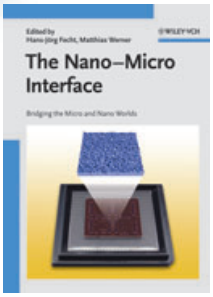
The Nano-Micro Interface



Bridging the Micro and Nano Worlds. Edited by *Hans-Jörg Fecht* and *Matthias Werner*. Wiley-VCH, Weinheim 2004. 327 pp., hardcover € 99.00.—ISBN 3-527-30978-0

Nanotechnology has not only attracted significant attention from various research communities, industries, and policy-makers, but has also drawn great public interest and enthusiasm. A lot of progress has been made lately, particularly in the past decade, and has resulted in a huge number of publications, focused journals, various scientific conferences, and monographs. The nanotechnology field is so broad and diverse and is evolving so rapidly that the information available on this topic is overwhelming. The issue is made more complex by the fact that people working in the nanotechnology field have varying opinions and perspectives about nanotechnology. That is not surprising, since nanotechnology is truly an interdisciplinary field. Scientists, engineers, and technicians from many different disciplines, including physics, chemistry, surface science, materials science, biology, medical science, and device sciences and technology, are all participating and contributing to the advancement of nanotechnology. People from different disciplines are educated and equipped with different ways of thinking and experimentation.

Nanotechnology has significantly promoted synergistic collaborations among researchers from different fields, resulting in a better fundamental understanding of science and technology, which in turn causes further development in the field. However, the many gaps between different research communities remain a great challenge, and hinder such synergistic collaboration among researchers. The book *The Nano-Micro Interface: Bridging the Micro and Nano Worlds* fills one of these gaps. More specifically, this book, as its subtitle indicates, bridges the micro and nano worlds. Nanotechnology deals with materials and/or structures in which at least one characteristic dimension is within the nanometer range (from several nanometers to several hundred nanometers). Chemists and materials scientists synthesize and study such materials, typically starting from the molecular level, which is described as the bottom-up approach, whereas electrical, electronic, and mechanical engineers designing and fabricating structures often rely on a lithographic or similar approach which starts with macroscopic materials, and is thus called a top-down approach. Nanomaterials and nanostructures can be synthesized and/or fabricated by both top-down and bottom-up approaches. Two research communities meet at this nano world from opposite directions, with different technical approaches and strengths.

The book consists of two parts: Part I, Nanotechnology Research Funding and Commercialization Prospects (6 chapters), and Part II, Fundamentals and Technology (17 chapters). The 23 chapters were contributed by a total of 71 authors from 14 countries. Contributions from western European countries predominate, but there are also noticeable representations from eastern European countries such as Poland, the Czech Republic, and Latvia, as well as from Japan, Canada, and the USA. The contributing authors are from academia, research institutes, industry, and government-funded agencies. Therefore, readers not only get a broad spectrum of opinions and perspectives about nanotechnology, but also learn of the research activities and commercialization efforts in various countries. The information presented in Part I is unique to this book, since most edited monographs on nanotechnology are focused on the technical aspects. The titles of these six chapters are indicative of their contents: 1. US National Nanotechnology Initiative: Planning for the Next Five Years; 2. Technological Marketing for Early Nanotechnology; 3. Asia-Pacific Nanotechnology: Research, Development, and Commercialization; 4. Cooperation with Small- and Medium-Sized Enterprises Boosts Commercialization; 5. Rapid Commercialization of Nanotechnology in Japan: from Laboratory to Business; 6. Nanomaterials and Smart Medical Devices.

The 17 chapters in Part II are more like a compilation of research papers covering subjects that range from synthesis and self-assembly of nanomaterials and fabrication of nanostructures and nanostructured surfaces to device fabrication and property characterization, and to applications of nanomaterials and nanostructures. These chapters provide readers with examples of a wide variety of research activities associated with nanotechnology, although these constitute only a small fraction of all nanotechnology research.

There is space for improvement in this book. For example, a more coherent link between different chapters could be established, with better focus, although that is always a great challenge in an edited monograph. If each chapter started with an executive summary or abstract, it would be really helpful for readers to grasp some key information without reading through the entire chapter. The quality varies noticeably from chapter to chapter. Some text could be better edited and polished, so as to eliminate some noticeable errors, such as "narrower bandgap with decreasing grain size" in the table on page VII.

The interface between the nano and micro worlds is an excellent topic for further books to introduce nanotechnology to the general public and broader scientific communities. Up to now, nanotechnology has remained generally defined as the design, fabrication, and application of nanostructures and nanomaterials. Past research has been focused mainly on the synthesis of nanomaterials and fabrication of nanostructures, and these efforts have resulted in

significant progress. One of the current challenges in nanotechnology is to find applications and commercialize the nanostructures and nanomaterials by establishing links between nanomaterials and micro-/macrostructures and systems, which require different talents and expertise.

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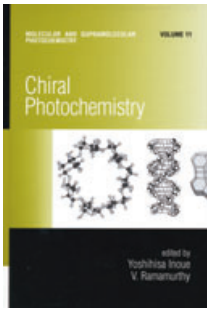
Chiral Photochemistry



(Series: Molecular and Supramolecular Photochemistry, Vol. 11.). Edited by *Yoshihisa Inoue* and *Vaidhyanathan Ramamurthy*. Marcel Dekker, Inc., New York 2004. 500 pp., hardcover $ 184.00.—ISBN 0-8247-5710-6

Although the founders of stereochemistry, van't Hoff and le Bel, suggested the use of circularly polarized light for the so-called "absolute asymmetric synthesis" (AAS) as early as the 19th century, the field of "asymmetric photochemistry" has undergone an accelerated development only during the past 20 years. The recent interest in the field is demonstrated by the fact that the editors of the present volume, *Chiral Photochemistry*, have up to now organized two international symposia on photochirogenesis in Japan in 2001 and 2003, with a wide international participation. A Google search of the Internet for "photochirogenesis" (May 2005) yielded 259 results. Photochirogenesis is a field that is extremely wide and interdisciplinary, yet is still not too large to be discussed comprehensively in most of its aspects within a single volume. The editors have achieved this in a most remarkable way, by collecting the contributions of 16 authors.

In Chapter 1, the book starts with a review on "Direct Asymmetric Photochemistry with Circularly Polarized Light" by Hermann Rau (University of Stuttgart). This author revitalized the interest in the field by a review in 1983, which can be considered to be a basis of information for many new developments since then. This chapter can be recommended as a relatively easy-to-read general introduction to the field of asymmetric photochemistry. In Chapter 2, "Coherent Laser Control of the Handedness of Chiral Molecules", P. Brumer and Moshe Shapiro dig quite deeply into the theory. This chapter will appeal to the theoretically minded photochemist. Systems such as an *enantiodiscriminator*, or, even more ambitiously, an *enantioconverter*, are discussed thoroughly, and one can only dream of turning them into practically usable devices. In the third chapter, G. L. J. A. Rikken discusses "Magneto-chiral Anisotropy in Asymmetric Photochemistry", a cross-effect between natural and magnetic optical activity, which was predicted by Groenewege in 1962, and has since been discussed by several other authors. A comprehensive review on experimental results of "Enantiodifferentiating Photosensitized Reactions" is given by Yoshihisa Inoue in Chapter 4.

In Chapter 5, "Diastereodifferentiating Photoreactions", Norbert Hoffmann and Jean-Pierre Pete emphasize the fundamental difference between asymmetric synthesis or chiral catalysis in the ground state, and reactions carried out through the photoexcited state of molecules. In ground-state reactions, a stereoselectivity yielding *de* or *ee* values of at least 95 % is today regarded as the minimum that is acceptable for useful synthetic methods. In contrast, photochemical reactions are still far away from reaching such high selectivities. Nevertheless, as the authors point out, mechanisms exist whereby one might eventually achieve practically useful results.

Chapter 6, by Yasushi Yokoyama and Masako Saito, gives a comprehensive treatment of "Chirality in Photochromism". Then, in Chapter 7, Shigeyoshi Sakaki and Taisuke Hamada review "Chiral Photochemistry with Transition Metal Complexes", a field in which there have been impressive developments, mainly based on excellent photosensitizers of the type exemplified by $[Ru(bipy)_3]^{2+}$.

The second part of the book, Chapters 8 to 16, is concerned with enantioselective photochemical reactions in molecular aggregates. Chapter 8, by Benjamin Grosch and Thorsten Bach, considers "Template-Induced Enantioselective Photochemical Reactions in Solution". In Chapter 9, "Supramolecular Asymmetric Photoreactions", Takehiko Wada and Yoshihisa Inoue discuss photochemical reactions in chirally modified zeolites. Chapter 10, "Circular Dichroism in the Solid State", by R. Kuroda, is the only one that is not concerned with photochemical processes, but instead deals with diagnostic methods, which are carried out with sophisticated instrumentation. Chapter 11 (Masami Sakamoto), Chapter 12 (John R. Scheffer), Chapter 13 (Hideko Koshima), Chapter 14 (Yuji Ohashi), Chapter 15 (V. Ramamurthy, J. Sivaguru, J. Shailaja, Arunkumar Natarajan, Lakshmi S. Kaanumalle, S. Karthikeyan, and Abraham Joy), and Chapter 16 (Eiji Yashima), are all concerned with chiral photochemistry in the solid state or in polymers.

As is often the case in multi-author books, the various chapters are not systematically coordinated, and in some cases are not connected at all. For example, the isomerization of cyclooctene is shown seven times in almost identical schemes (pp. 22, 139, 148, 150, 367, 377, and 566), Bach's chiral host is discussed twice (pp. 371 and 330), and Sakamoto's bromination also twice (pp. 419 and 465). These are very important examples, and it is quite natural that they are cited several times from different perspectives. But the overall feeling of déjá vu grows stronger as one reads further. A chapter by the editors, or at least a few pages, commenting on the state of the art and the perspectives in a global way would have been most useful for specialists, who will probably not read all the chapters in all details.

In conclusion, this book is a timely and comprehensive review of the state of chiral photochemistry at the begin-

