junction with pulse-amplitude-modulated (PAM) Chla fluorescence. PAS will enable the investigators to make detailed and quantitative analysis of photochemistry *in vivo* as well as probe energy storage, energy transfer and adaptive state changes *in vivo*. Although the current chapter on PAS by Malkin and Canaani (who introduced this technique of 'listening' to photosynthesis) is a bit difficult because of the technical details for uninitiated readers, it contains useful details on how to use PAS in physiological studies.

The story of blue-light-mediated photomorphogenesis is fast becoming as interesting as phytochrome-regulated physiological processes. The transduction of blue light signals in higher plants and blue-light-mediated gene expression add significantly to our knowledge of signal transduction processes in plants. The correlation between blue-light-induced phosphorylation of plasma membrane protein, light-mediated activation of GTPase, changes in gene expression and involvement of nonmitochondrial b-type cytochromes tend to support the assumption that there are several different processes and independent pathways of regulation for common physiological processes. Signal transduction in plants is going to dominate the photobiological investigations in plants.

In short, the 1994 volume covers a wide spectrum of emerging research themes in plant biology. Its high cost puts it out of the reach of individual scientists in India but it should be an important addition for a teaching or research library. How wonderful it would be if a more affordable edition of the various Annual Reviews is made available for scientists in the less privileged parts of the world!

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Patterning of Material Layers in Submicron Lithography. U. S Tandon and W. S. Khokle. Wiley Eastern Ltd., 4835/24, Ansari Road, Daryaganj, New Delhi 110 002. 1993. 183 pp. (including plates) Price. Rs 450.

Constant and continued search towards sophistication – required for high-performance devices like multimegabit memories, for low power consumption in high-frequency applications, and for utilization of the smallest real estate of the material – have all evoked a keen interest among technologists the world over to search for new avenues and methods for micrometer and nanometer geometry patterning. The technology has gone through sea changes in this direction during the last decade. Photolithography and electron beam lithography, though in use for a few decades, have been improved upon to achieve the industrial targets in the speed of writing patterns, the patterning areas and smaller features. Ion beam and X-ray lithography are somewhat more complex techniques but, due to breakthroughs in masking materials, mask fabrication and development techniques, are becoming more powerful tools. Due to the fact that they open up avenues for more application areas in the development of newer devices, they have of late been finding more thrust in R&D efforts. Many conferences have recently been held in this field. The submicron patterning of material layers forms the subject matter of this excellent and handy monograph and covers various facets of the techniques. The book is well-planned into five chapters for submicron patterning.

The first chapter discusses the factors evoking the technology push in patterning layers, the highlights of achievements in devices' performance in the industrial and biological fields and in basic research. It also discusses the various fundamental issues of importance in the realization of new devices, which are only with the use of submicron patterning.

The second chapter discusses the basics of electron beam lithography, which include the description of e-beam systems, their operation, the highlights of the resists used for this technology, the problems associated with high voltage e-beam lithography and their solutions, and a comparison of the available systems and their applications.

The third chapter provides reasonably good details on the various facets of ion beam lithography, various ion beam resists and their sensitivities, and exposure technologies. Also presented are some details of the most important technique of focussed ion beam (IB) lithography, including masked IB, multiple IB projection lithography, their problems and limitations and their applications with illustrations. The finer details of the newer resists, both organic and inorganic, have also been discussed. Also discussed are the various types of ion sources, their merits and demerits. The increase in the temperature of the mask due to the energetic ion beam and its application in direct write on wafer has also been dealt with in detail. A detailed comparison of the various machines presently available in the market, presented in this chapter, can be of help in choosing the appropriate system.

The fourth chapter describes the X-ray lithography system, X-ray masks and materials, their fabrication methods, resists types with their sensitivities and resolution, various alignment schemes and recent applications with illustrations. X-ray lithography is a new field and is of great importance in submicron patterning. The various sources of X-rays which seem suitable for lithography, various types of masks, with their merits and demerits and X-ray resists have been discussed. The alignment technique is quite intricate with this lithography and has been discussed well. The various available X-ray lithography systems have been described and the chapter concludes with applications and photographs of the generated patterns. The technology is so far limited in use but is a challenge in patterning for full commercial exploitation.

The fifth chapter as a conclusion delves into the present-day scenario in the area of micro and nanolithography, the trends results and projections for the near future.

The advancement in resist technology and excimer laser also pushed the optical photolithography limits to submicron range, which has been discussed in the first chapter as a passing remark. A chapter in this field would have given a completeness to the book.

The book is a monograph on the subject of submicron patterning, excludes the photolithography which also has its own standing in sub ·5 micron region. Overall, this is an excellent document for all scientists/engineers working in

the field and those to be initiated into it. The authors have done a tremendous task in achieving the objectives of the book.

The book has many illustrations which have been taken from various references. Their proper source should have been indicated in all the photographs

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Recent Developments in Biofouling Control. Mary-Frances Thompson, R. Nagabhushanam, R. Sarojini and M. Fingerman, eds. Oxford & IBH Publishing Co., 66, Janpath, New Delhi 110 001. 1994. 443 pp.

This volume consists of papers contributed by various authors in the Indo-US meeting on Recent Developments in Biofouling Control held in Bangalore during July 1992. Five topics dealing with microfouling, macrofouling, nontoxic antifouling agents and new inhibitors, performance of low-energy and controlled release of antifouling coatings and antifouling agents, coatings, treatments and testing are dealt with through 45 technical papers.

Deterioration and failure of metals and materials brought about by microorganisms have only been recognized since about two decades and increased awareness towards this problem has become evident only in the recent years. This publication is thus timely and will help in bringing into focus the role of microorganisms in the corrosion, deterioration and fouling of a number of structural materials used in modern technology.

Biofouling, especially in sea waters, is a topic of universal interest and comparatively very little is known about the microbiology and mechanisms involved in it. For a country like India, this problem has assumed gigantic proportions in our modern technological innovations. Typical cases in point are coastal-based nuclear power reactors, on-shore and off-shore oil drilling, civil and naval sea-going vessels as well as many marine structures. Proceedings of this Indo-US meeting deal with current research efforts in understanding and minimising biofouling.

Majority of the papers deal with biofouling in marine waters The Indian coastal waters studied include the east coast waters around Kalpakkam, Madras, and Vizagapatnam and the west coast waters around Cochin, Goa and Bombay. Scientists from USA have portrayed studies carried out in marine water off Pearl Harbour (Hawaii) and the Gulf of Mexico. Biology of organisms such as diatoms, barnacles, aerobic and anaerobic bacteria, serpulid worms and crustaceans has been discussed with respect to endocrine systems, chemosensory system, metamorphosis and other related physiological activities. Very few papers relate to freshwater macroorganisms. The above studies, however, have relevance to development of control technologies from biofouling point of view.

Little emphasis has been placed on mechanisms involved in biofouling processes with reference to materials and process circuits. A couple of presentations relate to slime formation and biofilm development and their evaluation.

Biofouling control has been brought out in detail. The uses of toxic and nontoxic antifouling compounds are discussed. Other control strategies enumerated include the use of neuropharmacological agents, natural antifoulants and their analogues, bacteriostatic compounds extracted from marine animals and plants, use of fouling-resistant paints and coatings as well as chemical methods, including chlorination, copper treatment and heat treatment. Development of environmentally benign antifouling agents holds the key to combat the menace of biofouling and, in this regard, the information provided through research work will have significant practical value.

Though this publication fails to bring out a comprehensive survey of all biological, chemical and engineering aspects concerning biofouling, the attempt in itself provides very useful data for scientists working in this vast interdisciplinary field. In this regard, this conference proceedings is definitely a valuable addition. Further, the subject matter covered is quite new, pertaining to a frontier area of applied science.

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