corrosion properties, will probably become a material of greater application in the future.

Copper wire is being coated by drawing it through a die, the entry side of which is flooded with molten tin. Provided that the wire surface is clean and freshly drawn, no flux is needed; uniform coatings about 40 micro-inches thick with reductions in wire diameter of 5–10 per cent have been obtained and drawing speeds are about 100 ft./min. The process is being patented.

A necessary preparation for steel sheet or strip before working or coating is 'pickling' by immersion in sulphuric acid, which has the effect of removing the surface oxide film. The severe shortage of sulphuric acid a few years ago, coupled with the problem of disposing of spent pickle liquor, led the Association to investigate the possibility of recovering acid from waste liquor. This is achieved by precipitating ferrous sulphate monohydrate from the liquor by evaporation, roasting the sulphate to sulphur dioxide, and oxidizing this to sulphuric acid in a contact plant using vanadium as catalyst.

Several difficulties were encountered. Research had first to be undertaken to determine the practical limits to the removal of ferrous sulphate from acid solutions. The solubility curves so produced were an original contribution to the literature since the published data had been found inconsistent. Then it became evident that the relatively small output of sulphate from pickling lines made it uneconomic to use the contact process for its conversion to sulphuric acid. The Laboratories therefore developed an alternative process of autoxidation.

In this method, sulphur dioxide is released from the ferrous sulphate by roasting with coal and is then dissolved in weak acid circulated through an absorber tower from an acid storage tank. The acid with sulphur dioxide in solution is then aerated by having small bubbles of air blown through it. This takes place in a diffusion tank and the oxidation of sulphur dioxide to sulphuric acid occurs at the bubble–liquor interfaces, catalysed by manganese sulphate which has been added. The liquor is thus enriched in acid, which is drawn off to storage tanks for supply to the pickle line. The iron oxide residue from roasting the sulphate can be used as blast-furnace feed.

Trials on a pilot plant indicated that the process becomes economic when 10 tons or more of acid are being handled. With acid strengths above about 23 per cent the catalyst needs to be kept active by injecting a little ozone with the diffuser air; acid strengths of up to 40 per cent can then be provided. A plant has been designed which could treat all the ferrous sulphate processed at the Trostre tinplate works of the Steel Company of Wales, Ltd., and this design is now being considered. A plant has been proposed, also, for a closed-cycle pickling system with acid recovery using this autoxidation process.

VACUUM DEPOSITION OF METALS

A MEETING organized by the Department of Physics of the University of Cambridge and the British Scientific Instrument Research Association was held in the Cavendish Laboratory on May 17 and 18 by invitation of Prof. N. F. Mott. Attendance was by invitation, and scientists were present from the Imperial College of Science and Technology, London, the University of Bristol, Tube Investments, Ltd., the University of Cambridge and the British Scientific Instrument Research Association.

In the first paper of the meeting, Dr. D. W. Pashley (Tube Investments) described recent experiments on the occurrence of epitaxy in deposits of copper, lead and thallium on crystalline substrates. Dr. Pashley's experiments showed that, while the nature of the initial deposit varied, according to the metal, from a uniform monolayer to a scattering of widely separated atom aggregates, the crystalline form was always that of the metal itself, undistorted by the supporting crystal, which, nevertheless, imposed a regularity of orientation. Later in the discussion, Dr. M. Blackman (Imperial College) examined the relation, for a wide range of materials, between epitaxy and the degree of misfit between the lattice structure of the film and its substrate, and showed that in contradiction to the theory of Frank and van der Merwe there appeared to be no critical degree of misfit above which orientation of the film could not occur. Following Dr. Pashley's paper, which also included a mention of a new technique for revealing dislocations by means of a moiré pattern, Dr. A. J. Forty (Tube Investments) gave evidence of the role of crystal boundaries as sites for nuclei from which the growth of films could start.

Dr. K. M. Greenland (British Scientific Instrument Research Association) described in general terms the work which is being done from the point of view of new and improved detecting elements, and explained that, in the first instance, the British Scientific Instrument Research Association is concerned with the binding forces between films and their substrates with special reference to gold and silver on glass and silica.

Dr. J. W. Mitchell (University of Bristol) described an investigation of the texture of copper films deposited by evaporation at very low pressures on glass held at the temperature of liquid nitrogen. The surface area of the film was measured by an adsorption method. In these experiments it was found that the porous structure of the film was independent of the thickness. As the temperature of the film was raised the structure became more compact, but the admittance of oxygen had a strong stabilizing effect.

Mr. D. G. Anderson and Mr. J. E. Knowles (both from the British Scientific Instrument Research Association) continued the account of work at the laboratories of the Association. Mr. Knowles gave a description of a method which was being investigated for the comparison of the energy released when gold films condense on substrates of differing kinds. This method might lead to a direct measurement of the energy of reaction between the gold film and the substrate. Mr. Anderson showed how chemical bonds might be formed between metal films and a silica or glass substrate and described some experiments designed to demonstrate the importance of oxygen in film bonding. Taking account of the ionic nature of the glass structure, the possibility of the existence of reactive ionic centres in a fractured glass surface was also considered. Prof. F. C. Frank (University of Bristol) summarized the Frank–van der Merwe theory of critical misfit in epitaxy and also discussed the stability of nuclei of cubic crystal forms.