The Structure of Metallic Coatings, Films and Surfaces.*

THE papers read at a symposium on this subject conducted by the Faraday Society and the discussions thereon appear in a special number of the *Transactions of the Faraday Society*. A number of well-known workers in this field have taken part and in all there are about thirty papers.

In Part I, Professor Finch and his collaborators have given a complete account of the study of surfaces by electron diffraction methods. Their paper surves as a valuable monograph for workers in this field. It is made quite clear that although there are still a few points to be cleared regarding the interpretation of experimental results, the method of electron-diffraction is probably the most powerful available for the study of surfaces. The evidence given by this method towards the clarification of the "vexed question" of the Beilby layer on polished surfaces is in favour of the existence of such a layer. In the general discussion on this problem Professor Kirchner makes the observation that diffuse bands of the type given by polished surfaces can also be obtained by reflection from suitably prepared, sputtered or evaporated films which however give sharply defined rings by transmission. But sputtered or evaporated films and the polished layer are two different things which are not directly comparable, and thus the evidence against the existence of the Beilby layer is not overwhelming. Hopkins finds that the Beilby layer is about 30 Å thick while Zees finds a layer of oriented crystals separating the Beilby layer from the polycrystalline layer underneath.

In the second part there is a very interesting paper by Professor Andrade, incorporating some remarkable results obtained by him recently. He has followed various stages in the growth of crystals in thin films of silver on heat treatment, by microscopic methods. Spherulites, *i.e.*, uniaxial crystal fibres radiating from a centre, are first formed on heating such films. These gradually grow into single crystals with their ||| planes parallel to the surface of deposition, on increasing the temperature. This observation is in agreement with the results obtained by previous workers by X-ray and electron-diffraction methods as to orientation of crystallites in metallic films on heat treatment.

The remaining papers deal with metallic coatings obtained by electro-deposition, hot dipping and spraying. Macnaughton and others present the results of a study of the hardness of electro-deposited nickel in relation to grain size, *p*H value of the electrolyte, etc. Blum and Kasper find that deposits obtained with nickel chloride solution are fine-grained and relatively smooth, strong, hard and brittle. Those obtained with sulphate baths are rough, coarse-grained, soft and ductile. Professor Kohlschütter's paper on "Somatoids" is valuable in understanding the formation of abnormal growths on the cathode during electro-deposition. Hothersall has studied the influence of the substrate on the structure of metallic coatings obtained by electro-deposition. Wood has made a thorough study of the differences between electrically-deposited metallic coatings and the normal metal by X-ray methods. He finds a broadening of the lines in the X-ray diffraction pattern of such deposits of nickel and chromium and points out a correspondence between this line broadening and the hardness of the deposit. He also finds that the brightness of the deposit was greater in the deposits showing more perfect orientation of the crystallites than in others.

The papers and the discussions which follow them provide a more or less complete survey of the subject. The discussions especially are highly stimulating and in them several interesting points are raised which may form subjects for further work. It is clear from a study of these that the method of electron-diffraction is invaluable for the examination of the structure of surface layers. But other methods involving the use of X-rays, optical properties of the surfaces and microscopic studies are also essential.

S. R.

* *Transactions of the Faraday Society*, 1935, **31**, Part 9*a*.

1705-35.—Printed at The Bangalore Press, Bangalore City, by T. Subramania Aiyar, Superintendent, and Published by B. N. Sastri, M.Sc., A.I.C., A.I.I.Sc., for the "Current Science" Board of Editors, Indian Institute of Science, Hebbal Post, Bangalore.