

Preface

Nowadays, the development of new materials is focusing on the rational design of advanced systems with particular properties that can be predicted and controlled, aiming at pre-determined technological applications. This suggests that the research within the field of Materials Science should be based on the criteria of multidisciplinary, thereby allowing the design and preparation of specific materials. Organic–inorganic hybrid materials constitute indeed a significant and promising category within the realm of Materials Science. The infinite kinds of organic functional groups, judicious control of inorganic units, and their corresponding marvelous assemblies endow them with tremendous potential to yield new materials beyond conventional composites, a domain in which nanocomposites push forward the frontier of discovery and advanced functional materials. Furthermore, the introduction of mesoporosity and even hierarchical porosity into the hybrid frameworks extends their application from traditional fields to high-tech areas. As a consequence, the encounter of hybrid chemistry and porous structures offers great opportunities for the development of functional materials, a fertile ground to harness the physicochemical, electrochemical, or biological activity of a myriad of organic and inorganic components and put them to scientific research and finally practical applications.

Providing a thorough list of contents that could fairly represent the large and fascinating family of porous organic–inorganic hybrid materials would be impossible. Instead, we have striven to present some emerging types including metal phosphonates, carboxylates, and sulfonates, exemplifying as the non-siliceous organic–inorganic hybrid materials, which would criss-cross the field revealing in some detail the basic principles and a variety of functional properties and applications. This book consists of six chapters. The Introduction (Chap. 1) describes the classification of porous materials. For better understanding of hybrids, Chap. 2 exhibits the development history of hybrid materials and strategies for integrating organic and inorganic moieties. The synthesis pathways of mesoporous non-siliceous hybrid materials and the key factors such as precursors, surfactants, adjustment of mesostructures and pore size, crystallization improvement of pore wall, as well as morphology control are elaborated in Chaps. 3 and 4, attempting

to provide insights into synthesizing high-quality mesoporous non-siliceous hybrid materials. In Chap. 5, the applications of mesoporous hybrid materials and discussions of structure–function relationship are presented. It is apparent that the mesoporous hybrids field is eager for more and more researchers from various fields to explore attractive applications. Finally, the latest progresses in development of mesoporous non-siliceous organic–inorganic hybrid materials are reviewed, and the outlook on next stages is given.

Looking toward the twenty-first century, nanoscience and nanotechnology will make a significant contribution to scientific and technological development. Hybrid materials are believed to play a major role in the design and preparation of advanced functional materials. Recently, the molecular approaches in chemical synthesis and nanochemistry have reached a high level of sophistication. The synthesis of mesoporous hybrid materials is considerably promising to be mastered.

We hope that this book can help and inspire those researchers who are interested in porous hybrid materials. Due to the relatively wide area covered in this book and the limited knowledge and competence of the authors, errors and omissions may not be avoided, therefore we sincerely appreciate the criticism and comments from the readers.

Acknowledgments

The authors thank the support from NSFC, and the Program for Innovative Research Team in University.

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Mesoporous Organic-Inorganic Non-Siliceous Hybrid
Materials

Basic Principles and Promising Multifunctionality

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2015, VIII, 121 p. 55 illus., 30 illus. in color., Softcover

ISBN: 978-3-662-45633-0