
BOOK REVIEWS

Annual Review of Physical Chemistry, Vol. 38, 1987, pp. 621, (eds) H. L. Strauss, G. T. Babcock and C. B. Moore, (Published by Annual Reviews Inc., 4139, El Camino Way, Palo Alto, California 94303, USA), Price: USA and Canada \$ 32; Elsewhere \$ 35.

As in previous years, the 38th volume of *Annual Review of Physical Chemistry* contains a large number of articles, 21 in all, on various aspects of physical chemistry/chemical physics. The areas covered in this volume undoubtedly reflect the enormous breadth of physical chemistry. In the following, we briefly review some of the articles published in this volume.

The first article is traditionally written by an established scientist, summarizing his life-long association with physical chemistry. This year's first article is written by Professor K. S. Pitzer (University of California, Berkeley) who is well-known for his pioneering work on thermodynamics, spectroscopy, liquids and solid state chemistry. The article presents an overview of his scientific career spanning over the last fifty years, during which he held many important academic and non-academic positions, received many prestigious awards and continued his excellent scientific work. This article makes an interesting reading especially to those who are familiar with Prof. Pitzer's work.

The second article by G. Herzberg on Rydberg molecules which are named after the Swedish Physicist who established that most excited states of atoms can be understood in much the same way as the excited states of the H atom in the old Bohr theory. A molecule is called a Rydberg molecule when the excited states, which give rise to delayed fluorescence, are not "valence" states but are all Rydberg of states. Herzberg presents a detailed review of the diatomic and polyatomic Rydberg molecules of their spectroscopic properties and also of the related molecular constants. This review contains much quantitative information and is expected to serve as a valuable reference for future studies.

The third article of the volume on high resolution electron microscopy by J. M. Cowley is a thorough and exhaustive article covering many aspects of this important technique. It contains a good review of the instrumentation and theoretical basis of the technique. The article reviews advances in crystal structure imaging, radiation effects and beam-

induced reactions and recent results on surface structure and reactions.

There are three articles on photochemical reactions. The article by J. Schroeder and J. Troe is on the elementary reactions in the gas-liquid range. This subject has drawn considerable attention in recent years because the critical tests of the stochastic theories of chemical reactions can be carried out by studying reactions in the gas-liquid range, especially the so-called Kramers' turnover may be observed. The article presents results of recent experiments in the gas-liquid transition range that seem to confirm the turnover behaviour. Another important conclusion is that the main effect in the transition region is that of the viscosity of the medium; other features of the transition do not affect the rate of the reaction. This is an interesting article and is recommended to students of reaction dynamics. The second article on photochemical reactions by Kevin Peters primarily deal with picosecond organic photochemical reactions in solution. A detailed review of recent literature on solvent effects in organic photochemical reactions and on crossings of electronic potential surfaces are given. The dramatic effect of a polar solvent on a photochemical reaction involving a polar excited state is clearly discussed. In the third article on photochemical reactions, J. Kommandeur, W. A. Majewski, W. L. Meerts and D. W. Pratt review recent studies of radiationless transitions in the molecule pyrazine. As the authors have pointed out, pyrazine played a very special role in elucidating many salient features of radiationless transitions, such as, the role of rotational degrees of freedom in radiationless electronic relaxation. This article also contains review of experiments carried out both in the time domain and in frequency domain. It also contains a good discussion on the intramolecular dynamics of pyrazine molecule.

There are four articles on subjects related to biophysical chemistry and this indicates the increasing importance of this field. In an interesting article on membrane and vesicle fusion, J. H. Prestegard and M. P. O'Brien discuss the involvement of membrane fusion in cellular function. Several fusion systems including anionic lipids, nonbilayer phase lipids and exogenous fusogens have been discussed. A readable discussion on fusion mechanisms is also given. J. M. Sturtevant reviewed biochemical applications of differential scanning calorimetry (DSC). The use of DSC in macromolecular and polymolecular struc-

tures is discussed. The article reviews instrumentation, theoretical aspects of DSC and numerical treatment of DSC data. Applications of DSC to thermal denaturation of proteins, conformational transitions in nucleotides and phase transitions in phospholipids are attractively discussed. T. M. Jovin, D. M. Soumpasis and L. P. McIntosh have reviewed the transition between B-DNA and Z-DNA. The physical properties of Z-DNA are discussed. Different aspects of the B-Z transition, such as the transition pathways, energetics and theory and kinetics are discussed. Budil *et al* have discussed the art of three-dimensional X-ray crystallography of membrane proteins, especially how this technique provides insights into the mechanism of electron transfer reactions in biological systems.

There are two articles on phase transitions. A. D. J. Haymet has presented a review of the equilibrium theory of liquid-solid phase transitions. This subject has drawn considerable attention in recent years following the density functional formulation of the freezing transition by Ramakrishnan and Yusouff. The review of Haymet clearly brings out the considerable advances that have been made in understanding this important transition. G. D. Patterson and A. Munoz-Rojas have reviewed dynamic light scattering as a tool to understand dynamics of glass transition. The dynamic light scattering experiments provide useful insight into density-density fluctuations in dense liquids near glass transition and also on orientational fluctuations which are claimed to be important for glass transition in several microscopic theories. Patterson and Munoz-Rojas provide a brief but clear discussion on the theory of dynamic light scattering and a good comparison of the theory with the available experimental results.

There are several other interesting articles that need to be mentioned. The article by Doll and Voter briefly discusses the recent advances in the theory of surface diffusion and compares them with the available experimental results. Peter Kollman discussed role of molecular model building in understanding various problems of physical chemistry. This article is a bit vague. F. Rondelez, D. Ausserre and H. Hervet review experimental studies of polymer concentration profiles at solid-liquid and gas-liquid interfaces by optical and X-ray evanescent techniques. This subject is of considerable interest in polymer science and the review is informative. Baldridge *et al* review recent theoretical studies of silicon chemistry with special emphasis on reaction surfaces. J. W. Nibler and J. J. Yang

present a detailed review of recent advances in non-linear Raman spectroscopy of gases.

In summary, the 38th volume of *Annual Review of Physical Chemistry* contains quite a large number of good review articles and will be a very useful addition to any research library on chemical and physical sciences.

BIMAN BAGCHI

Solid State and Structural
Chemistry Unit,
Indian Institute of Science,
Bangalore 560 012.

Annual Review of Nuclear and Particle Science, Vol. 37, 1987, (ed.) J. D. Jackson, (Published by Annual Reviews Inc., 4139 Camino Way, Palo Alto, California 94306, USA), pp. 576, Price: USA \$ 34, Elsewhere \$ 37.

The present volume (Vol. 37) of *Annual Review of Nuclear and Particle Science* continues the tradition of earlier volumes, and includes several interesting and informative reviews covering the frontline areas of nuclear physics, particle physics and advanced physics instrumentation. The scope of nuclear physics research has broadened considerably in recent years, encompassing more and more of what might have traditionally belonged to the realm of particle physics. This blending of the fields is much in evidence in the topics reviewed in the present volume.

In recent years, there has been considerable interest in the measurements of heavy ion fusion cross-sections and the developments in the recoil mass spectrometers have contributed greatly to the progress made in these studies. Recoil mass spectrometers play a unique role in the detection and identification of the low energy reaction products in the medium energy heavy ion reactions while preserving the time correlation between the detected reaction product and the associated radiations from the reaction. The design and performance features of some of the spectrometers now operated in different heavy ion laboratories and the typical applications of these in various areas of low energy physics are reviewed in the article by Cormier. Another article of interest to those working in the field of low energy nuclear physics is on nuclear magnetic dipole excitations where experiments with real photons are emphasized. Extensive studies of spin vibrations of nuclei through charge

exchange reactions, inelastic proton and electron scattering, and nuclear resonance fluorescence experiments have been reported recently. New developments in investigations of the spin-flip and orbital M1-resonance with the help of electromagnetic interaction is reviewed by Berg and Kneissel.

Pion production in heavy ion collisions and pion-nucleus interaction form the subject-matter of two separate reviews. The cross-sections for the production of pions in nucleus-nucleus collisions are observed to be much larger than those expected in terms of thermal models or models involving independent nucleon-nucleon collisions, suggesting a coherent mechanism of pion production. The present experimental and theoretical status of this subject has been reviewed.

Traditional nuclear models attempt to explain nuclear structure in the framework of nucleonic degree of freedom only. The limitations of this framework have been carefully mapped by deep inelastic scattering experiments using electrons and μ -mesons, in the last few years. The interpretation of electron scattering data in 2- and 3-body systems requires the explicit treatment of non-nucleonic degrees of freedom, while confirming basic nuclear shell models. The original EMC effect stimulated broad interest in q and \bar{q} distributions in nuclei and led to many international collaborations. Results of some of these studies are reviewed in two separate articles. QCD has been accepted as the correct theory of strong interactions. However, quantitative calculations rely rather heavily on the so-called perturbative methods and important gaps exist. Heavy quark spectroscopy like many of the well-known two-body systems, promises to be a rich source of information on the underlying interaction. The present status of important QCD results and the theoretical and the experimental aspects of heavy quark systems are reviewed extensively in two separate articles. Fragmentation is a process universally present in all high energy nuclear collisions. While considerable effort, both experimental and theoretical, has been made in the past few years towards an understanding of the process, the multiplicity of models, all claiming impressive success at reproducing simple observables such as the mass and charge multiplicities of intermediate mass fragments, clearly indicate the need for more discriminating experiments and theories. While the present status of fragmentation models is reviewed in two articles, a third describes an important cosmic ray collaborative experiment aimed at studying very high energy nucleus-nucleus collisions.

It is conjectured that at the extremely high energy density and temperature expected in ultra-relativistic nucleus-nucleus collisions, the nuclear matter may undergo phase transformation to the state of quark-gluon plasma. A major experimental effort is at present underway to look for signals of such phase transformation. The article in this volume which is devoted to the subject of probes of the quark-gluon plasma in high energy collisions is therefore of much contemporary interest. Advances in accelerator physics have always held a key to the important discoveries in particle physics. Advanced accelerator concepts and their applications to high energy physics, in particular to electron-positron linear colliders, is another topic of review in the volume. This article which discusses the new accelerator concepts in near field, wakefield, switched power, plasma accelerators and collective implosion accelerators, should be quite useful in the transformation of these concepts into the connected work of prototype design and engineering.

The appetite of experimental high energy physics for computing power is well-known, both for purposes of on-line monitoring and trigger selection and off-line reconstruction and analysis. While the recent developments in computer technology—both hardware and software—have contributed to this need in a big way, those developments have not always reflected the special needs of the high energy community. This has resulted in the community breaking its own path in this area, by way of development of multiprocessor systems, parallel processing systems, etc, specially suited to their needs. A very informative and interesting summary of these developments on the use of new computer technologies in elementary particle physics is given in the article by Gaines and Nash.

Another article describes how computers are finding interesting applications in simulating nuclear dynamics during medium energy nucleus-nucleus collisions. With the easy accessibility of super computers and also dedicated small scale powerful processors to an increasing number of researchers for simulation work, studies involving computer simulation of nuclear dynamics are expected to further grow in the coming years and this article should be of much interest to all the researchers engaged in these studies.

Application of nuclear techniques has also been given its rightful place in the volume by the inclusion of a review on sub-surface geology using nuclear techniques.

This volume of the *Annual Review of Nuclear and*

Particle Science will be a welcome addition to any library catering to the researchers in nuclear and particle physics.

S. S. KAPOOR

Physics Group,
Bhabha Atomic Research Centre,
Bombay 400 085.

Tomorrow's Materials by Ken Easterling, (Published by the Institute of Metals, Carlton House Terrace, London SW1Y 5DB), 1988, pp. 109.

The book attempts to introduce recent developments in materials science for beginners who intend to take up uncommonly trodden disciplines and for those working on materials and are desirous of an overview of the recent advances in and potentials offered by new materials. It is not a conventional text-book incorporating basic concepts and worked-out problems nor is it comprehensive in covering all aspects of the subject. Rather this small volume may better fit into the description of a popularistic approach to materials science, aiming to draw the reader's attention to rapidly developing topics and leaving him to search for more details elsewhere. The text is perhaps enjoyable to those with some knowledge of the basic principles. The first part of the book deals with the fundamentals in a general way and attempts to classify the various types of materials into four groups: crystalline amorphous, composite and cellular. The second part describes the applications of a selected number of advanced materials.

The section on fundamentals is definitely superficial and filled with randomly chosen topics. In order to understand what gives materials the different physical properties they possess, knowledge about the chemical bonding in them and the hierarchy of three-dimensional arrangements is inevitable, no matter how one attempts to classify the materials. The advantage of the traditional classification of materials into metals, ceramics and polymers is that the correlation between chemical bonding and physical properties is made abundantly clear. However, when a ceramic or a polymer behaves like a metal or when a metal becomes glassy, one has to look beyond these classifications. In crystalline materials, all atoms are piled up in perfectly ordered symmetry while in amorphous materials the atomic agglomerates have little order or symmetry. Various

crystalline and amorphous phases can be mixed to produce composites. Depending upon the physical state of subdivision of the dispersed phase, there can be different types of composites. By imitating nature, one arrives at the cellular materials with distinct patterns in three-dimensional microstructure leading to controlled physical properties.

The section dealing with the applications of new materials starts with the example of high-strength, low-alloy steels and the light-weight alloys of lithium containing aluminium. The second example of advanced materials is fibre-reinforced polymer composites. Wear-resistant and heat-resistant materials form the matter for the next example which treads through the meandering description of surface treatment, rapidly solidified metals and advanced ceramics. The latter differ from the conventional ceramics mainly in the way they are formed from fine powders, particularly of non-oxidic refractory materials. Ceramic reinforced composites are remarkable for their high hardness, heat and thermal-shock resistance. Applications in ceramic engines, special tools, bioceramics and spacecraft building hold exciting promises for the advanced ceramics. Materials with special optical properties, particularly the optical fibres with low losses in light intensity for optical communication systems and materials for solar cells are dealt with subsequently. The last topic, on electronic and magnetic materials, comprises silicon chip processing, the world beyond silicon, viz. gallium arsenide, and conducting polymers, the new powerful magnetic materials such as Nd-Fe-B alloys and the high-temperature superconducting oxides, with their projected applications in power transmission, magnetic technology and switching devices.

By way of conclusion, even if this book is overlooked by fresh students of materials science, it is going to be a 'no-loss affair' since it has only selected topics presented in a sensationally gushing style, less comprehensible by them, whereas those working in materials may be missing an overview with predictions for tomorrow.

T. R. N. KURIY
Materials Research Laboratory,
Indian Institute of Science,
Bangalore 560 012.

Rural Waste Management, by A. C. Varshney, (Published by Associated Publishing Co., 8798/7, Shidipura, Karol Bagh, New Delhi 110 005), 1987, pp. 215, Price: Rs. 150.00, US \$ 30.00.

Recycling of crop residues and rural waste has been practised by man for centuries. These practices have served their purpose, providing domestic fuel and fertilizer. But direct disposal of untreated waste, frequently leads to severe environmental degradation affecting humanity and other living creatures. Quality of human environment plays an important role in building up the human behaviour and healthy society for living. The recent technology developed in the country helps to improve the environment in a big way for building up healthy society. Very few publications on this aspect are available and the present book is a welcome addition. This comprehensive technical book on rural waste management brings out up-to-date review of various disposal systems of rural waste, its utilization for production of energy, food, feed, fertilizer and other commercial products. The book is divided into eight chapters presenting the current knowledge on various rural waste management with over 118 references.

In the short introduction the author summarizes the various types of rural waste available, their handling and disposal systems and the terminology related to research and management. Chapter II covers briefly the importance of waste disposal and its management with reference to pollution. Estimated annual production of crop residues in India, heat potential of waste material and its manural values provided in tabular columns are very informative.

Chapter III covers some of the physical and chemical properties of rural waste and its importance for the development of waste management. In chapter IV the proper management and disposal of plant residues are dealt with in detail. Industrial utilization of plant wastes for production of commercial products like papers, boards, furfural, plastics, acids and other building materials are discussed. Energy value of bio-mass and its conversion process like pyrolysis, gasification, liquefaction, hydrolysis and related equipment have been described with line diagrams and the necessary conversion equations have been presented clearly. Anaerobic and aerobic conversion of plant wastes are also covered in brief. The information provided in the form of tabular columns on the availability of various crop residues, their properties and industrial

values are very informative.

Chapters V and VI are devoted on availability of animal waste and its byproducts in rural sectors. Their composition and conversion into food, feed, manure and other commercial products have been described. Production of bio-gas from animal waste and its utilization are described scientifically. Various designs of bio-gas plants adopted in India have been discussed in detail with line diagrams, and their respective design equations, are clearly stated.

Chapter VII deals with the availability of various domestic wastes and human excreta in rural areas. Their storage and collection systems, different types of cleaning equipment and vehicles used for refuse collection are also described. Methods of domestic waste disposal incineration, different types of sanitary latrines and their design considerations are explained in detail. The availability of possible industrial wastes and their byproducts in the rural sectors and their conversion process into useful form are discussed in brief in the last chapter.

Each chapter begins with a short introduction and ends with a bibliography.

After a perusal of the material explained above, the following observations have been made.

(1) Quite a few printing mistakes have been observed in the book. Some of them are by products (p. 73), tea great (p. 75), Kca/gm (T.5.4), 0.135 (T.5.5), is this (p. 94), chapter 6 (p. 124), chapter 7, (p. 141) and Kachha (p. 153), instead of by-products, a great, K cal/gm, 0.105, in this, chapter VI, chapter VII and Kachcha respectively.

(2) There is lack of information about various industrial wastes in rural sectors, such as waste from coir industry, dhal mills, oil mills, fruit processing industry, etc., their processing and utilization.

(3) Not much coverage has been given in this book on the forest biomass available and its utilization for domestic fuel and other commercial products.

(4) Though mentioned in brief about the conversion of plant waste into various useful forms, not much importance has been given on better utilization of crop residues into a domestic fuel.

However, the author has made a valuable contribution to the rural waste management literature. This book provides an excellent compilation of the present knowledge on rural waste management systems. The book on the whole is a good compilation and should find a place in the library of all educational institutions. The Calico Binding and the dust cover is very attractive. The printing and get-up

are, of the usual standard, but the price of the book is rather on the higher side.

R. RAMAIAH
M. CHOWDE GOWDA

Department of
Agricultural Engineering,
University of
Agricultural Sciences,
Bangalore 560 065.

An Annotated Bibliography of Betelvine Diseases
(Revised second edition), by M. L. Nayak and M. S. Bhale, (Published by the Department of Plant Pathology, J. N. Agricultural University, Jabalpur 482 004, India), 1987, pp. 93.

The field of plant pathology is growing so rapidly that it is difficult to keep abreast of the new developments in areas other than those of immediate interest. Locally published literature reviewing the current state of knowledge are extremely useful for students, teachers and researchers when the topics are reviewed by eminent experts in the field.

The main constraints in betelvine cultivation are the ravages due to diseases which take a heavy toll

of the produce every year. This bibliography is an effort to meet the demand for available information on betelvine diseases up to 1987. The information collected and given is up-to-date and complete. This will be useful to get background information and extent of research carried out so far on betelvine diseases. In the present bibliography, 287 citations covering the period from 1915 to 1987 have been included with the available abstracts. The references have been cited from different issues of abstracting journals, and proceedings of workshops, conferences, symposia, etc.

Some of the references are not given in chronological order. However, this does not detract from the value of the bibliography. It is better that the bibliography is printed and sold at a lower price in order to meet the demand of research workers, teachers and students.

A few typographic mistakes noticed here and there will no doubt be duly eliminated when this bibliography is printed.

R. K. HEGDE

Office of the
Director of Instruction (Postgraduate Studies),
University of Agricultural Sciences,
Krishnagar, Dharwad 580 005.

ANNOUNCEMENTS

SEMINAR ON MANAGEMENT OF AQUATIC ECOSYSTEMS
(National Institute of Oceanography, Dona Paula, GOA)

Under the auspices of Society of Biosciences, a Seminar on "Management of Aquatic Ecosystems" is being held at N.I.O., Goa during 9-11 December 1988. Dr. B. N. Desai, Director, N.I.O. and Vice-President of the Society of Biosciences shall be the Seminar Director.

25/4, Ram Bagh Road,
Muzaffarnagar 251 001.

V. P. AGRAWAL
Secretary General
Society of Biosciences