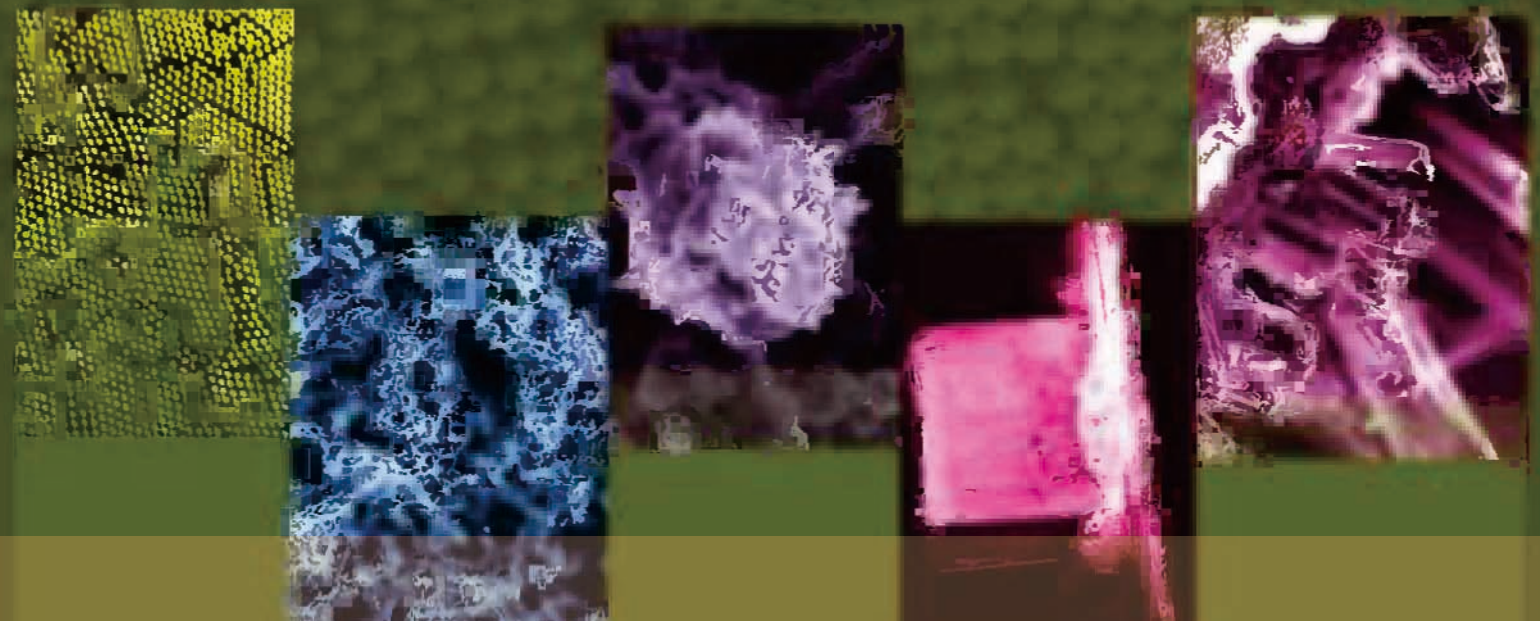
ELECTROCHEMICAL NANOFABRICATION

Principles and Applications

edited by Di Wei



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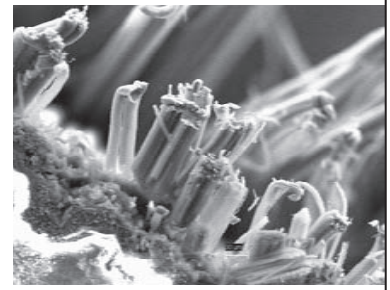

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Preface

The great nature has shown us the beauty of nanotechnology in the wings of Papilio butterfly and leaves of lotus through millions of years of evolution. In the 21st century, nanotechnology is a key research topic in universities, research institutes, and industries globally because it enables us to create new functional materials, devices, and novel applications by means of physical, chemical, and biochemical processes and has had disruptive impact in our economy and daily lives.

One key part of nanotechnology is its fabrication technique. Traditional nanofabrication techniques such as chemical vapor deposition, sol-gel, and self-assembly had been intensively studied as means of delivering some specific nanostructure. However, these traditional methods are either expensive for mass production or hard to couple to electronics directly. Electrochemical nanofabrication is a versatile method for fabricating nanostructures with its simplicity, low-temperature processing, cost-effectiveness, and precise control of the deposit thickness through control of the total charge passed, which are the essential advantages over other nanofabrication techniques till date. In addition, electrochemical nanofabrication has shown compatibility with the state-of-the-art semiconductor manufacturing technology and can be largely used in chip fabrication and the packaging of microelectronics.

This book summarizes various electrochemical nanofabrication methods and shows their various essential applications in areas such as batteries, sensors, optoelectronics, and many future applications. The authors, selected from six countries, are leading scientists in both academia and industry. We hope our book will be a useful reference for readers interested in or involved in the research of electrochemistry and nanotechnology.

Contents

"This book provides an innovative and thought-provoking view of electrochemical processes in nanofabrication. A comprehensive overview of the field is complemented by focused coverage of niche specialist topics involving metallic, oxide and polymeric materials in diverse combinations and complex interfacial architectures. A pedagogical approach to the central fundamental concepts allows the non-specialist to appreciate the significance of some perceptive subsequent analytical critique. Excellent use of illustrative material assists appreciation of the synergy between the novel fundamental science and its application in practical devices. This is an excellent book for those working in the field and others considering entering it."

Prof. A. Robert Hillman
University of Leicester, UK

Nanotechnology has attracted billions of dollars in venture capital from research institutes, governments, and industries in recent years. Traditional nanofabrication techniques, such as CVD, sol-gel, and self-assembly, have been intensively studied. However, the electrochemical nanofabrication technique, which offers huge benefits for manufacturing nanomaterials as well as broad applications in industries, has not been paid much attention compared with the traditional nanofabrication methods. This book fits the niche of such technology because it summarizes various electrochemical nanofabrication methods and shows their various essential applications in areas such as batteries, sensors, and many future applications.

Di Wei is a senior research scientist at the Nokia Research Centre, Cambridge, UK. He received his bachelor's degree from the University of Science and Technology of China and obtained his master's degree and PhD with distinctions from the Abo Akademi University Process Chemistry Centre of Finland. He joined the University of Cambridge in 2007 as a research associate and then Nokia Research Centre, Cambridge, in 2008. Wei is a senior member of Wolfson College at Cambridge and member of RSC (Royal Society of Chemistry) and ISE (International Society of Electrochemistry). His research interest covers organic electronics, sensors, electrochemical nanofabrication, and nano-enabled energy solutions such as photovoltaics, fuel cells, supercapacitors, and batteries. In addition to contributing to 30 peer-reviewed journal publications and 24 conference proceedings, Wei has also written chapters for books on nanotechnology and is the inventor of dozens of patents.

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