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BOOK REVIEWS

From Enzyme Models to Model Enzymes. By Anthony J. Kirby and Florian Hollfelder (University of Cambridge, U.K.). Royal Society of Chemistry: Cambridge.2009. xii + 274 pp. $139.00. ISBN 978-0-85404-175-6.

Enzymologists have sought for over a half a century to design and synthesize model systems that reproduce enzymatic activity in all of its facets, e.g., speed, binding, and stereospecificity. In fact, it can be argued persuasively that only at the point at which it is possible to do so will we be able to say that we understand how enzymes function. This book by Kirby and Hollfelder documents this effort, from early work on hydrophobic solvents and intramolecular catalysis to more recent studies on protein design and directed evolution. The organization is logical, progressing from an introduction of the principles of catalysis through model systems to more sophisticated efforts that include biochemical methods to improve the catalytic function of proteins. The coverage of topics is broad rather than deep, consistent with the authors' goal of introducing enzyme models to a wide readership.

The initial chapter covers the basics of the chemistry involved in the mechanisms of enzymes, e.g., pH-dependence, general acid−base catalysis, kinetic equivalence, intramolecularity, energetics, hydrophobicity, binding, cofactors, etc. In the second chapter, the authors briefly discuss the kinetics of enzyme-catalyzed reactions and the difficulties of comparing enzymatic reaction rates with their nonenzymatic counterparts, whether model systems or in solution. Both chapters are short—combined length is 41 pages—making it impossible to cover this material in much depth. The lack of a comprehensive introduction to the theory of enzyme catalysis and model systems is understandable in a treatise on enzyme models rather than on the details of catalytic principles, but the brief discussion of these principles makes this work accessible only to those who already have some familiarity with the fundamentals of catalysis.

As a prelude to the model systems that are discussed subsequently, Chapter 3 gives an overview of the approaches and strategies that have been utilized in the construction of enzyme models. The authors start with a consideration of solvent effects and then describe the role of functional groups and noncovalent interactions. They conclude with a discussion of the use of existing enzymes as catalytic scaffolds to accommodate new functionality. Here, the authors give a good perspective on the challenges that are faced by those whose goal is to use a rational approach to the development of enzyme models.

Slightly more than half of the text is devoted to enzyme models classified by reaction type, specifically acyl transfer, phosphoryl transfer, glycosyl transfer, hydrogen transfer, radical reactions, and pericyclic reactions. The authors concentrate on relatively straightforward reactions that have been mimicked by model systems. Various modeled enzymes are discussed, along with the basic chemistry involved, and intramolecular, synthetic, and supramolecular models are described. Given the large amount of work that has been done on these systems, the coverage is necessarily selective. Nevertheless, the systems chosen are illustrative, and the discussions are illuminating. A brief foray into the realm of catalytic polymers—synzymes, dendrimers, and molecular imprinting—complements sections on catalytic antibodies, nucleic acid catalysts, and modification of protein enzymes in the final chapter. As with the previous chapters, there is no attempt to be exhaustive in the coverage of each topic.

Overall, this is a valuable monograph, particularly for those who are reasonably conversant with the underlying principles of catalysis. The text is very well written, and the coverage of the topic is sufficient to give a broad overview of the field. General conclusions are drawn whenever possible, enabling the reader to come away with a good understanding of the state of the field. Although the goal of the authors was to write a text for students, this work will be useful as an overview for the more accomplished practitioner as well.

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Optical Properties and Spectroscopy of Nanomaterials. By Jin Zhong Zhang (University of California, Santa Cruz). World Scientific: Hackensack, NJ.2009. xvi + 384 pp. $38. ISBN 978-981-283-665-6.

Optical Properties and Spectroscopy of Nanomaterials is an introductory level book on the current state of knowledge of the optical properties of inorganic nanomaterials and the spectroscopic and other techniques that are used for characterizing nanomaterials. It is aimed at upper level undergraduate and beginning graduate students and covers the most basic aspects of nanomaterial optics and spectroscopy and their applications.

The chapters on experimental techniques are a welcome addition for this type of book and fit with the goal of the author to deliver a textbook-type experience for students entering the field of nanomaterial optics and spectroscopy. This section is inconsistently written, however, presenting very sketchy ideas and concepts of the methods but then jumping to advanced data as illustrations. One striking example is the inadequate explanation of how an atomic force microscope (AFM) functions. The level of detail is insufficient for investigators new to this technique to grasp even the basic principle that is described or the subsequent discussion of an illustration of frequency modulation AFM data collected under positive frequency shift—much less to infer from these data that repulsive forces are at work. Anyone but readers experienced in this area will be lost here. The figures on the methods and the choice of methods included in the discussion are informative and are a good basis for materials to be used by experienced teachers in their courses. These chapters do, however, miss the mark in bringing readers up to speed through independent study.

The following chapters address the synthesis (briefly) and optical properties of the four categories of inorganic nanoma-

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terials discussed in the book: semiconductors, metal oxides, metals, and composites thereof. These chapters cover a lot of ground; thus, the reader should be prepared to find a lot of topics that are only briefly discussed—in many instances, less than a page per topic. When considering important issues, such as the effect of the shape of nanoparticles on their optical properties or the role of the electronic structure of nanomaterials in the observed optical properties, this is a bit of a concern. Ample referencing is provided to direct the reader to more detailed source materials, however. Fortunately, an appropriately detailed discussion on the band/electronic structure of nanomaterials, such as the role of trap states, and additional phenomena, such as Auger processes in quantum dots, is given in a separate chapter. This is probably the strongest chapter in the book because it strikes a good balance between introducing the material to novice readers and providing enough detail without being overwhelming.

The author appropriately references key articles on original research and methods, and recent references have been added to illustrate the current state of research as well. The extensive bibliography makes this book a good reference work representative of the field as a whole. Concerning the language used in the book, there are many noticeable grammatical errors throughout the text, such as the omission of articles.

Overall the book is well organized and covers the necessary topics to serve as an introductory text to the properties and role of nanomaterials in optical and photonic applications. However, because the author tried to cover too much material in too little space, the detail and slower pace needed to bring novices, who are the target audience for this book, up to speed is lacking in many instances. Thus, the book is somewhat hit-or-miss in terms of achieving its goal of being a self-contained resource for independent study as well as being a quality textbook for classroom education. Still, this book can be recommended as an introductory text or as a textbook, if the reader is prepared to find additional materials through the provided references to expand on the contents. In the end, the key strengths of the book are that it presents a nicely flowing birds-eye overview of nanomaterial optics and spectroscopy, and it is attractively priced.

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