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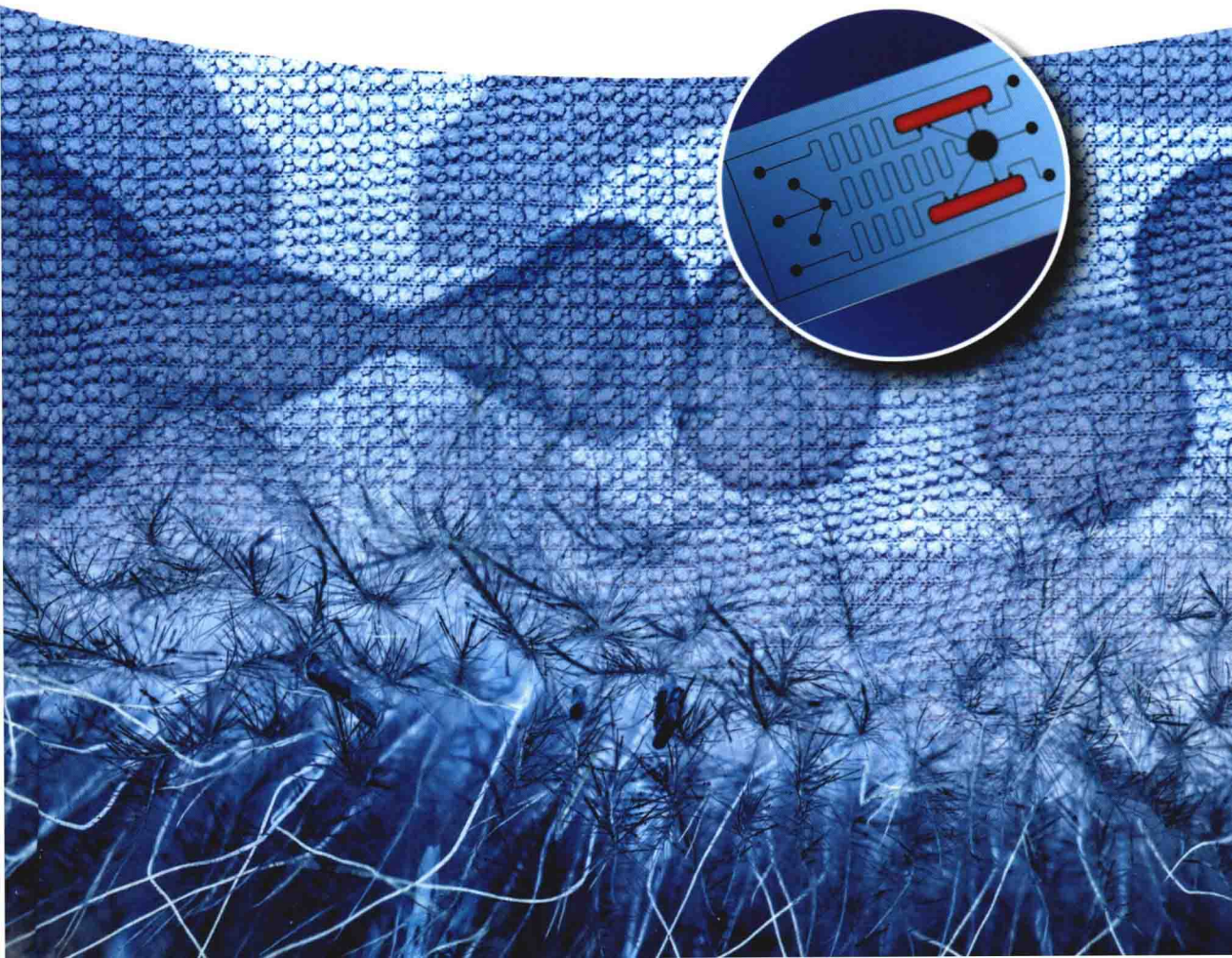

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Preface

Microfluidics, or the so-called lab-on-a-chip, has emerged as a distinct new technology since the beginning of the 1990s. The dimensions of the microfluidic channels and components are tens to hundreds of micrometers. The microfluidic devices can be used to flexibly manipulate the flow of microvolume fluids in microchannels, which are considered putting the lab on a chip. Due to the trend of miniaturization and integration of modern scientific and technological development, microfluidic technology has been widely concerned and valued by the international scientific and industrial communities. Since microfluidic technology can accurately manipulate small-volume fluids, it is rapidly extending from the original analytical chemistry platform for microanalysis and microdetection to high-throughput drug screening, micromixing, microreaction, microseparation, and so on. Due to its excellent ability to control fluid interfaces as well as excellent heat and mass transfer performances, microfluidic technology has become a novel and promising material preparation technology platform. Microfluidic technology has emerged in the construction of precisely controllable microstructured new functional materials with high performances and especially shows incomparable creativity and superiority compared with traditional technology in the design and preparation of some new functional materials with high added values.

This book, entitled *Microfluidics for Advanced Functional Polymeric Materials*, comprehensively and systematically treats modern understanding of the microfluidic technique and its great power in controllable fabrication of advanced functional polymeric materials. The contents range from the design and fabrication of microfluidic devices, the fundamentals and strategies for controllable microfluidic generation of multiphase liquid systems (e.g., discrete multiple emulsions and continuous laminar multiflow systems), and the use of these liquid systems with elaborate combination of their structures and compositions for controllable fabrication of advanced functional polymeric materials (e.g., solid microparticles, porous microparticles, hollow microcapsules, core–shell microcapsules, hole–shell microcapsules, multicompartmental microcapsules, microfibers, in-chip membranes, and microvalves). All the chapters together clearly describe the design concepts and fabrication strategies of advanced functional polymeric materials with microfluidics by combining the structures with the compositions of multiphase liquid systems to achieve advanced and novel functions. Vivid schematics and illustrations throughout

the book enhance the accessibility to the relevant theory and technologies. This book aims to be a definitive reference book for a wide general readership including chemists, chemical engineers, materials researchers, pharmaceutical scientists, biomedical researchers, and students in the related fields.

The book is composed of 14 chapters. In Chapter 1, a brief introduction of the superiority and potential of microfluidics in the construction of microscale phase interfaces and preparation of novel functional materials are briefly introduced. In Chapters 2 and 3, microfluidic strategies for shear-induced and wetting-induced generations of controllable multiple emulsions are introduced, respectively. In Chapters 4–6, microfluidic strategies for controllable fabrication of monodisperse hydrogel microparticles, porous microparticles, and hierarchical porous microparticles are introduced, respectively. In Chapters 7 and 8, microfluidic strategies for controllable fabrication of monodisperse hollow microcapsules and core–shell microcapsules with an oil core and a stimuli-responsive hydrogel shell are introduced, respectively. In Chapter 9, the microfluidic strategies for fabrication of controllable hole–shell microparticles from double emulsions are introduced. In Chapter 10, a microfluidic strategy for template synthesis of multicompartmental microparticles, with accurate control over the structures of their inner compartments and the encapsulation characteristics of their loaded contents, is introduced. In Chapter 11, simple and versatile microfluidic strategies for controllable fabrication of functional microfibers with tubular, peapod-like, and spindle-knot-like internals are introduced. In Chapter 12, a microfluidic strategy for *in situ* fabrication of nanogel-containing smart membranes in the microchannel of microchips is introduced. In Chapter 13, fabrication and performance of microchips incorporated with smart hydrogel microvalves for thermostatic control and trace analytes detection are introduced. Finally, perspectives on the microfluidic fabrication of advanced functional polymeric materials are given in Chapter 14.

The authors' group at Sichuan University (group website: http://teacher.scu.edu.cn/ftp_teacher0/cly/) has been devoted to the microfluidic fabrications of polymeric functional materials since 2006. In the past decade, they have made significant contributions to the development of this field. Most of the contents in this book are the fresh achievements of the authors' group on advanced functional materials fabricated with microfluidics. Prof. Liang-Yin Chu wrote Chapters 1, 4, 5, 7, 12, and 14, and Prof. Wei Wang wrote Chapters 2, 3, 6, 8–11, and 13. The authors are very grateful to Prof. David A. Weitz at Harvard University who helped the authors a lot to carry out investigations in the field of microfluidics. The authors would like to thank all the current and former group members who contributed to the investigations on microfluidics, especially Prof. Rui Xie, Prof. Xiao-Jie Ju, Prof. Zhuang Liu, Dr Li Liu, Dr Nan-Nan Deng, Dr Mao-Jie Zhang, Dr Zhi-Jun Meng, Dr Ya-Lan Yu, Dr Jie Wei, Dr Lei Zhang, Dr Chuan-Lin Mou, Dr Li-Li Yue, Dr Gang Chen, Dr Ying-Mei Liu, Dr Hai-Rong Yu, Dr Xiao-Heng He, Dr Ming-Yue Jiang, Dr Shuo Lin, Dr Fang Wu, Dr Xiao-Yi Zou, Jian Sun, Hao Zhang, Ping-Wei Ren, Jian-Ping Yang, Shuo-Wei Pi, Xi Lin, Guo-Qing Wen, Yi-Meng Sun, Chao Yang, Wei-Chao Zheng, Mei Yuan, Xiu-Lan Yang, and Ming Li, for their creative researches on microfluidics. The authors gratefully acknowledge all the professors, friends, and colleagues who helped the authors' group

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