

Metallurgy, Liverpool). She showed how the addition of small amounts of cadmium to an aluminium-copper-magnesium alloy leads to the formation of a superstructure with cadmium atoms around the edge of the plate-like zones which prevent their further growth. The structure of the zones in aluminium-copper alloys to which lithium and indium have been added was then described. The influence of cold work upon subsequent precipitation phenomena is a topic of great theoretical and practical interest. Miss Silcock reviewed some of the earlier investigations in this field and then described results she had obtained which indicate that prior cold work limits the number of orientations in which the θ' phase forms on aging aluminium-copper alloys. Cold-worked aluminium-copper alloys containing cadmium behave in the same way as alloys free of cadmium, an effect which was attributed to an association between the cadmium atoms and the extra vacancies introduced during deformation.

The study of precipitation phenomena in steels has lagged far behind the work on light alloys. The main reasons for this are that X-ray techniques are not readily applicable to the early stages of the precipitation reactions since it is impossible to prepare single crystals of martensite, while at the later stages, bulk chemical extraction techniques followed by X-ray diffraction of the extracts serves only to identify the phases and gives no idea of the size, shape and distribution of precipitated particles. With the aid of extraction replicas and the electron microscope, the study of precipitation reactions in steels has greatly advanced, and recent results obtained in this field were described by Prof. R. W. K. Honeycombe (Department of Metallurgy, Sheffield). He described the morphological changes associated with the decomposition of martensitic plain carbon steels and then discussed the modifications introduced by the addition of strong carbide-forming elements, contrasting the different effects of chromium, molybdenum and vanadium, and the influence of small additions of niobium and tantalum. Precipitation in austenitic steels has not been studied in as great detail as that in ferritic materials, but Prof. Honeycombe described some new results on the formation of chromium carbides and niobium carbides in a standard creep-resistant austenitic steel.

The discussion which followed the principal papers was concerned mainly with the presentation of new results obtained by electron microscopy. Miss K. B.

Day (British Aluminium, Gerrards Cross) put in a plea for the retention of the oxide replica technique for studying precipitation in aluminium alloys, illustrating the many advantages of the technique for investigating the advanced stages of precipitation reactions. P. M. Kelly (Cambridge) described how he had been able to prepare thin foils of steel from bulk material which were suitable for examination by direct transmission in the electron microscope. The results he obtained on high-carbon martensites and tempered plain carbon steels were illustrated. A film on precipitation in an aluminium-4 per cent copper alloy was shown by G. Thomas and M. J. Whelan (Cambridge). The film was obtained by aging thin foils of the alloy on a heating stage in the electron microscope and recording the structural changes as observed on the viewing screen with a cine-camera. The film showed conclusively that the final stages of aging involved the resolution of small particles and growth of large particles of the θ -phase.

A number of contributors presented results on the precipitation of vacancies in pure metals and alloys. R. E. Smallman (U.K. Atomic Energy Authority, Harwell) showed electron micrographs of the effects produced when vacancies were precipitated from nickel, copper, silver and gold and discussed the results obtained in terms of the energies of stacking faults in the respective metals. P. B. Hirsch (Cambridge) presented similar results and gave an account of the formation of tetrahedral stacking faults in gold. The formation of dislocation spirals by the condensation of vacancies on screw dislocations in an aluminium 4 per cent copper alloy was described by M. J. Whelan and G. Thomas (Cambridge). These spiral dislocations provide favourable sites for the nucleation of precipitates and are responsible for the structures shown by Mme. A. R. Weill (Paris) of abnormalities in the distribution of the θ' precipitates after aging.

The object of the conference, in attempting to bring two groups of workers together, was admirably conceived; the fruits of this union will be awaited with interest. For the electron microscopists at least the agreement between their results and those obtained by X-ray diffraction was reassuring, and vindicated their efforts of the past few years in the development of the thin-foil techniques for the direct examination of metals by transmission.

J. NUTTING

FUEL RESEARCH

THE report of the Fuel Research Board for 1957*, issued on October 31, 1958, is particularly noteworthy for the fact that it records the decision to close down the Fuel Research Station at Greenwich, and transfer to the new Warren Springs Laboratory at Stevenage only two main items of research. These are the programmes of work concerned with the measurement and abatement of air pollution and with the synthesis of oil from carbon monoxide and hydrogen, which are obtained from the gasification of coal.

In recent years quite a number of other organizations have also been concerned with research on fuels,

* Department of Scientific and Industrial Research. Fuel Research 1957: Report of the Fuel Research Board with the Report of the Director of Fuel Research for 1957. Pp. iv + 59 + 4 plates. (London: H.M. Stationery Office, 1958.) 4s. 6d. net.

most of them in connexion with more or less specialized aspects of fuel technology and its associated bearing on industrial practice.

The new laboratory at Stevenage is envisaged as the centre of research in Britain on air pollution, though again many aspects of the problem associated with processing must necessarily rest to some degree in the domain of other organizations. The co-operative scheme for the measurement of pollution together with the collection and analysis of the results will also be continued at Stevenage. A new and much required programme of research will be undertaken on the chemical reactions of pollutants in the atmosphere, and on dispersal and convective processes in the atmosphere.

An interesting feature of the report is the reference to the development of a small portable instrument,

which is intended to be used in place of the Ringelmann chart. Those familiar with the Ringelmann method will recognize that it has never proved to be a really satisfactory means of assessing smoke pollution. In principle, the new instrument consists of a small telescope containing a number of translucent screens, darkened to standard shades, with which the smoke can be compared. The instrument is held so that the screens are seen against the same background as the smoke. It is easy to read, and consistent observations are obtained by different observers.

Another problem which has been investigated is the emission of exhaust gases from motor-vehicles, a nuisance familiar alike to motorist and pedestrian. In this case the effectiveness of a catalytic combustion unit has been examined and found to reduce substantially the concentration of carbon monoxide in the exhaust gas. The life of the catalyst, however, as would be suspected, is a limiting factor of usefulness, signs of deterioration having been shown after 11,000 miles.

There is an impression on the lay mind, arising perhaps from the magic associated with the development of nuclear energy, that a new scientific sun has arisen which will put out the candle of coal. As yet it may be wishful thinking. Our coalfields are still of great importance to Great Britain, and this situation must yet remain for a long time. Accordingly, the reference in the report to the continuation

of work on the synthesis of oil from coal should be regarded as a timely reminder of the problems ahead. With the development of nuclear energy, the rapid spread both domestically and industrially in the use of oil, and the foreshadowed increase in the application of oil to the making of towns' gas, it is not possible to envisage a future surplus of low-grade coal of the kind now consumed by power stations. The total gasification of such coal into gaseous fuels suitable for distribution or for synthetic purposes is a matter to which serious attention should be given. It will need national support on a far more substantial scale than has been applied in the past. By this means alone can the sulphur problem in atmospheric pollution be solved. The reduction in the consumption of coal may before long become a major issue in fuel policy. We are approaching the situation in which we may see even remunerative collieries shut down, while at the same time attempting to sell exports in a highly competitive market in order to pay for imported fuels that have replaced the use of coal.

This statement may well be regarded as controversial, but to envisage the possibility is to take stock of the remedy. There is accordingly no less urgency in fuel research than there was when the Fuel Research Station at Greenwich was established in 1917, for as the field of activity has extended the problems have multiplied. In this way alone does technological advancement, so much needed in a modern world, take place.

R. J. SARJANT

THE METROPOLITAN WATER BOARD

REPORT FOR 1955-56

THE Metropolitan Water Board now distributes 322 million gallons of water daily, taking its raw supplies both from rivers and wells, treating them by a wide variety of processes and carrying out very extensive chemical, bacteriological and biological research to develop new methods of treatment and control and to maintain the safety and palatability of the finished product. The reports of the Director of Water Examination always contain a detailed and well-documented account of the quality control, and research, for which he is responsible. A large part of the bacteriological section of the present report* is concerned with the enumeration of bacteria, particularly of coliforms, by the method of multiple tubes and by membrane filtration. It has been shown that the membrane filtration technique is superior for the examination of some, but not all, types of water; it is, for example, now used as the standard method for the routine examination of all stored waters. It has been found that the membranes, which are somewhat expensive, can be re-used several times, and it seems possible that the method may eventually prove to be much cheaper in materials than the multiple tube technique previously employed. Another very useful piece of work described in this part of the report deals with the standardization and selection of bile salts and peptone—different samples of which differ considerably in their properties in the MacConkey test.

The biological section of the report is concerned mainly with the control of the growth of planktonic

* Metropolitan Water Board. Thirty-seventh Report on the Results of the Bacteriological, Chemical and Biological Examination of the London Waters for the years 1955-1956. By E. Windle Taylor. Pp. 112+7 plates. (London: Metropolitan Water Board, 1958.) 21s.

algae in reservoirs. A constant check is made of the numbers of these at different depths and of the concentration of nutrient substances in the water, and from this information the counter-measures to be used to prevent interference with the treatment plants are decided. It is sometimes possible to avoid trouble by altering the depth at which water is drawn from a reservoir; sometimes copper sulphate is added, though this always involves a considerable risk of failure and usually requires calm weather to be successful; and it is still necessary at times to take a reservoir out of service until an outburst of algae has died down. Hydrographic studies on the King George VI reservoir, together with experiments with models made in conjunction with the University of London, have suggested that the difficulties caused by thermal stratification, which limit the allowable depth, may not be so serious as had been thought and that it might be practicable and economic to induce vertical circulation of the water by pumping or by careful design of inlets. A differential temperature recorder for varying thermal stratification has been developed and has been tested in the field.

There is a further account of research on the sterilization of jute yarn, which is used for packing joints between pipes. It is now suggested that the yarn might be sterilized by the vapour of formaldehyde, being then treated with copper sulphate, iron alum, and sodium carbonate to prevent rotting.

A long section of the report deals with comparative tests with several large experimental plants (both upward-flow and horizontal-flow) on the clarification of water after coagulation with alum and activated