<<微纳米加工技术及其应用>>

图书基本信息

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前言

In the summer of 1994, I went back to China to attend the Chinese Young Scholars Forum on Applications of Optical Technologies for Microfabrication. This was the first time I returned to China since I came to the UK in 1989 to work as a postdoctoral researcher at the Microelectronic Research Centre, Cambridge University, and subsequently at the Central Microstructure Facility, RutherfordAppleton Laboratory. China was still considered back then to be far lagging be-hind in mainstream modem high technologies. I presented my work on optical li-thography at 0.35 μ m technology for Very Large Scale Integrated Circuit （VLSI） manufacturing, which was unheard of in China at the time. Later in 1995 I wrote an article for the Chinese bimonthly journal "Science" （"VLSI microfabrication technologies", Science, V.47（3）, p.26, 1995）, introducing optical lithography, electron beam lithography, focused ion beam and X-ray lithography and their ap-plications in manufacturing of Integrated Circuits （IC）. I was trying to emphasise the importance of new microfabrication technologies in IC manufacturing, which is the basis of all modem technologies. China was slow to catch up with the indus-trialised nations in this area, partly due to its own backward manufacturing indus-try and partly due to the unavailability of advanced microfabrication equipments it could import from overseas. The situation has changed dramatically in the last 10 years. I have been going back to China every year since 1994 and have personally witnessed the economi-cal boom taking place in China. With its enormous purchasing power, its eager embracing of the global economy and its admission to the global market, China was able to import some of the most advanced micro-nanofabrication equipments. Laboratories and R&D centres on micro-nanotechnologies sprung up all over China. Some well-equipped laboratories are on par with the best known laborato-ries in the West. For IC manufacturing, China is now the fastest growing region in the world in the VLSI industry. Some of the IC manufacturers in China are ranked among the top 5 largest companies in the world. The investments in R&D of MEMS （Micro-Electro-Mechanical Systems） and nanotechnology are equally fast growing. While the hardware is important for a modem laboratory, the well-educated professionals who can operate the equipment and explore their full po-tential are even more important. Besides, anyone who is engaged in researching or using micro-nanotechnologies will need to know how micro or nanostmc-tures/devices are fabricated, as the functionalities of these structures/devices are very much dependent on the way they are fabricated. There is a huge demand in China for knowledge of micro-nanofabrication technologies. Meeting such a de-mand prompted me to write this book.

内容概要

《微纳米加工技术及其应用》集作者多年来的实践经验与研究成果，系统地介绍了微纳米加工技术的基础，包括光学曝光技术、电子束曝光技术、聚焦离子束加工技术、X射线曝光技术、各种刻蚀技术和微纳米尺度的复制技术。
对各种加工技术着重讲清原理，列举基本的工艺步骤，说明各种工艺条件的由来，并注意给出典型工艺参数。
充分分析了各种技术的优缺点及在应用过程中的注意事项。
《微纳米加工技术及其应用》强调实用，避免烦琐的数学分析，既注重基础知识又兼顾微纳米加工领域近年来的最新进展及在各高科技领域的应用，并列举了相关参考文献供进一步深入研究，因此不论是对初次涉足这一领域的大专院校的本科生或研究生，还是对已经有一定工作经验的专业科技人员，都具有很好的参考价值。

作者简介

Dr. Zheng Cui graduated in 1981 from Southeast University in Nanjing, P.R. China, with a Bachelor degree and subsequently obtained a Master degree in 1984 and a Ph.D. degree in 1988 in electronic engineering at the same university. In 1989 he was invited as a visiting research fellowto the Microelectronics Research Centre, Cavendish Laboratory of Cambridge University in the UK, sponsored by the UK Science and Engineering Research Council （SERC）. In 1993 he joined the Central Microstructure Facility, Rutherford Appleton Laboratory of UK （UKs largest national laboratory）, as a Senior Scientist. In 1999 he became a Principal Scientist and a group leader. Dr. Zheng Cuis main areas of expertise and interests are in micro and nanofabrication technologies, including various fabrication technologies for both VLSI manufacturing and MEMS development. In the past 16 years he has participated in 7 European joint research projects, acting as coordinator for two of the projects. He was also the principal investigator and co-investigator of a number of UK national projects and the project leader of two UK Royal Society funded projects. He has authored and co-authored over 130 technical publications, is a programme com-mittee member of the annual International Symposium on Design, Test, Integra-tion and Packaging of MEMS/MOEMS, an associate editor for the Journal of Mi-crolithography, Microfabrication and Microsystems （jM3）, a member of referee panel on nanotechnology for the European Community Framework 6 research programme, and a Fellow of the UK Institution of Electrical Engineers （IEE）. Since 1994, he has been awarded 4 times of the K.C. Wong Scientific Research grants, has won 2 Royal Society UK-China Joint research grants. He has been in-vited as a guest professor in a number of research institutes and universities in China. In 2002, he was selected as an Overseas Assessor for the Chinese Academy of Sciences, and in 2004 he was awarded the Overseas Prominent Scholar fund by the Chinese Academy of Sciences.

书籍目录

章节摘录

Chapter I Introduction 1.1 Micro-nanotechnologies and micro-nanofabrication technologies Since the advent of the world first transistor in 1947, semiconductors and microelectronics, from which all other miniaturization technologies have been developed, have become the pillar of all modern high-tech industries. Integrated circuits, commonly called ICs or microchips, have nowadays penetrated into every aspect of modern life, in particular of the so called 3Cs, namely Consumer electronics, Computers and Communications. Today, powerful laptop computers, small and smart mobile phones, and multifunction home appliances are every-where. In 2004, the world total output of semiconductors and integrated circuits has reached $215 billions, which supports a one-trillion-dollars market of all the electronics and information technology related products. In the next 6 years, the world IC industry will have a growth rate of 15% annually. By 2010, the sales of worldwide semiconductor ICs are expected to reach $410 billions [1], supporting an electronics and information technology industry with total value of 4-5 trillion US dollars. While the IC industry had been witnessed phenomenal growth in the last few decades, another technology revolution was quietly taking place since the 1980s, which was the development of microsystem technology. Microsystem is a broad name for all miniaturized non-electronic systems. It is also known as MEMS （Micro Electro Mechanical System）. They can be micromechanical systems, microopto-electro-mechanical systems, microfluid systems and biochips. Some of the examples are micromotors of only 1 mm diameter, video cameras of only a fingernail size, micro gas chromatographic devices less than the size of a pea, a chemical laboratory on a chip and an optical bench on a chip. These microsystems have become or are becoming commercial products entering all fields of industry and modern life. While IC technology is mostly seen in the 3C types of products, microsystems have much wider applications. From a system point of view, an IC chip can provide a system with the brain for thinking and decision making, micro-systems, in the form of microsensors and microactuators, provide the system with eyes, ears, nose, hands and legs.

编辑推荐

The book is a collection of the authors years of experience and research findings, as well as the latest development, in micro-nanofabrication technologies. It gives a detailed introduction on the basics of microonanofabrication, including optical lithography, electron beam lithography, foused ion beam technique, X-ray lithography, various etching and replication techniques. For each of the fabrication technology it introduces, the emphasis is on clear explanation of the basic principle, the essential steps in the processes, various process conditions and typical process parameters. The advantages and disadvantages of each technique arc also analysed. The applications of micro-nanofabrication technologies focus on manufacturing of very large scale integrated circuits （VLSI）, nanoeiectronics, optoelectronics, high density magnetic storage, micro-electro-mechanical systcm or MEMS, biochip or lab-on-chip and nanotechnology. Each of the applications is accompanied by practical examples to demonstrate how particular fabrication techniques are applied. There is an extensive list of references following each chapter for readers to explore further. The book is not only a good supplementary reading material for university undergraduates of postgraduates who are novices in this field,but also a good reference book for experienced engineering professionals who wish to know other fabrication techniques outside their own field.

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