

THE AUSTRALIAN DEFENCE STANDARDS LABORATORIES

THE annual report of the Department of Supply of the Australian Defence Standards Laboratories, Maribyrnong, covering the period July 1, 1962–June 30, 1963*, mentions that a joint unit with the U.K. Ministry of Aviation has been set up to investigate the causes of deterioration of materials in tropical environments. The main laboratory for this purpose is near Innisfail, where 'hot-wet' conditions prevail, and a second laboratory is at Cloncurry in western Queensland, where the conditions are 'hot-dry'. Other sites, such as the marine site at Clump Point near Innisfail, will be used as required.

"Operation Blowdown", planned by the Australian Army and the Laboratories in 1961 in order to obtain data for military importance concerning the effects of a large explosion occurring in a tropical rain forest, was expected to culminate in July 1963 by the explosion of some tens of tons of trinitrotoluene at a height of 140 ft. above the ground in the rain forest area at Iron Range, Cape York Peninsula, 320 miles north of Cairns. The scientific tasks undertaken by the Laboratories included: the assembly of the explosive charge and its detonation; measurements of blast wave using pressure gauges with high speeds of response; measurements of tree strain and the investigation of displacement hazards to articulated dummies representing troops; and the assessment of damage to the forest as a whole.

In the Physics Division the work on the detection by an electron spin resonance spectrometer of the defects produced in polymethyl methacrylate by irradiation by γ -rays was extended to include the effect of a red dye, commercially incorporated in 'Perspex', as used in radiation dosimetry. The dye does not affect the free radical spectrum of the substrate, but gives rise to an additional signal. A wide-line nuclear magnetic resonance spectrometer was used to make a general survey of the resonance of nitrogen-14 nuclei in a variety of compounds, including formamide and nitrophenol. Cobalt complexes, irradiated beryllium oxide and resonances in oxygen, aluminium, chlorine, titanium and mercury were also investigated. From measurements of the anisotropy of the electrical conductivity of silicon for high electric fields at lattice temperatures of 77° K and 300° K, the temperatures of the hot electrons in the normally equivalent valleys were deduced as a function of the electric field.

The electronic counting of optical interference fringes is regarded as a promising method for the improvement in high-precision measurements of length, and equipment of this kind for the measurement of lengths up to 2 in. to an accuracy of 1 in 10^6 has been recently installed in the Physics Division. It is to be used for the standardization of about 900 sets of standard gauges. A method for the calibration of analytical weights using the built-in weights of a direct-reading balance as standards has been developed. The uncertainty in the values obtained is less than the precision of the balance, and thus the application of the method will enable the majority of chemical laboratories to standardize their own analytical weights to a high order of accuracy. The Division has taken an active part in the drafting of specifications for the range

of 'Radiac' (radiation indicating and computing) instruments for use by the Australian armed services and civil defence organizations. The instruments include pocket quartz fibre dosimeters, β - γ Geiger counter contamination meters, and ionization chamber survey meters.

As part of the Chemistry Division's programme of elucidation of the molecular structure of organic compounds, the nitrogen-hydrogen stretching frequencies in a number of primary and secondary amines and amides have been determined. The results indicate that the apparent splitting of the first overtone symmetric amine stretching band arises from a combination frequency and not, as others have suggested, from the tunnelling through an energy barrier or the presence of rotational isomers. Investigations using electron impact in a mass spectrometer have shown that, while β -bond cleavage is the principal mode of fission in both aliphatic cyanides and iso-cyanides, the iso-cyanides exhibited in addition markedly greater α -bond cleavage and hydrogen rearrangement. The investigation of the effect of activation temperature on the properties of chemically pre-treated brown coals has been completed. New methods for the determination of a number of atmospheric contaminants at the maximum allowable concentration for continuous exposure have been developed. The investigation of various factors which could influence the oxygen yield in electro-deposited chromium by the Adcock method has shown that, for material containing oxygen of the order of 0.1 per cent or higher, the preliminary heat treatment as required by the Adcock method significantly reduces the yield by the vacuum fusion method. Research on the photo-conductivity of zinc oxide and zinc oxide-resin mixtures has been carried out in order to explain phenomena associated with the xerographic reproduction. It has been confirmed that the chemisorption of oxygen on the surface of zinc oxide microcrystallites is an important factor in the mechanism of the dark and photo-conductivity of zinc oxide and that photoconductivity decay follows an Elovitch type of chemisorption equation. Many other factors, including the temperature, pressure, and the presence of water vapour and gaseous ions, also affect the conductivity.

The main interests of the Metallurgy Division have been, as formerly, the methods of processing chromium and chromium alloys, and measurements of their ductility, strength and creep; the abrasion of metals, including the examination of magnesium oxide particles suitable for metallographic polishing, and of the dislocation arrays produced in germanium by deformation at room temperature; and the long-term stability of nickel-base thermocouple alloys.

The annual report lists the various personnel of the Laboratories and their status, and gives details of the publications by members of the staff during the year under review. The staff numbered 724 on July 1, 1962, and 730 on June 30, 1963. Six members of the staff were in Great Britain for all or part of the year to gain experience in special aspects of their work, and the superintendent, Dr. F. A. Fox, visited both Great Britain and the United States to study present-day trends in defence and in the management of research and development organizations.

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* Commonwealth of Australia: Department of Supply. Defence Standards Laboratories Annual Report, 1962–63. Pp. 36. (Maribyrnong, Victoria: Department of Supply, Defence Standards Laboratories, 1963.)