia Moreno (Madrid) presented results on the flight paths and lifetimes of burning wood particles.

Related topics were considered in a group of five contributed papers under the heading "Fire Research". Four of these, by S. Martin (U.S. Naval Radiological Defense Lab.), by W. D. Weatherford, jun., and D. M. Sheppard (Southwest-Research Inst.), by P. L. Blackshear, jun., and K. A. Murty (Minnesota) and by E. R. Tinney (Washington State), were concerned with the ignition and burning of cellulosic materials. D. Gross and A. F. Robertson (National Bureau of Standards) considered enclosed fires, and K. Akita and T. Yumoto (Fire Research Inst. of Japan) the combustion of liquid methanol.

The remaining fourteen papers in the discussion on aerodynamics in combustion were largely concerned with engineering problems connected with combustion. Of the four papers on rocket combustion instability, two, by R. W. Hart and F. T. McClure (Johns Hopkins) and by L. Crocco (Princeton), dealt with the theoretical aspects of solid and liquid rocket propellant combustion instability, respectively. The other two, by E. W. Price (U.S. Naval Ordnance Test Station) and by R. S. Levine (Rocketdyne), discussed the experimental data on instability.

The ten papers on low- and high-speed combustion processes were concerned with the problems associated with different types of combustors of industrial interest. A. M. Brown and M. W. Tring (Sheffield) discussed the application of pressure-jet burners to marine boilers, and F. Mauss, E. Perthius and B. Sale (Inst. Français du Petrole) low-frequency oscillations in fuel-oil boilers. Efficiency problems of combustors were investigated by J. M. Beer and K. B. Lee (International Flame Research Foundation), using suitable models. Results of theoretical and experimental examinations of high intensity combustors were presented by W. E. Francis (Gas Council). Oscillatory effect, in tunnel burners were considered by J. K. Kilham, E. G. Jackson and T. J. B. Smith (Leeds). Practical problems connected with gas turbine combustion were discussed by A. H. Lefebvre (College of Aeronautics, U.K.). Combustion rates in confined turbulent flames were investigated by N. M. Howe, jun., and C. W. Shipman (Worcester Polytechnic Inst.), and the burning of propane in a spherical combustor by A. E. Clarke *et al.* (Lucas Gas Turbine Equipment, Ltd.). F. S. Billig (Johns Hopkins) presented results on the supersonic combustion of aluminium alkyl fuels, and M. M. Gibson (Northern Research and Engineering Corp. International) data on flames in supersonic premixed combustible gas streams.

The "Detonation" session consisted of twelve papers. Six were concerned with condensed phase. Various aspects of the subject were considered—detonation limits in composite explosives by W. E. Gordon (Combustion and Explosive Research, Inc.), critical diameter by A. N. Dremin and V. S. Trofimov (U.S.S.R.), pressure measurements during shock initiation by V. M. Boyle, R. L. Jameson and F. E. Allison (Ballistic Research Labs.), detonation front structure by B. G. Craig (Los Alamos), the application of a shock wave approximation to detonation initiation by D. C. Pack and F. J. Warner (Royal College of Science and Technology, Glasgow). B. Hayes (Los Alamos) reported the results of electrical conductivity measurements on reaction zones of explosives and revived the long discarded (at least for flames with no visible soot formation) solid carbon theory to account for his observations. Six papers dealt with gaseous detonations: R. W. Getzinger *et al.* (Berkeley) discussed steady detonations in ozone; D. R. White and G. E. Moore (General Electric), induction zones in H_2—O_2 and CO—O_2 mixtures; P. A. Urtiew, A. J. Laderman and A. R. Oppenheim (Berkeley), the generation of pressure waves by accelerating flames; E. K. Dabora, J. A. Nicholls and R. B. Morrison (Michigan), the influence of a compressible boundary on detonation propagation; J. H. Lee, B. H. K. Lee and T. Shanfield (McGill, Montreal), two-dimensional unconfined detonation waves; M. L. Wilkins, B. Squier and B. Halperin (California University, Livermore), equations of state for selected explosives.

The contributed papers in the "Combustion and Flow" section centred round topics similar to those in the discussion on aerodynamics in combustion, and mainly related to flame instability and turbulence. Stability and oscillations of laminar jet flames were considered by I. Kimura (Tokyo), mechanisms of acoustic effects associated with flames by Tau-Yi Toong *et al.* (Massachusetts Institute of Technology); high-frequency oscillations in a rocket motor by H. Tsuji and T. Takeno (Tokyo), the combustion of droplets in a gas stream undergoing acoustic oscillations by W. C. Strahle (Princeton). Turbulence problems were dealt with by numerous authors: turbulent boundary layers, by G. A. Marxman (United Technology Center) and by C. E. Wooldridge and R. J. Muzzy (United Technology Center); concentration intermittency in jets by H. A. Beckers, H. C. Hottel and G. C. Williams (Massachusetts Institute of Technology); turbulent exchange behind flameholders by G. Winterfeld (D.V.L. Inst. für Luftstrahlentriebe); turbulent flashback by L. N. Khitrin *et al.* (U.S.S.R.). N. H. Pratt and J. E. C. Topps (National Gas Turbine Establishment) described a new experimental method for the investigation of heat release in expanding combustion products, and H. Edmondson and J. E. Garside (Leeds) the lifting of diffusion flames; H. Phillips (Safety in Mines Research Establishment), experiments on buoyant methane flames.

The "Solid Propellant Combustion Fundamentals" section comprised six papers. Three of these discussed perchlorates: G. A. McD. Cummings and R. A. Hall (Rocket Propulsion Establishment), premixed flames of perchloric acid with CH_4, C_2H_6 and CH_3OH; J. Powling and W. A. W. Smith (Explosives Research and Development Establishment), the surface temperature of burning ammonium perchlorate; M. Barrère and L. Nadaud (ONERA, France), the combustion of ammonium perchlorate spheres in a stream of gas. Chemical kinetics of cordite explosions were considered by G. Sotter (Sheffield); emittance of solid metal oxide particles in propellant combustion products by D. J. Carlson (Philco Research Labs.); regression rates of solid fuels and polymer degradation by B. Rabinovitch (United Technology Center).

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The next symposium will be held in 1966 at Berkeley, California.

E. M. BULEWICZ

THERMAL CONDUCTIVITY

THE expanding field of new materials and their use in all branches of technology, particularly those involving transfer of heat, has increased the scope of work on thermal conductivity during the past two decades and created a revival of interest in the subject. The problems are international, and this was apparent during July 15–17 when 150 invited delegates, representing 11 countries, met at the National Physical Laboratory to discuss their work in this subject. For many years the Laboratory has been involved in work on the thermal properties of materials and it was, therefore, a most appropriate venue for such a gathering.

The comprehensive programme of 50 papers contained a majority which were devoted to methods of measurement, supplemented by others which included results for some particularly important materials in solid, liquid or gaseous state. In some of the cases where metals or semiconductors were reported on, the results were accompanied by an analysis which was of value in relating the behaviour of real materials to the theory of solids.

Much attention was directed to the difficulties encountered in the measurement of thermal conductivity over the very wide range of temperature now considered of practical importance. It was also realized that poor experimental work cannot be explained with elaborate hypotheses; measurements to high accuracy are required before any attempt is made to assess materials or investigate theories. Significant advances have been made in methods for all conductivity ranges both for fundamental purposes and for the less accurate but rapid practical requirements.

Some particularly important developments have been made to the original unmatched guard apparatus first proposed by M. J. Laubitz (National Research Council, Ottawa). He has dispensed with the guard tube and now undertakes the measurement of temperature profile along the axis of his two-sectioned centrally heated rod by means of a tightly fitting thermocouple sliding inside an axial hole. These accurate measurements coupled with a reasonably simple mathematical analysis of the system seem capable of yielding results very quickly, since equilibrium conditions are attained rapidly, at temperatures up to 1,000° C. For basic studies of materials at these temperatures this is an important step forward and the possibilities of extending its temperature range by using optical pyrometry were seen immediately.

H. E. Robinson (U.S. National Bureau of Standards) discussed forms of line heat sources that could be used as heaters in apparatus for measurements at lower temperatures on insulating materials in disk and slab form. These new configurations lend themselves more readily to mathematical analysis, they are more simple to use and would appear to be able to yield more accurate results.

R. Berman (Clarendon Laboratory, Oxford), during a session devoted to low temperatures, described a significant new measurement technique whereby thermal conductivities can now be undertaken between 1° and 300° K using a single method involving thermocouples for temperature measurements. These couples are a combination of gold alloyed with 0·02–0·03 per cent iron together with chromel or a semi-conductor as the opposite element. The thermocouple sensitivity over the whole range is never less than 10 μV/°C and temperature differences of 0·001° C can be measured to a few per cent. By this means it has been possible to study solid helium in the body-centred cubic phase which exists only over a temperature range of a few hundredths of a degree. The method is also being applied to measurements on lithium fluoride using different concentrations of the ^{6}Li and ^{7}Li isotopes, in order to obtain a better understanding of the effects of phonon scattering.

In the two sessions devoted to fluids it soon became apparent that there was a division of interests between precise and practical requirements. B. Vodar (Centre National de la Recherche Scientifique, Bellevue) and his collaborators satisfied those delegates interested in the former by describing several new methods together with their results estimated to be accurate to 1 per cent for a series of gases and liquids over a 600° C temperature range and pressures up to 1,000 bars. There is, however, a very great interest in quick and reliable methods capable of yielding the more practical accuracies of 5–10 per cent. The thermal comparator method developed by R. W. Powell (National Physical Laboratory) and others, and the hot-wire method as suggested by D. T. Jamieson (National Engineering Laboratory), are two which should fulfil these needs. The whole subject of thermal conductivity of liquids is overshadowed by the very large discrepancies in the results that are available for a number of liquids in general use. H. Poltz (Physikalisch-Technische Bundesanstalt, Braunschweig), in discussing the effects of radiation in liquids, has found that the effective conductivity is dependent on the optical thickness of a liquid layer. There are measurable contributions due to this mode of heat transfer even at room temperature. It is possible that this radiation effect, if studied further, may well be a significant contribution towards resolving the existing divergencies which cannot as yet be fully explained.

The design and efficient operation of nuclear reactors are greatly dependent on a knowledge of the thermal properties of the materials used. These facts were emphasized in three contributions devoted to materials at present in use and two dealing with those for advanced reactors. Results for post-irradiated uranium, UO_2 during neutron irradiation and *Dragon* fuel cartridge materials were presented by D. Shaw, D. J. Clough and J. Milne (U.K. Atomic Energy Authority), respectively, and were supplemented by McElroy's (Oak Ridge National Laboratory) two reports, one on graphite materials to 1,000° C and the other dealing with UO_2 to 400° C. The borides and nitrides of Ti, Zr, Hf and Nb are now being considered as high-temperature materials of the future, and recent work has shown that they have valuable practical physical properties coupled with unusual electronic and lattice conductivity behaviour which have yet to be fully explained. R. Mendez-Penalosa (University of Madrid) discussed his work on zirconium nitride, and M. Hoch (Cincinnati University) presented results for a collection of these materials up to 1,800° C obtained using an inductive heating method. The evaluation of thermal conductivity required an accurate knowledge of emissivity and specific heat, which in this case were independently measured. This last-mentioned factor served to highlight the controversy that existed during several sessions whereby the relative merits of the measurement of thermal conductivity, as opposed to its evaluation from thermal diffusivity determinations, were elaborated. G. C. Danielson (Iowa State University) has indicated that