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Book Review

Advances in Photochemistry, Volume 19

by D.C. Neckers, D.H. Volman and G. von Bunau (eds.), Wiley Interscience, Chichester, 1995, ISBN 0-471-04912-3, 325 pp., £96.00.

Under a re-shaped editorial team, the latest volume in this worthwhile series offers a fascinating variety of content and style, reflecting the catholicity of photochemistry.

First there is a long review, with more than 500 references, on the *cis–trans* photoisomerization of stilbene and stilbene-like molecules. The emphasis is on the effect of ring-substitution on aromatic ring extension on the mechanisms. This apparently simple reaction has been studied for over 60 years, and only now is a fully coherent picture emerging, which the authors encapsulate in a one-page mechanistic summary at the end of their well-written review.

Atomic force microscopy and scanning tunnelling microscopy are relatively new analytical tools about which I previously had only a superficial awareness. The second chapter in this volume provides an introduction to the techniques, and then describes in detail how they can be applied to solid-state photochemical reactions, particularly photodimerizations. The account touches on related techniques and other photoprocesses than can be studied, and I found particularly interesting the possibility of obtaining information about photobiological processes.

In the chapter on photophysical and photochemical processes of semiconductor nanoclusters (or 'quantum dots'), there is a good account of the general effects arising in systems with particles of very small size. This is developed for excited state processes into the particular subject of non-linear optical properties, which is of relevance to some of the ultramicroscopic techniques described in the previous article. Selected applications are described – photoconductive effects and specific examples of photochemical conversion, and such areas as solar energy and photopolymerization are introduced briefly.

The final chapter on the equation of the artificial photosynthesis of ammonia on heterogeneous catalysts makes fascinating reading. The conclusion is that "...despite the large number of reports, we found none in which the suggested reaction has been demonstrated unequivocally. The literature...shows many internal inconsistencies in activities, yields...". There are some parallels between this potential discovery and that of nuclear fusion by electrolysis of water at palladium electrodes, except that the search for ammonia photosynthesis has been handled without obtrusive scrutiny by the media and with appropriate scientific caution! Other workers may not agree with all the conclusions in this account, but all the issues appear to be described clearly.

All in all, another good volume for stimulating photochemists to continue their cross-disciplinary explorations.

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Photochemical Key Steps in Organic Synthesis: An Experimental Course Book

by Jochen Mattay and Axel G. Griesbeck, 350pp, VCH, Weinheim, DM 58.00, ISBN: 3-527-29214-4.

Synthetic organic photochemistry has outstanding potential in providing the chemist with a clean and brief route to otherwise inaccessible molecules, although it has not yet been as widely exploited as some other areas of organic chemistry. Mattay and Griesbeck would like to rectify this shortcoming, and their contribution is in the form of a collection of experiments for multistep synthesis having one or two photochemical key steps. Over 100 such experiments are included in this book, written in a style reminiscent of *Organic Syntheses* and including full spectroscopic data on the intermediates and products. Nearly 50 active photochemists have contributed their "showpiece" experiments. Much of the strength of the book stems from these interesting achievements, but it is also the source of problems with balance of content and length of contributions. For example, the first thirteen pages are devoted to two syntheses of tetra-*t*-butyltetrahedrane, ingenious and highly academic syntheses of a molecule with almost no synthetic applications. The book does not always include examples of significant reactions, such as light-induced endoperoxide formation from [2+4] cycloaddition of singlet oxygen to a conjugated diene or conventional Norrish type II photoelimination from carbonyl compounds.

The described syntheses are divided into sections (carbonyl compounds, nitrogen-containing chromophores; aromatic compounds; alkenes, arylalkenes and cycloalkenes; organometallic compounds; photo-oxygenation and photoreduction; photochemistry in organised media; and photochromic compounds), each of which has a useful introductory overview, and gives further review-type references. The experimental descriptions are very clear and con-

sistently laid out. The progression of the text through individual reaction steps has meant that there is a fair amount of duplication of structural formulae as we pass through the individual stages of a synthesis. Infuriatingly, the structural formulae are not numbered and it is therefore quite difficult to connect the text to the diagrams, especially when there is more than one photoproduct presented (e.g. pp. 20, 43 and 94): some compound numbering would have been much more use than the relative molar masses, which are given in large print! Nevertheless, the book should become a useful and up-to-date successor to the early slim volumes of *Organic Photochemical Syntheses* (Srinivasan, 1971 and 1976). Practising organic chemists will certainly like the 17 page graphical index of the book's photochemistry.

Overall, the authors have largely succeeded in their aim of producing a useful *vade-mecum* for the experimental organic photochemist, especially because the price of the book is sufficiently modest that it will allow the purchase of personal copies.

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Polymeric Materials for Microelectronic Applications
by H. Ito, S. Tagawa and K. Horie (eds.), ACS SYMPOSIUM SERIES No. 579, Published by the American Chemical Society, Washington, DC, ISBN 0-8412-3055-2, 1994, $110.

This book is an edited text based on the main lectures presented at a conference on Polymers for Microelectronics held in Kawasaki, Japan during November 1993. The physical and chemical properties of many polymer materials makes them ideal and versatile candidates for various applications in the electronics industry. This provides the reader with what was then a snapshot of the current developments in this rapidly expanding field. Although the conference took place two years ago the contributions nevertheless appear to be state-of-the-art in terms of developments in the field. Furthermore, many of the contributions are from Japanese scientists and therefore, the book provides a unique insight into Japanese developments. The book is over 450 pages in length and is divided into five major themes.

The first section covers the chemistry and physics of irradiated polymers comprising a total of four chapters. Here the emphasis is on the photophysics, photo-optical, liquid crystalline, electron capture and luminescence properties of aromatic polymers. The properties of aromatic polyimides and cinnamates are heavily covered centering on the mechanistic features involved with emphasis on their photoreactions and luminescence characteristics. The second section deals with the science and technology of resist materials comprising twelve chapters in all. There is a diversity of topics here covering chemically amplified resists, dual tone negative resists, donor–acceptor reactions, photogeneration of acids, the use of various cationic initiators, influence of water, thermal properties, modelling and surface imaging of resist materials. The third section covers insulating polymers and comprises a total of four chapters. Here photosensitive polyimides are covered in detail as well as epoxy resins. The fourth section on optoelectronic, conduction and photoresponsive systems has a total of nine chapters. The subject areas here are wide-based covering a variety of specialised applications dealing with waveguiding for high temperature materials, fluorinated polyimides for birefringent optical materials, excitation dynamics, charge-carrier generation, radiation dosimetry, future of fullerenes, holography and photocontrol of liquid crystals. The final section deals with silicon-containing polymers and covers their optical/electronic properties and structure and synthesis. Some of the chapters are presented as overviews of the subjects while others are in research paper format which makes their readability somewhat difficult.

The book is nicely presented and well illustrated and referenced throughout as would be expected for this type of format. In general, the book forms a useful basis from which imaging scientists are able to further develop, compare and gain experience and information in terms of the scientific and technological limitations of the materials currently being used and considered. It is also a valuable text for the applications photochemist and physicist and is a must for libraries in academia, industry and government laboratories.

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