

Molecular Encapsulation

The research in the latest application area of supramolecular chemistry, that of reactions inside molecular capsules and cavities, has been collected into a 520-page book edited by Udo Brinker and Jean-Luc Miesset of the University of Vienna, Austria. The title, *Molecular Encapsulation: Organic Reactions in Constrained Systems*, is self-explanatory, and the book serves as a very up-to-date account of what is perhaps the most fascinating area of modern chemistry, the design and utilization of self-assembling molecular capsules or cavities that are capable of either inhibiting reactions by confinement of unstable molecules or promoting or catalyzing reactions within the confined space inside the capsules.

During the last 40 years, supramolecular chemistry has offered many families of supramolecular hosts, typically macrocyclic structures exhibiting molecular recognition and encapsulating properties. These classical families of compounds include crown ethers, cyclodextrins, calixarenes, resorcinarenes, cucubiturils, and other similar cyclophanes. Further modification of these core structures can give more sophisticated host structures, such as carcerands. Such macrocyclic cavity-containing structures can also be created by metal-ligand coordination bonds, leading to metal-ion-assisted capsules, bowls, or—in the solid state—metal-organic frameworks (MOFs). Also, purely inorganic three-dimensional frameworks, such as zeolites, can serve as confined cavities in which reactions can be promoted or catalyzed. Regardless of the chemical structure of the system, whether it is purely organic, metal-organic, organometallic, or inorganic, the prerequisite for promoting reactions is the formation or existence of a cavity of suitable size and shape—a void space that can accommodate the reacting molecular entities.

The book consists of 17 chapters written by 38 contributors, a composition that has both advantages and drawbacks. The contributors, in addition to the editors, are well-known experts in their respective fields, such as R. Breslow, L. Mandolini, R. Warmuth, Y. Inoue, K. Takahashi, J. N. H. Reek, B. D. Smith, J. B. F. N. Engberts, and P. L. Luisi, to mention only a few of them. Some of the chapters are short and rather superficial in their literature coverage (e.g., 17 pages and 30 references), while

others are very comprehensive with a lot of references (e.g., 34 pages and 121 references). The book is constructed so that some of the chapters focus on chemical reactions grouped according to the use of specific macrocyclic hosts or structures (cyclodextrins, Chapters 2–4; calixarenes, Chapter 8; carcerands, Chapter 9; zeolites, Chapter 5; vesicles, Chapter 16; liposomes, Chapter 17), whereas the others are more general and approach the topic from the standpoint of a particular type of reaction carried out in several different molecular systems (photochemistry, Chapter 1; self-assembled nanoreactors, Chapter 6; concave reagents, Chapter 7; reactive intermediates, Chapter 10; dyes, Chapter 11; organic cations, Chapter 12; metallo-, DNA, and RNA enzymes, Chapters 13 and 14; supramolecular systems in general, Chapter 15).

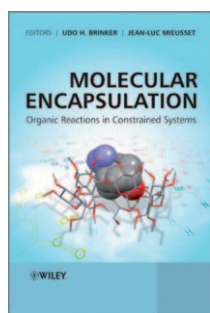
The work, despite the heterogeneous nature of the contents, offers a very valuable cross-section of the old macrocyclic and the new bio-inspired systems that are used to promote chemical reactions within cavities in constrained systems. Many of the chapters give a very clear and well-formulated view of a specific host system (e.g., Chapter 9 on carcerands). However, there is considerable overlapping of the chapters; merging some chapters and/or parts of the chapters would have resulted in a more coherent treatment, based either on the chemical reactions or on the constrained systems.

To summarize, the book gives a clear, but in some respects a snapshot-like, view of the use of molecular encapsulation to promote, induce, or catalyze organic reactions in constrained systems, a field of research that is yet in its juvenile state, but shows a great future for real applications. The book has a broad scope and serves its purpose very well for everyone who is interested in the preparation of molecular reactors, the stabilization of reactive intermediates, reactions of unusual regioselectivity, confined photochemical reactions, or supramolecularly enhanced reactions in water, organic solvents, or the solid state. Thus, the book is well suited both for beginners and for experts, and it is an essential addition to the bookshelf of a supramolecular chemist.

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