

properties offer a new range of display devices. The temperature-sensitive colours of some liquid-crystal phases offer a direct form of thermography. Lyotropic liquid crystals offer an understanding of the state of membranes in living systems as well as explaining the properties of commercial surfactants and foams. In short the subject has something to offer virtually everybody.

The pace and diversity of the subject makes frequent reappraisal desirable and the proceedings of the series of international meetings have provided a valuable and necessary record. This volume is amply fitted to stand beside its predecessors. It contains both state-of-the-art surveys and original research papers. There are papers dealing with almost every conceivable physical approach: hydrodynamics, light scattering, electrical, magnetic and electro-optical properties, phase-diagram investigations, thermodynamic properties, surface-tension measurement, circular dichroism and a variety of spectroscopic techniques. A single biological paper by Professor Ambrose of the Chester Beatty Research Institute on the organizational role of liquid crystals in living systems appears to point to an awakening of interest in liquid crystals in molecular biology also.

There are two classic papers of special interest to crystallographers. Both deal with thermotropic phases. The one by de Vries is very much the sort of paper one has come to expect from this author. It gives a survey of the contemporary structural knowledge of thermotropic phases, discusses the interrelations between different phase types and argues in favour of the scheme of nomenclature proposed by the author. The other paper by Vainshtein & Chistyakov is complementary in character. It relates the X-ray diffraction patterns of nematic and smectic phases to the statistical distribution functions describing the molecular arrangement. The relevant calculations are described and the concepts are elegantly illustrated by a series of optical diffraction patterns. It is a pity that an account of the third X-ray paper presented at the conference did not materialize in this volume. In dealing with the lyotropic phases it would have completed the structural survey of mesophase types.

The book is well presented and adequately illustrated with black and white photographs and line drawings. Although the 570 pages of the volume make it appear of daunting size, the individual papers are all concise and readable, and the uniformity of style in the presentation makes one suspect a good deal of effort has been expended by the editor to achieve this.

This is an interesting and useful reference volume. It is available at reasonable cost and can be warmly recommended both to those with an interest in liquid crystals and those on the periphery of the subject.

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**NMR basic principles and progress. Vol. 9. Lyotropic liquid crystals.** By C. L. KHETRAPAL, A. C. KUNWAR, A. S. TRACEY and P. DIEHL. Pp. 11+85, Figs. 18, Tables 5. Springer-Verlag, 1975. Price \$15.60.

In this short monograph the authors give a concise yet comprehensible survey of the literature on NMR studies of

lyotropic liquid crystals up to 1974. Following a short introduction, the review is divided into two sections: the first describes investigations of the structures of the mesophases themselves, while the second is concerned with studies of the geometry of molecular and ionic species dissolved in the so-called 'nematic' mesophases which may be macroscopically orientated in magnetic fields to provide an ordering matrix for the solute. This latter subject reflects the research interests of the authors and will be of little interest to those concerned with the properties of liquid crystals as discussed in the first section. Each section is appended with a useful, referenced table of the systems reported.

The book should be particularly useful as a source of references for NMR spectroscopists working in either of the fields described, but has little to offer the general reader with an interest in liquid crystals.

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**Advances in liquid crystals. Vol. 1.** Edited by GLEN H. BROWN. Pp. xi + 320, Figs. 243, Tables 19. Academic Press, 1975. Price \$31.50.

We are at present witnessing an intensive, multidisciplinary attack on the properties of liquid crystals, albeit their discovery by Reinitzer and Lehmann dates back to 1888. The combination of molecular order and fluidity confer on these materials fascinating properties which find a diversity of applications ranging from their use in electro-optic devices to their role in the lipid membranes of biological structures. The introduction of this new series is therefore timely and will be welcomed by research workers in the field.

There are five chapters in this first volume; all authoritatively written and beautifully illustrated. The first, by Per Ekwall, is by far the most substantial (142 pages, 140 figs., 7 tables, 134 references); it is an exhaustive review of the composition, properties and structures of aqueous lyotropic liquid crystalline phases formed by amphiphilic compounds. The collection of phase equilibrium diagrams for binary and ternary systems will be particularly useful to workers in this field. In Chap. 2 (23 pages, 14 figs., 2 tables, 65 references), Christyakov describes the structure of thermotropic liquid crystals as derived from X-ray diffraction studies. Next Skoulios gives an intelligible account (19 pages, 14 figs., 53 references) of how block copolymers may form mesomorphic phases with structures similar to those exhibited by soap-water mixtures. Smith, in Chap. 4 (77 pages, 37 figs., 9 tables, 320 references) discusses the complementary nature of the disorder in plastic and liquid crystals and their significance for the melting of molecular crystals; this article should interest the general reader. In the final chapter (44 pages, 38 figs., 1 table, 45 references), Kleman gives a lucid account of the structural defects encountered in liquid crystals.

These articles are written for the specialist and as they cover a diverse range of topics it is doubtful if they would all interest a single reader. The series is, therefore, more likely

to be purchased by libraries than to find its way to the bookshelves of the individual, particularly at the price of \$31.50.

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**Applications of liquid crystals.** By G. MEIER, E. SACMANN and J. G. GRABMEIER. Pp. iii + 164. Springer-Verlag, 1975. Price \$23.00.

A review of this book by J. E. Lydon has been published in the October issue of *Journal of Applied Crystallography*, page 418.

**Количественный рентгенографический фазовый анализ.** By Л. С. Зевин and Л. Л. Завьялова (**Quantitative X-ray phase analysis.** By L. S. Zevin and L. L. Zavyalova). Pp. 184, Figs. 53, Tables 26+7 (in appendices). Moscow: Nedra, 1974. Price Rb 0-62.

A review of this book by K. Łukaszewicz has been published in the December issue of *Journal of Applied Crystallography*, page 513.

**Technische Mineralogie. Bd. 8. Auflösung von Kristallen.** By R. B. HEIMANN. Pp. viii + 270. Springer-Verlag, 1975. Price DM 115.00.

The subjects of crystal habit, solution and etching with which this text deals have a history from the early days of crystallography (one reference is to 1820) up to the present-day development and application of dislocation theory and chemical kinetics.

The first and longest section of this book is devoted to 'micromorphology', *i.e.* the systematic study of the form, stability and kinematics of surface etching. It begins with a survey of theoretical approaches to these topics, leading on to illustrative examples in which the structural and chemical aspects play their role in detail. Due weight is given to the symmetry of etch pits and their relation to crystal symmetry groups. In Chap. 6 there is a brief account of techniques of etching and chemical polishing and of various procedures for observing and recording the results. There is also reference to 'hypomorphy' and other steric effects. The second section, on 'macromorphology', deals principally with the kinematics of solution of spheres and hemispherical holes, with appropriate examples.

From the wide literature available it can be claimed that this text is a selection well chosen to illuminate the whole field in a reasonable compass without neglecting the 'applied' aspect. The introductions to various theoretical facets are, by reason of brevity, somewhat demanding and presuppose in particular a good knowledge of classical crystallography – a demand somewhat lightened by adequate literature references. This would apply to such topics as the Gross

kinematic theory, the Gibbs–Wulff and Herring theories and the Frank topographic theory. The standards of presentation and printing, apart from a few misprints, mostly of minor importance, are generally high. The generous provision of diagrams and plates is a most acceptable feature. It is a book to arouse as well as satisfy the reader's interest.

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**Electronic structure of polymers and molecular crystals.** Edited by JEAN-MARIE ANDRE and JANOS LADIK. Pp. 704. New York and London: Plenum. Price \$67.20.

This rather formidable work is an edited volume in the NATO Advanced Study Institute Series, and contains the main lectures read at a course held in the University of Namur from September 1st to 14th 1974. At the present time there is a great experimental effort in progress in the optical and conductivity properties of molecular crystals, and future practical applications, if they are to come, will eventually involve polymers, if only to secure adequate mechanical properties for material to be used in electronic devices. So there is a great need to develop the theory of electronic behaviour of  $\pi$ -electron molecular crystals at the present time. The same may be said for polymers, although the efforts here may still be a little premature.

The first three lectures, by J.-M. Andre, J. Ladik and J. Delhalle (of Namur) outline successively *ab initio* and semi-empirical band structure calculations in polymers, LCAO band structure calculations, and some numerical applications of the foregoing to one-dimensional chains. In the fourth lecture G. D. Mahan (Indiana) discusses methods of interpreting, and theoretically calculating, the optical properties of molecular crystals. This author concludes that a high-density, close packing of polarizable substituents is absolutely essential to attain high-temperature superconductivity [since these lectures were given the first polymeric superconductor (SN)<sub>x</sub> has been discovered, with a critical temperature of 0.26 K]. W. L. McCubbin (E. Anglia) deals with the symmetry properties of polymers and their influence on calculated band structure, E. Atkins (Bristol) discusses the X-ray structure determination of polymers, and Ph. Coppens (Buffalo) deals with experimental charge densities (from X-ray crystallography) and their use in testing theoretical band structure calculations. D. T. Clark (Durham) in 130 pages gives an exhaustive account of ESCA as applied to polymers. J.-L. Calais (Uppsala) surveys the various efforts to deal with electron correlation in polymers and molecular crystals, F. C. Collins (Ohio) deals with *ab initio* SCF–LCAO Hartree–Fock calculations, and F. E. Harris (Utah) and D. P. Santry (Hamilton, Ontario) continue with reviews of their own contributions. R. Rein (Buffalo) discusses methods for calculating intermolecular interactions between biopolymer units leading on to M. Simonetta's (Milan) discussion of the conformation of constituents in molecular crystals. F. Herman (IBM San Jose) with K. H. Johnson and R. Kjellander outline applications