thermal decomposition of hydrocarbons in the presence of metallic catalysts, the so-called CCVD (catalytic chemical vapor-deposited) filaments.

In the chapter "Structure" a basis is laid down for all the discussions that follow concerning the properties of the fibers. Starting from the crystal structure of graphite and the structural defects that are observed, the different types of filaments with partially graphitic structure are described, as well as highly disordered fibers. The picture thus developed is supported by results from X-ray diffraction, small angle scattering and electron microscopy.

The chapter "Lattice Properties" begins with a description of the lattice dynamics of single crystal graphite and the related elastic constants, and goes on to develop models for the fibers, taking into account the effects of defects. Techniques for structural characterization are described, in particular Raman spectroscopy which provides a sensitive method for non-destructive analysis of the spatial distribution of lattice disorder in carbon fibers.

After the preparatory treatment of fundamentals, the central theme of the book is reached, namely the thermal, mechanical, electronic, magnetic and high-temperature properties of carbon fibers (138 pp.). The anomalous temperature dependence of the in-plane lattice constants and the corresponding temperature dependence of the thermal expansion coefficient are taken as a basis for understanding the experimental behavior of fibers from different sources. The mechanical properties are of crucial importance for technological applications. Although the theoretical tensile strength and elastic modulus of an ideal graphite lattice are not fully realized in practice, the strength-to-mass ratios of fibers and fiber-resin composites are superior to those of metals. The degree of orientation, nature of defects, stacking arrangement of the fibrils, and uniformity of stress within the fiber influence the models and are shown to determine the experimental properties of the technical fibers.

The high degree of ordering in CCVD fibers ensures that, in every chapter of the book, this type is given preferential treatment compared with the fibers based on pitch and polyacrylonitrile which are currently used in engineering applications. The authors expect the production costs of vapor-grown fibers to fall to comparable levels in the future, with market penetration into all areas of application where the short fiber length is adequate.

Special chapters are devoted to intercalation and ion implantation. The intercalation reaction starts at the free ends of the fibers and is facilitated by a high degree of structural order, so here again vapor-grown fibers dominate the discussion. The applications of fibers and composites receive only a condensed treatment in the last chapter (35 pp.).

Of the 500 literature references listed, a large proportion are for the years 1984 to 1987. The detailed subject index (22 pp.) greatly facilitates using the book as a work of reference. However, it would have been desirable to include a summary of the numerical properties of fibers and filaments made by different processes and after-treatments in the form of an appendix table. This well produced book can be recommended without reservation, and has the potential to become a standard work on the physical properties of carbon fibers, especially if the authors are also prepared to take on the job of updating the treatment in the future.

Ferdinand von Sturm
Biberbach (FRG)

Thin Liquid Films. Edited by *I. B. Ivanov*. Marcel Dekker Inc, New York 1988. 1160 pp., bound, US $ 295.— ISBN 0-8247-7763-8

The editor has undertaken the tremendous task of bringing together 23 leading experts in the field of liquid films, to contribute to this volume which is intended to cover comprehensively and systematically the major aspects of this rapidly developing field.

Thin liquid films are very important in many technological and biological areas such as oil recovery, coating, the etching or protection of microelectronic elements and cell communication in biology, but these subjects are not covered by this book. Instead it considers basic principles and processes, and there is definitely a need for a well-founded collection and critical evaluation of the status of research in this fundamental area.

The book is organized into 15 chapters with the first six arranged in a logical way whereas the others are important but could partly be presented in a different order. At the beginning there are two chapters on thermodynamics followed by one on the statistical mechanics of inhomogeneous films. Then van der Waals interactions, electrostatic interactions and steric interactions are analyzed and described in consecutive chapters. Very important for the theoretical understanding are the problems of drainage and hydrodynamic stability and this is presumably the reason why these specialized areas are presented following the fundamental theory.

Then a separate chapter is devoted to quasielastic light scattering from liquid films, because this technique shows great promise in the study of dynamic properties. The coalescence of dispersions is then considered theoretically for various practical situations and the results are compared extensively with experimental data. The same holds for the chapter on equilibrium properties of free films and the stability of foams and emulsions. The section on interfacial rheological properties of surfactant films then presents experimental data and briefly relates them with theoretical models.

The next chapter then considers ordering processes and forces in liquid crystalline films, comparing theory and experiment. A long chapter on black lipid membranes then mostly concentrates on electrochemical and photochemical studies displaying relevant theories and drawing many conclusions about biological processes (bioenergetics and physiology). In the final chapter the electrical breakdown of bilayer lipid membranes is analyzed theoretically. This process

has been of high theoretical interest for years but is also of biological relevance for processes like cell fusion.

The editor has managed to smoothly connect these chapters avoiding much duplication of information from the different contributors. The contributions are very thoroughly written and edited, and the illustrations are well conceived. The book contains numerous important references which are complete up to about 1984 but are fewer in number for the following years, depending on the subject and on the insight of the corresponding authors into recent literature.

The book is highly recommended for those scientists looking for a detailed, in depth treatment and understanding of the principal mechanisms since theoretical questions are discussed exhaustively. It contains extended and critical reviews of specialized topics and is thus very valuable. However, I do not think that the book will find a broad readership, despite the fact that the field is expanding: It contains more than 1100 pages and is too demanding for the student or non-expert. Thus, I am afraid it will not contribute as much as intended to a cross-disciplinary discussion.

In criticizing the large volume of the book it is very daring to list subjects which I had wished to be included. However, since in my view progress in the field has to a large extend been due to the availability of new characterization techniques there should have been one contribution on these new methods. Examples of these techniques are evanescent wave techniques applied in optical and Raman spectroscopy or in X-ray and neutron scattering, and nonlinear optical techniques and IR spectroscopy which are useful in the study of the structure of liquid films. Various classical techniques like optical microscopy have gained new importance through developments of affordable image analysis systems. There are also several groups involved in computer simulations of the behavior of surfactants at interfaces and these studies, started in the last decade, will gain considerable value in the near future. These things are unfortunately not mentioned in the book. Despite these deficiencies, this is a very important work for those wanting to specialize in some aspects and for those that need an in depth coverage of thin films but I am skeptical, despite personal wishes, that it will find a broad readership.

Helmuth Möhwald
Institut für Physikalische Chemie
der Universität Mainz (FRG)

Inorganic and Organometallic Polymers (ACS Symposium Series 360). Edited by *M. Zeldin, K. J. Wynne* and *H. R. Allcock*. American Chemical Society, Washington 1988. xii, 512 pp., bound, US $ 119.95.—ISBN 0-8412-1442-5

This book reviews the field of inorganic-organic polymers—polysilanes, polysilazanes, polysiloxanes, polyphosphazene, boron-containing polymers and other related polymers—both from a fundamental point of view and with regard to their uses in advanced materials (if such a distinction is still necessary). Such a book was needed since this field is in rapid development. The origin of the book was a symposium held on this topic in Denver in April 1987, which accounts for the very large number of authors involved. A serious effort seems to have been made to avoid the inconsistancies and overlapping inherent in this type of publication. The scientific content is of high quality throughout the book, the presentation is well harmonized, and the indexes (authors, affiliation, subject) are useful guidelines for finding the topics of interest. Only a few typographical errors have been noticed. The drawings are of good quality and accompanied by explicit captions. The book is divided into seven sections, with special emphasis on the chemistry of polysilanes.

A brief preface and an introduction are given before the various fields are reviewed. The part devoted to polysilanes and polycarbosilanes constitutes one fourth of the book. It is justified by the high level of activity on this topic. The historical parts of most chapters overlap each other and, more than once, the chemical pathways shown and the types of synthesis described are repeated. Apart from these minor points, this section is well documented and presented and very informative. It should be read by anyone who intends to begin work in this area. It is also very useful for the specialist who wants to find fairly recent references in this burgeoning field. *F. S. Kipping* is usefully cited as the grandfather of this organosilicon chemistry. This was necessary since many other pioneers in other disciplines have been forgotten. All aspects of the polysilane field are treated: synthesis, characterization, spectroscopic data (absorption and fluorescence) structures, computational information, new synthetic routes, kinetic experiments and mechanisms.

The second section is related to polysilazanes and also suffers from the overlapping of certain chapters. However, as previously, the quality of each section more than compensates for this minor inconvenience. This part is of appropriate length (40 pages) for as are all the other sections of this book.

The chapter treating polysiloxanes is more conventional, since this field is well documented and most readers are familiar with the chemistry of the siloxane group, the various derivatives which can be formed, and the expected properties of the materials. The amphipathic nature of the polysiloxane derivatives is usefully recalled and related to some specific properties: biocompability, resistance to atomic oxygen, adhesiveness, etc. The chapter devoted to molecular metals is not altogether consistent with the previous sections, and relevant pioneering work is not mentioned. The brief section concerned with chemical routes which avoid the use of elemental silicon for making alkyl silicates would have been better inserted into another chapter.

The section on polyphosphazene is written by leading experts in the field, as are most of the other sections. All the latest developments in this now firmly established field are covered.

The use of sol-gel processes for making materials is usefully treated, with special emphasis on SiO_2 and TiO_2 based