

very recent years that asphalt technologists have really begun to understand that, not only does the size of the asphaltene micelle vary greatly, but also the chemical composition of this vital part of any bitumen varies, with consequent influence on the properties of the commercial material.

The author follows with an extensive chapter on rheology where, again, the importance of the asphaltenes is emphasized. Here, too, there is a clear plea for more fundamental thinking and for the use of more scientific test methods than are often utilized in the industry to-day. Other tests discussed in a further chapter include items such as specific heat and permeability to water vapour, which are often neglected.

Following chapters on the manufacture of asphalts and other bituminous 'specialities', the author passes to a consideration of the modern asphalt pavement. This section is, perhaps, not entirely comprehensive, and suffers from the fact that, quite naturally, it does not deal at all with many of the asphalt road surfacings that are commonly used in Britain. For this type of information the reader must turn to the more 'practical' books which are available.

The final chapter deals with the subject of durability. This is, of course, a matter of first importance, both to the practical asphalter and to the more scientific research worker, and the author again brings fresh thought to bear, incidentally once more introducing his basic concept of the influence of the carbon/hydrogen ratio. We are probably fortunate in Britain in having generally available to us bitumens of a high quality and good durability, but recent researches—for example, those at the Department of Scientific and Industrial Research Road Research Laboratory—have shown that durability in relation to the general success of an asphalt road in service is a complex matter which needs a great deal of further investigation.

Barth's new book may be said to consist largely of 'scissors and paste', but this should not be regarded as a serious criticism as it is indeed useful to have gathered together such a mass of information, much of which comes from sources not readily available other than by considerable library research. Barth's own views regarding the work of others are clearly brought out and the isolated researches are linked together in a useful manner. In all cases the necessary references are included for the benefit of those wishing to delve more deeply into any particular point.

To many, the main criticism of this book will be its high price. This will inevitably limit its sale in Britain, but those fortunate enough to have access to a copy will find it a useful reference book, particularly as a companion to the more practical volumes which are available in the field of bituminous road and building work.

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RHEOLOGY OF EMULSIONS

Rheology of Emulsions

Edited by P. Sherman. (Proceedings of a Symposium held by the British Society of Rheology at the St. George's Hotel, Harrogate, October 1962.) Pp. vii + 146. (London and New York: Pergamon Press, 1963.) 50s. net.

THE contents page of *Rheology of Emulsions* invites us to read ten papers on various aspects of emulsion behaviour, principally droplet flocculation, emulsification, stabilization, emulsifier behaviour, dielectric properties and viscosity/concentration relations. In fact, nine complete contributions are presented, one being only a brief abstract. It is to be regretted that the contribution not included, "The Behaviour of Deformable Drops in Laminar Shear Flow", was an important one. Presumably this will be published elsewhere, although no mention is made of this.

The papers, which are well presented, collectively form a useful contribution to a somewhat neglected field of rheology; a logical sequel, too, to a previous symposium of the British Society of Rheology on the "Rheology of Disperse Systems" (1959) which dealt with solid-in-liquid dispersions. A commendable variety of topics is covered, but there is, inevitably, some overlapping of material here and there. Each paper is well provided with references; with one exception, no author gives less than a dozen, useful, individual references. Clear graphical presentation of results is the common pattern.

Elements of well-known theories are combined to give support to experimental data in two interesting papers which examine induced or accelerated particle aggregation arising from simple shear flow. The effects of particle interaction on dispersion viscosity appear to be satisfactorily accounted for, if agglomeration of particles is considered to trap and immobilize continuous phase fluid; this leads to an apparent increase in the dispersed phase volume. The inherent polydispersity of most emulsions, however, limits their application to investigations of this phenomenon which is strongly dependent on globular size. Another paper tackles the difficult subject of emulsification and attempts to analyse the mechanics of the disruption of the interface between two immiscible fluids. While one can be sympathetic to the author's approach, unfortunately no direct evidence substantiates the proposed mechanism of jet formation and break-up. To enhance the tradition of the Netherlands school, there is an authoritative, though scarcely rheological, paper which, in an elaboration of certain aspects of the theory of colloidal stability, considers the free energy of charged interfaces. This will interest some rheologists.

In pharmaceuticals, gum acacia as an emulsifying agent for oil-in-water emulsions is well known, but the physico-chemical basis for the formation of its elastic interfacial films remains unexplained. It seems likely to be at least partly dependent on the chemical nature of the emulsified oil. A paper dealing with this substance contributes little to elucidating the manner of this film formation, but does demonstrate interesting viscosity changes in acacia-stabilized emulsions with time and oil globule size which can be related to alterations in acacia film thicknesses. Another contribution which takes a particular material as its subject is one concerned with the physical structure of ice-cream. From creep measurements at small deformations it is deduced that the structure is based on a network of fat droplets enveloped and joined together by denatured milk protein. The physical state of the protein structure is questioned, however, by a communicant in the general discussion.

An unusual topic for rheologists is to be found in a rather long paper, but this is not to its detriment, on the dielectric behaviour of emulsions both at rest and under shear. The results in good, clear graphical form show, not unexpectedly perhaps, the very different dielectric behaviour of oil-in-water compared with water-in-oil emulsions. The dielectric properties of the latter, but not the former, show marked changes with shear flow. Two articles consider the effects of the concentrations of the constituents on emulsion viscosity. In one, attention is mainly confined to the influence of emulsifier concentration in both oil-in-water and water-in-oil emulsions containing high volume concentrations of dispersed phase. The data are discussed at length. In a different vein, the other article shows how a largely empirical expression can be derived relating the effective viscosity and the dispersed phase volume concentration and at the same time allowing for temporary particle aggregation. This contribution draws a mathematician's interesting comments on other equations in the discussion.

Following the papers there is a general discussion of seven pages; rather more might have been expected. The book concludes with good author and subject indexes.

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