

is currently directing research under the supervision of Sir Eric Rideal.

Dr. Matalon began by discussing, with frequent blackboard illustrations, the techniques that he uses for the study of foams, bubbles and laminae. He went on to deal with the chemical and structural properties connected with foam formation and foam stability, referring to the phenomena of molecular orientation, packing of molecules and structure in the adsorbed phase. There is evidence of liquid crystal formation and of a highly organized state in the bubble walls. He spoke next of elasticity and plasticity in foams and bubbles. Of essential importance for the stability of foams are those factors which control the rate of drainage of the interlamellar liquid. To cosmetic chemists, whose work on bath fluids and shampoos brings them into close touch with problems of foam formation, Dr. Matalon's remarks on interlamellar drainage and stability were of special interest, as were also, in certain other respects, his comments on the physicochemical properties related to anti-foaming.

Much of the subsequent discussion was concerned, in fact, with the problem of selecting or devising anti-foaming agents for use with specific systems (for example, sodium oleate in saponin solutions), in cases where foaming or excessive foaming is regarded as undesirable. Defoamers, it was emphasized, are simply disorganizers of surface structure. Dr. R. H. Marriott referred to the defoaming action for sodium alkyl sulphate solutions of traces of sodium stearate; while, speaking more generally, Mr. Jack Pickthall spoke of the many cosmetic applications of a 15 per cent solution of wool wax fatty acids in mineral oil as a defoaming agent. Dr. Matalon concluded the discussion by affirming that specific defoamers can readily be devised, and that many suggested by him have already been proved highly successful when used in relatively minute proportions.

A further talk was given by Mr. A. L. Waddams, of Shell Chemicals, Ltd., who dealt principally and at some length with the practical relationship of foaming and foam stability tests to the actual detergent effect of surface-active solutions on soiled fabrics.

F. V. WELLS

FUNDAMENTAL ASPECTS OF LUBRICATION

THE subject of lubrication is one of interest to the physicist, chemist and engineer, as it involves a knowledge of the physical, chemical and mechanical properties of liquid films and metal surfaces. It is not surprising, therefore, that the topics discussed in the thirteen papers presented at the conference on "The Fundamental Aspects of Lubrication" held by the Section of Physics and Chemistry of the New York Academy of Sciences during March 3-4, 1950, and the text of which has recently been published (*Ann. New York Acad. Sci.*, 53, Art. 4, pp. 753-994, June 27, 1951; 4 dollars) cover a wide field. The conference was under the chairmanship of Dr. O. A. Beeck, of the Shell Development Co., and an outstanding figure in lubrication research, whose untimely death from a heart attack on July 5, 1950, is greatly to be deplored. It is fitting that the monograph covering the conference proceedings is dedicated

to his memory. In addition to a photograph of Dr. Beeck as frontispiece, Prof. H. Mark, of the Brooklyn Polytechnic Institute, contributes a brief obituary in which he refers to Dr. Beeck as an ingenious research worker, a stimulating lecturer and a creative writer.

In the first three papers, recent developments in full-fluid lubrication, fundamental mechanical aspects of thin-film lubrication and the influence of surface films on the function, adhesion and surface damage of solids are dealt with. J. T. Burwell, of the Massachusetts Institute of Technology, explains that full-fluid lubrication generally means the condition of operation of a bearing where the surfaces are completely separated by a bulk film of lubricant so that no solid contact takes place. Both hydrodynamic lubrication, where the surfaces have either tangential or normal relative motion, and hydrostatic lubrication, where the surfaces are relatively at rest, are included. Side leakage and film rupture in journal bearings, bearings under dynamic loading and the effects of laminar and turbulent lubricant flow are also considered; and as an illustration of the spectacular application of hydrostatic lubrication, Dr. Burwell refers to the Mt. Palomar 200-in. telescope, the total weight of which, one million pounds, is supported at three points by hydrostatic pads and for which a torque of only 50 ft.-lb. is required to enable the telescope to follow the stars.

Thin-film lubrication, discussed by H. Blok, of the Koninklijke/Shell Laboratory, Delft, lies between the two extremes of hydrodynamic lubrication and boundary lubrication. In the latter the load is fully borne by direct contact between the rubbing surfaces, and some aspects of this case, where the contact/load ratio is very high, are discussed in the third paper, by an acknowledged authority on this subject, Dr. F. P. Bowden, of the Department of Physical Chemistry, University of Cambridge. He reviews recent experimental investigations undertaken in his laboratory and discusses the bearing of the results obtained on the theory of friction.

Other papers in the monograph deal with X-ray and electron-diffraction studies of lubricating surfaces; surface chemical phenomena; physically and chemically adsorbed films in the lubrication of graphite sliding contacts; viscosity and molecular structure, in which the basic relations which exist between molecular structure, intermolecular forces and viscosity are developed in order to act as a guide for the preparation of synthetic lubricants; the measurement of the incremental friction coefficient of certain hydrocarbon compounds; the influence of roughness and oxidation on wear of lubricated metal surfaces; and the fine structure of lubricating greases. Two papers on the complex process of metal cutting are of considerable interest. The process involves two main problems—the plastic deformation and failure of metals, and the friction and wear of sliding surfaces; thus it provides a convenient means for the study of the frictional properties of metals in sliding contact.

In the concluding paper in the monograph the fundamentals of lubrication studied by the aid of large metal crystals are described by A. T. Gwathmey. The results of experiments to determine the action of gases and liquids on the single crystals, in the form of spheres and polished electrolytically, and the effect of static friction and wear between two base crystals of copper are discussed. The importance of the crystal face in lubrication chemistry and in friction and wear processes is clearly demonstrated.