

steel isothermally at a series of temperatures." One of the illustrations in the chapter on joining consists of a variety of screw heads!

Several features of the book, especially the very extensive lists of standard specifications and numerous tables of numerical values of properties, betray a measure of confusion between the roles of a textbook and a handbook (such as the *Metals Reference Book*). 100 pages are devoted to elementary school mechanics, which have no place in a book of this kind, supposedly directed at professional engineers-to-be. According to the preface, the book is in fact directed not only at these but also at technicians taking pre-degree courses. But these, also, need and deserve un-

derstanding, not just a diet of undigested and sometimes erroneous fact.

Ray also has the peculiar habit of providing a list of keywords for each chapter, apparently in the hope that the reader can check for himself whether he has learned key concepts. In a chapter on engineering design, the list of keywords includes, inter alia, "perseverance, willpower, scientific knowledge, conceptual ability". The author has demonstrated the first two but not, alas, the last two.

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Liquid Crystals

Thermotropic Liquid Crystals. Edited by G. W. Gray. Wiley, New York 1987. 178 pp., £ 38.00.—ISBN 0-471-91504-1

As long ago as 1962, G. W. Gray published the book "Molecular Structure and the Properties of Liquid Crystals", which was a classic for a long time. Display technology has stimulated the synthesis of thousands of new liquid crystal compounds; many of the technologically relevant ones come from Gray's laboratory. Usually, a purely physical approach is chosen for the presentation of the field of thermotropic and lyotropic liquid crystals. This is convenient because it is necessary to describe precisely the properties of anisotropic fluid systems. Furthermore, a great variety of physical measurement techniques directly related to technological applications has to be mastered. Chemists, however, will be more familiar with the approach chosen in this book that has been edited by G. W. Gray; it contains six articles written by different authors.

The wealth of mesomorphic phases in organic compounds, and in particular the recently discovered phases, require a refinement of the classification scheme. This is outlined by A. J. Leadbetter (27 pages) with special regard to structural analysis by X-ray and neutron diffraction. The phases are characterized essentially by positional order, orientational order, and molecular orientation. This makes it possible to distinguish between different smectic phases and, more generally, between a liquid crystal and a true (though disordered) crystal; such a clear cut distinction has not always been made in the literature. Discotic phases are briefly mentioned. They are not formed exclusively by aromatic compounds, as is erroneously stated.

K. Toyne (36 pages) presents a detailed discussion of the influence of individual structural elements of the rigid backbone and the terminal or lateral substituents on transition temperatures, especially for the nematic to isotropic phase transition. The correlation of this temperature with the length/breadth ratio and the packing density is outlined. The influence of the chemical structure of a compound on

properties relevant for technological applications is only briefly mentioned. However, I. Sage (35 pages) describes the known correlations with optical and dielectric anisotropy, elastic constants and viscosity. The structures and modes of operation of the most important types of displays employing nematic phases are also discussed.

The requirements for compounds and mixtures with smectic A and C phases are considered by D. Coates (21 pages). In this chapter the reader is familiarized with displays that make use of these smectic phases. D. G. McDonnell (25 pages) gives a survey on the current state of development of thermochromic cholesteric liquid crystals. He outlines clearly the influence of different parameters on the selective reflection of light. The description of the influence of chemical structure on the optical rotatory power and the sign of rotation of the helix characteristic for the cholesteric phase is particularly interesting to read. H. Finkelmann (26 pages) gives a good overview of the synthesis, the phase behavior (as influenced by the molecular structure), and the properties and applications of liquid crystalline linear and branched polymers. This contribution contains many details that are important for a deeper understanding.

All the articles are written with great care, and focus on the essentials of this rapidly progressing field. An extensive up to date reference list is also provided. Thermotropic liquid crystals are discussed with particular regard to their application potential in display technology. For this reason the book treats almost exclusively calamitic, as opposed to discotic or other recently discovered molecular assemblies of fluid systems. The figures, chemical formulas, tables and physical equations are well selected and useful. The book can be recommended as a reference work to chemists active in the field, as well as to physicists having a basic knowledge of chemistry. It will also be valuable for newcomers.

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