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Structure and Bonding

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Aims and Scope

The series *Structure and Bonding* publishes critical reviews on topics of research concerned with chemical structure and bonding. The scope of the series spans the entire Periodic Table and addresses structure and bonding issues associated with all of the elements. It also focuses attention on new and developing areas of modern structural and theoretical chemistry such as nanostructures, molecular electronics, designed molecular solids, surfaces, metal clusters and supramolecular structures. Physical and spectroscopic techniques used to determine, examine and model structures fall within the purview of *Structure and Bonding* to the extent that the focus is on the scientific results obtained and not on specialist information concerning the techniques themselves. Issues associated with the development of bonding models and generalizations that illuminate the reactivity pathways and rates of chemical processes are also relevant

The individual volumes in the series are thematic. The goal of each volume is to give the reader, whether at a university or in industry, a comprehensive overview of an area where new insights are emerging that are of interest to a larger scientific audience. Thus each review within the volume critically surveys one aspect of that topic and places it within the context of the volume as a whole. The most significant developments of the last 5 to 10 years should be presented using selected examples to illustrate the principles discussed. A description of the physical basis of the experimental techniques that have been used to provide the primary data may also be appropriate, if it has not been covered in detail elsewhere. The coverage need not be exhaustive in data, but should rather be conceptual, concentrating on the new principles being developed that will allow the reader, who is not a specialist in the area covered, to understand the data presented. Discussion of possible future research directions in the area is welcomed.

Review articles for the individual volumes are invited by the volume editors.

In references *Structure and Bonding* is abbreviated *Struct Bond* and is cited as a journal.

Banglin Chen • Guodong Qian
Editors

Metal-Organic Frameworks for Photonics Applications

With contributions by

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Preface

Photonics, the science of light emission, transmission, modulation, manipulation, and detection, are playing an essential role in many fields, including information processing, communication technologies, military, and biomedicine. Compared to electronics, photonics enable the transport and processing of information at the speed of light. The present boom in optical fiber technology is an excellent example of how much impact photonics has on the advancement of our society. Up to now, various inorganic and organic materials have been widely developed for photonics applications, including nonlinear optical materials, luminescent materials, laser materials, photoactive materials, photoconductors, and so on. The research on the photonics materials combines the applied research of chemistry, solid state physics, materials science, and optical and computer engineering and will be the most dominating forces in various fields of science and engineering.

Currently, metal-organic frameworks (MOFs) are being intensively studied as a novel class of hybrid inorganic–organic material with ultrahigh porosity, enormous internal surface areas, together with the extraordinary tailorability of structure, dimension, size, and shape. Although the photonics application of MOF materials is still at the early stage compared with the application for gas storage, separation, and heterogeneous catalysis, the currently available results have unambiguously demonstrated that the design and construction of MOFs for photonics functionality is very active. Because of the inherent advantages of both organic links (easily modify, flexibility, versatility, etc.) and inorganic metal ions (unique electronic and optical nature), MOFs will open a land of promising applications in photonics fields where conventional inorganic or organic materials might not be suitable. The MOF approach can also offer a variety of other attractive characteristics such as the straightforward syntheses, predictable structures and porosities, and collaborative properties to develop new photonics materials and important applications.

Due to the importance as well as the rapid progress of the MOF materials in the field of photonics, it is quite appropriate to publish this first book on MOFs for photonics application. The book presents the most up-to-date source of information on photonics applications of MOFs and not covered yet by other books. In this

book, the database of photonics MOFs, the design principles, the unique characteristics of MOFs, and the potential photonics applications are discussed in detail. The results obtained in the last years by the main leading MOF researchers all over the world are presented in this book, thus providing a valid and precious overview on the last developments and moreover on the future innovative applications of the MOF materials in the field of photonics for scientists working in this area.

The book is organized in six chapters and opens with a chapter titled "Design and Construction of Metal-Organic Frameworks" by Chen and Zhang, which reviews the fundamental characteristics, molecular design, and synthetic strategies of MOFs. The chapter titled "Luminescent Properties and Applications of Metal-Organic Frameworks" by Qian et al. elaborates on the luminescent behavior of MOFs and describes the applications of luminescent MOFs in the fields of lighting-emitting, chemical sensors, and medicine. In chapter titled "Metal-Organic Frameworks for Photocatalysis" by Lin discusses the photocatalysis application of MOF materials. Vital et al. then describe the photochemical transformation within MOFs in chapter titled "Photochemical Transformation within Metal-Organic Frameworks". The chapter titled "Metal-Organic Frameworks for Nonlinear Optics" by Du et al. provides a comprehensive review of MOFs that display nonlinear optical properties. Lastly, Furukawa and coworkers in chapter titled "Host-Guest Metal-Organic Frameworks for Photonics" describe the luminescent properties of host-guest MOFs and their potential applications as sensing materials.

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