

# Preface

Intelligent materials are emerging composite materials that have boomed since 1990s. These novel materials have gained outstanding achievements and influenced multidisciplinary fields in recent years. In the 21st century, the content of intelligent materials is continuously expanding and the domains of which are constantly being broadened. The outstanding features are the tight connection between fundamental researches and practical applications, as well as the tight coupling of biomimetic technology and nanotechnology. The intelligent material system is of great scientific significance; it combines studies that explore nature, mimic nature and surpass nature, involving a multitude of structures and functions. It provides new ideas, new theories, and new methodologies for the innovation of science and technology. After millions of years of evolution, plants and animals have almost completely and perfectly adapted to natural environments. Thus, mimicking the natural microstructures and functions of these creatures will build a bridge between biology and technology, which may provide inspirations for solving today's technological problems.

By summarizing the research findings on the synthesis, properties, and applications of photonic/electrical stimulative intelligent interfacial materials, we were the first to propose the concept of "Binary cooperative complementary micro/nanoscale interfacial materials". According to this design idea, the contact and coupling of heterogeneous materials will result in novel properties on the surface or interface of materials, which may create new functional materials and

devices. For example, investigations on superamphiphilic surfaces (the material's surface is both superhydrophilic and superoleophilic), superamphiphobic surfaces (the material's surface is both superhydrophobic and superoleophobic), and smart switchable superhydrophobic/superhydrophilic materials will have important applications in daily life, environmental protection and a good number of other domains.

This book devotes to give a complementary introduction about biomimetic intelligent micro/nanoscale interfacial materials, paying attention to the intelligent materials with special wettabilities. The first chapter summarizes the definition of intelligent materials, the design ideas and representative examples of biomimetic intelligent micro/nanoscale interfacial materials. The second chapter introduces some natural creatures with special surface properties, including self-cleaning of lotus-leaf, walking-on-water of water strider, walking-on-wall of gecko, water-collection of desert beetle, special structural color of opal, wing of butterfly, feather of peacock and many others. In Chapter 3, we demonstrate the relationship between surface microstructures and special wettabilities in theory. The fourth chapter gives some typical manufacturing methods of biomimetic superhydrophobic surfaces; the fifth chapter introduces intelligent micro/nanoscale interfacial materials with special wettabilities. In the last and sixth chapter, we give a conclusion of intelligent materials with some personal perspectives in this area.

In this text we have tried to strike a balance between specialty and popular science. This monograph has summarized a great deal of relative literature and our group's research findings on biomimetic intelligent micro/nanoscale interfacial materials in recent years. It can be used not only as a reference book for researchers in areas including chemistry, materials science and biology, but also for science enthusiasts. We would be very gratified if this book could spur readers' interests in biomimetic intelligent micro/nanoscale interfacial materials.

This book is the collective effort and creative results of our research group. It would not be possible without the help and support from many colleagues. We would like to give our most sincere appreciation to the following colleagues: Prof. Jian Xu, Prof. Zhenzhong Yang, Prof. Lin Li, Prof. Yanlin Song, Prof. Meixiang

Wan, Prof. Yuliang Li, Prof. Yunqi Liu, Prof. Jin Zhai at the Institute of Chemistry, Chinese Academy of Sciences, Prof. Xi Zhang, Prof. Quanshui Zheng, Prof. Xiqiao Feng, Prof. Ziniu Wu at Tsinghua University, Prof. Guangzhao Zhang at the University of Science and Technology of China, Prof. Bai Yang at Jilin University, and Prof. Xianbao Wang at Hubei University. Great thanks to academicians Daoben Zhu, academicians Chunli Bai, academicians Jiannian Yao, academicians Zhenhe Tong, academicians Qi Wu, academicians Hongyuan Chen, and academicians Long Jiang of the Chinese Academy of Sciences. Thanks for the hard work of graduates and post-docs of our group: Huanjun Li, Jian Jin, Yingshun Li, Taolei Sun, Xinjian Feng, Shuhong Li, Huan Liu, Chaowei Guo, Mei Li, Shutao Wang, Ying Zhu, Jingxia Wang, Yong Zhao, Xuefeng Gao, Meihua Jin, Yongmei Zheng, Xianbao Wang, Fan Xia, Weiqin Zhu, Hongli Ge, Wenlong Song, and others.

Particular thanks go to teacher Guilan Wang, Dr. Jinming Xi, Dongliang Tian, Nv Wang, Hui Zhang, Dan Wang, Wenfang Yuan, Liang Xu, Tianyi Zhao, Chunling Yu, Jihua Zhang, and Huiqiong Zhou for their efforts on images treatment, literature collection and proofreading of the manuscript.

Lei Jiang and Lin Feng  
Beijing, China