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Laser Precision Microfabrication

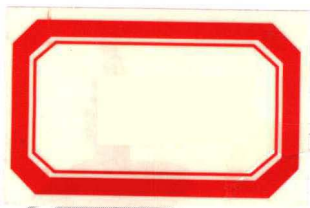
激光精确微加工

(影印版)

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序 言

物理学是研究物质、能量以及它们之间相互作用的科学。她不仅是化学、生命、材料、信息、能源和环境等相关学科的基础,同时还是许多新兴学科和交叉学科的前沿。在科技发展日新月异和国际竞争日趋激烈的今天,物理学不仅囿于基础科学和技术应用研究的范畴,而且在社会发展与人类进步的历史进程中发挥着越来越关键的作用。

我们欣喜地看到,改革开放三十多年来,随着中国政治、经济、教育、文化等领域各项事业的持续稳定发展,我国物理学取得了跨越式的进步,做出了很多为世界瞩目的研究成果。今日的中国物理正在经历一个历史上少有的黄金时代。

在我国物理学科快速发展的背景下,近年来物理学相关书籍也呈现百花齐放的良好态势,在知识传承、学术交流、人才培养等方面发挥着无可替代的作用。从另一方面看,尽管国内各出版社相继推出了一些质量很高的物理教材和图书,但系统总结物理学各门类知识和发展,深入浅出地介绍其与现代科学技术之间的渊源,并针对不同层次的读者提供有价值的教材和研究参考,仍是我国科学传播与出版界面临的一个极富挑战性的课题。

为有力推动我国物理学研究、加快相关学科的建设与发展,特别是展现近年来中国物理学家的研究水平和成果,北京大学出版社在国家出版基金的支持下推出了“中外物理学精品书系”,试图对以上难题进行大胆的尝试和探索。该书系编委会集结了数十位来自内地和香港顶尖高校及科研院所的知名专家学者。他们都是目前该领域十分活跃的专家,确保了整套丛书的权威性和前瞻性。

这套书系内容丰富,涵盖面广,可读性强,其中既有对我国传统物理学发展的梳理和总结,也有对正在蓬勃发展的物理学前沿的全面展示;既引进和介绍了世界物理学研究的发展动态,也面向国际主流领域传播中国物理的优秀专著。可以说,“中外物理学精品书系”力图完整呈现近现代世界和中国物理

科学发展的全貌,是一部目前国内为数不多的兼具学术价值和阅读乐趣的经典物理丛书。

“中外物理学精品书系”另一个突出特点是,在把西方物理的精华要义“请进来”的同时,也将我国近现代物理的优秀成果“送出去”。物理学科在世界范围内的重要性不言而喻,引进和翻译世界物理的经典著作和前沿动态,可以满足当前国内物理教学和科研工作的迫切需求。另一方面,改革开放几十年来,我国的物理学研究取得了长足发展,一大批具有较高学术价值的著作相继问世。这套丛书首次将一些中国物理学者的优秀论著以英文版的形式直接推向国际相关研究的主流领域,使世界对中国物理学的过去和现状有更多的深入了解,不仅充分展示出中国物理学研究 and 积累的“硬实力”,也向世界主动传播我国科技文化领域不断创新的“软实力”,对全面提升中国科学、教育和文化领域的国际形象起到重要的促进作用。

值得一提的是,“中外物理学精品书系”还对中国近现代物理学科的经典著作进行了全面收录。20 世纪以来,中国物理界诞生了很多经典作品,但当时大都分散出版,如今很多代表性的作品已经淹没在浩瀚的图书海洋中,读者们对这些论著也都是“只闻其声,未见其真”。该书系的编者们在这方面下了很大工夫,对中国物理学科不同时期、不同分支的经典著作进行了系统的整理和收录。这项工作具有非常重要的学术意义和社会价值,不仅可以很好地保护和传承我国物理学的经典文献,充分发挥其应有的传世育人的作用,更能使广大物理学人和青年学子切身体会我国物理学研究的发展脉络和优良传统,真正领悟到老一辈科学家严谨求实、追求卓越、博大精深的治学之美。

温家宝总理在 2006 年中国科学技术大会上指出,“加强基础研究是提升国家创新能力、积累智力资本的重要途径,是我国跻身世界科技强国的必要条件”。中国的发展在于创新,而基础研究正是一切创新的根本和源泉。我相信,这套“中外物理学精品书系”的出版,不仅可以使所有热爱和研究物理学的人们从中获取思维的启迪、智力的挑战和阅读的乐趣,也将进一步推动其他相关基础科学更好更快地发展,为我国今后的科技创新和社会进步做出应有的贡献。

“中外物理学精品书系”编委会 主任
中国科学院院士,北京大学教授

王恩哥

2010 年 5 月于燕园

Koji Sugioka
Michel Meunier
Alberto Piqué
Editors

Laser Precision Microfabrication

With 158 Figures



Springer

Preface

The use of lasers in materials processing, machining, diagnostics, and medical applications is a rapidly growing area of research. The main driving force behind this research is that lasers can provide unique solutions in materials processing, offer the ability to manufacture otherwise unattainable devices, and yield cost-effective solutions to complex manufacturing processes. In particular, recent advances in short-pulse and short-wavelength beams have stimulated research into laser precision microfabrication (LPM) in the fields of electronics, optoelectronics, micro- and nanomachining, new materials synthesis, and medical and biological applications.

In view of the impact of LPM, The Japan Laser Processing Society (JLPS) organized the inaugural International Symposium on Laser Precision Microfabrication (LPM 2000) in 2000 in Omiya, Saitama, Japan. The aim of this symposium was to provide a forum where leading experts, end users, and vendors can congregate to discuss both fundamental and practical aspects of LPM. It has grown in strength through successive conferences held annually in Singapore (2001), Osaka, Japan (2002), Munich, Germany (2003), Nara, Japan (2004), Williamsburg, USA (2005), Kyoto, Japan (2006), Vienna, Austria (2007), Quebec, Canada (2008), Kobe, Japan (2009), and Stuttgart, Germany (2010) and it is now recognized as one of the biggest and most important events in the field of laser microprocessing. The numbers of participants as well as papers presented continue to increase year by year due to expansion of the range of laser applications in both fundamental and practical research.

This book was primarily planned to introduce key papers presented at recent LPM symposia. However, we felt that its scope should be broadened to provide readers with more comprehensive information on the state of the art and future prospects of LPM. The book consists of 13 chapters covering a broad range of topics in LPM, introduced by internationally recognized experts in the field, most of whom are involved in the committee of the LPM symposia. It includes an overview of LPM (Chap. 1), theory and simulation (Chaps. 2 and 8), laser devices and optical systems for LPM (Chap. 3), fundamentals of laser-matter interaction (Chap. 4), beam shaping techniques (Chap. 5), biomedical applications (Chap. 6), nanotechnology (Chaps. 7 and 8), relevant processing techniques such as surface modification, micromachining, and laser-induced forward transfer (LIFT) (Chaps. 4, 9, and 10–12), and practical applications (Chap. 13).

We believe that this book offers a comprehensive review of LPM, which will be used not only by researchers and engineers already working in the field, but also by students and young scientists who plan to work in this area of research in the future. Last but not least, we would like to thank all of the chapter contributors for their great efforts and kind cooperation in editing this book.

Saitama, Montréal, Washington
April 2010

Koji Sugioka
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Contents

1	Process Control in Laser Material Processing for the Micro and Nanometer Scale Domains	1
	Henry Helvajian	
1.1	Introduction	1
1.2	Laser Processing	5
1.2.1	Laser Wavelength	7
1.2.2	Laser Power	11
1.2.3	Laser Dose	13
1.2.4	Laser Beam	16
1.2.5	Laser Pulse Temporal Profile	19
1.2.6	Pattern Generation	23
1.3	Possible Steps Forward	26
1.4	Conclusions	29
	References	30
2	Theory and Simulation of Laser Ablation – from Basic Mechanisms to Applications	35
	Laurent J. Lewis and Danny Perez	
2.1	Introduction	35
2.2	Basic Physics	37
2.2.1	Light-Matter Interaction	37
2.2.2	Material Removal from the Target: The Basics of Ablation	37
2.3	Ablation in the Thermal Regime	38
2.3.1	Thermodynamics	38
2.3.2	Conventional Wisdom: Early Theories	39
2.3.3	A New Understanding	41
2.3.4	Computer Models	41
2.3.5	The Femtosecond Regime	44
2.3.6	Picosecond Pulses and Beyond	49
2.3.7	Molecular Solids	50
2.4	Materials Processing	53
2.4.1	Nanoparticle Production in Solvents	53
2.4.2	Damages and Heat Affected Zones	55

2.5	Conclusions and Perspectives	58
	References	59
3	Laser Devices and Optical Systems for Laser Precision	
	Microfabrication	63
	Kunihiko Washio	
3.1	Introduction	63
3.2	Laser Devices	64
3.2.1	Various Laser Devices from Deep UV and Mid-IR Spectral Region	64
3.2.2	Diode-Pumped High-Brightness Continuous Wave Solid-State Lasers	67
3.2.3	Q-Switching and Cavity Dumping	70
3.2.4	Picosecond and Femtosecond, Ultrafast Pulsed Laser Oscillators and Amplifiers	72
3.3	Optical Systems	77
3.3.1	Optical Components for Modification and Control of Laser Beams	77
3.3.2	Optical Systems for Beam Shape Transformation	78
3.3.3	Galvanometer-Based Optical Scanners	81
3.3.4	Spatial Light Modulators	82
3.3.5	Nonlinear-Optical Systems for Harmonic Generation	83
3.3.6	Optical Systems for Beam Characterization and Process Monitoring	84
3.4	Summary	86
	References	86
4	Fundamentals of Laser-Material Interaction	
	and Application to Multiscale Surface Modification	91
	Matthew S. Brown and Craig B. Arnold	
4.1	Introduction	91
4.2	Fundamentals of Laser Surface Processing	92
4.2.1	Light Propagation in Materials	92
4.2.2	Energy Absorption Mechanisms	94
4.2.3	The Heat Equation	96
4.2.4	Material Response	98
4.3	Laser Surface Processing Applications	101
4.4	Case Study I: Surface Texturing for Enhanced Optical Properties	104
4.5	Case Study II: Surface Texturing for Enhanced Biological Interactions	110
4.6	Conclusions	116
	References	117

5	Temporal Pulse Tailoring in Ultrafast Laser Manufacturing Technologies	121
	Razvan Stoian, Matthias Wollenhaupt, Thomas Baumert, and Ingolf V. Hertel	
5.1	Introduction	121
5.2	Fundamental and Technical Aspects of Pulse Shaping	123
5.2.1	Basics of Ultrashort Laser Pulses	123
5.2.2	Frequency Domain Manipulation (Mathematical Formalism)	123
5.2.3	Analytical Phase Functions Relevant to Material Processing	127
5.2.4	Pulse Shaping in the Spatial Domain	130
5.2.5	Experimental Implementations for Temporal Pulse Shaping	130
5.2.6	Optimization Strategies	132
5.3	Material Interaction with Temporally Shaped Pulses	133
5.3.1	Control of Laser-Induced Primary Excitation Events	133
5.3.2	Engineered Thermodynamic Phase-Space Trajectories	135
5.3.3	Refractive Index Engineering by Temporally Tailored Pulses	139
5.4	Conclusion and Perspectives	141
	References	142
6	Laser Nanosurgery, Manipulation, and Transportation of Cells and Tissues	145
	Wataru Watanabe	
6.1	Introduction	145
6.2	Laser Direct Surgery	146
6.2.1	Nanosurgery with a Focused Laser Beam in the Ultraviolet and Visible Region	146
6.2.2	Femtosecond Laser Surgery	147
6.3	Nanoparticles and Chromophore-Assisted Manipulation and Processing	153
6.3.1	Chromophore-Assisted Laser Inactivation	153
6.3.2	Plasmonic Nanosurgery	154
6.4	Laser Manipulation and Transport of Cells and Tissues	154
6.4.1	Optical Tweezers	154
6.4.2	Laser Transport of Cells	155
6.5	Application of Laser-Induced ShockWaves and Mechanical Waves	155
6.5.1	Targeted Gene Transfection by Laser-Induced Mechanical Waves	155
6.5.2	Femtosecond Laser-Induced ShockWave in Liquid	156
6.6	Laser-Induced Stimulation	157

6.7	Fabrication of Microfluidic Channels and Scaffolds	158
6.8	Summary and Conclusions	159
	References	159
7	Laser Synthesis of Nanomaterials	163
	Sébastien Besner and Michel Meunier	
7.1	Introduction	163
7.2	General Principles of Laser Based Synthesis of Nanomaterials	164
	7.2.1 Nanosecond Pulsed Laser Ablation	165
	7.2.2 Ultrafast Laser Ablation	166
7.3	Synthesis of Nanomaterials Based on Laser Ablation of a Bulk Target	168
7.4	Laser Ablation in Vacuum/Gas Environment	171
7.5	Laser Ablation in Liquids: Formation of Colloidal Nanoparticles	173
	7.5.1 Ablation Mechanisms	173
	7.5.2 Effect of Laser Parameters	176
	7.5.3 Effect of Stabilizing Agents	177
	7.5.4 Process Model	179
7.6	Synthesis of Nanomaterials Based on Laser Interaction with Micro/Nanomaterials	180
7.7	Conclusions and Perspective	182
	References	183
8	Ultrafast Laser Micro- and Nanostructuring	189
	Wolfgang Kautek and Magdalena Forster	
8.1	Introduction	190
8.2	Theoretical Background	190
	8.2.1 Dielectrics	191
	8.2.2 Metals	194
	8.2.3 Thermodynamic Approach	195
8.3	Recent Results	198
	8.3.1 Top-Down Approaches to Nanostructures	198
	8.3.2 Thin Film Ablation	199
	8.3.3 Incubation Phenomena	201
	8.3.4 Bottom-Up Approaches to Nanostructures	203
	8.3.5 Biogenetic Materials	204
8.4	Outlook	206
	8.4.1 Recent Instrumental Developments	206
	8.4.2 Nanostructuring in the Nearfield	208
8.5	Summary	209
	References	209

9	3D Fabrication of Embedded Microcomponents	215
	Koji Sugioka and Stefan Nolte	
9.1	Introduction	215
9.2	Principles of Internal Processing	216
9.3	Refractive Index Modification.....	217
9.3.1	Advantages of Femtosecond Laser in Photonic Device Fabrication	217
9.3.2	Optical Waveguide Writing	218
9.3.3	Fabrication of Photonic Devices.....	220
9.3.4	Fabrication of Fiber Bragg Gratings (FBGs)	223
9.4	Formation of 3D Hollow Microstructures	225
9.4.1	Direct Ablation in Water	225
9.4.2	Internal Modification Followed by Wet Etching	226
9.5	3D Integration of Microcomponents	228
9.6	Beam Shaping for Fabrication of 3D Microcomponents	231
9.7	Summary	233
	References.....	234
10	Micromachining and Patterning	239
	Jürgen Ihlemann	
10.1	Introduction	239
10.2	Direct Writing.....	240
10.3	Micro Fluidics.....	241
10.4	Gratings	243
10.5	Diffraction Optical Elements	245
10.6	Micro Lenses/Lens Arrays	246
10.7	Patterning of Layers	249
10.8	Dielectric Masks	252
10.9	Two Step Processing of Layers: Ablation + Oxidation.....	253
10.10	Summary and Outlook	255
	References.....	256
11	Laser Transfer Techniques for Digital Microfabrication	259
	Alberto Piqué	
11.1	Introduction	259
11.2	Lasers in Digital Microfabrication	261
11.3	Origins of Laser Forward Transfer	262
11.3.1	Early Work in Laser-Induced Forward Transfer	262
11.3.2	Transferring Metals and Other Materials with LIFT	264
11.3.3	Fundamental Limitations of the Basic LIFT Approach	265
11.4	Evolution of Laser Forward Transfer Techniques	265
11.4.1	The Role of the Donor Substrate	266
11.4.2	Development of Multilayered Ribbons and Dynamic Release Layers	267

11.4.3	LIFT with Ultra-Short Laser Pulses	269
11.4.4	Laser Transfer of Composite or Matrix-Based Materials	270
11.4.5	Laser Transfer of Rheological Systems	271
11.4.6	Jetting Effects	273
11.4.7	Laser Transfer of Entire Devices	274
11.4.8	Recent Variations of the Basic LIFT Process	276
11.5	Applications	277
11.5.1	Microelectronics.....	277
11.5.2	Sensor and Micropower Generation Devices	278
11.5.3	Biomaterials	281
11.5.4	Embedded Electronic Circuits	283
11.6	The Future of Laser-Based Digital Microfabrication	284
11.6.1	Laser Forward Transfer vs. Other Digital Microfabrication Processes	285
11.7	Summary	286
	References.....	287
12	Hybrid Laser Processing of Transparent Materials	293
	Hiroyuki Niino	
12.1	Introduction	293
12.2	Multiwavelength Excitation Process	294
12.2.1	Principle of Multiwavelength Excitation Process.....	294
12.2.2	Microfabrication of Transparent Materials by Multiwavelength Excitation Process	295
12.3	Media Assisted Process.....	297
12.3.1	Classification of Media Assisted Processes	297
12.3.2	LIPAA Process	299
12.3.3	LIBWE Process	302
12.4	Conclusions	306
	References.....	307
13	Drilling, Cutting, Welding, Marking and Microforming	311
	Oliver Suttman, Anas Moalem, Rainer Kling, and Andreas Ostendorf	
13.1	Parameter Regimes	311
13.1.1	Pulse Duration.....	312
13.1.2	Wavelength	314
13.1.3	Beam Quality	315
13.1.4	Output Power	315
13.2	Drilling	316
13.2.1	Laser Drilling Without Relative Movement Between Laser Spot and Workpiece.....	316
13.2.2	Laser Drilling with Relative Movement Between Laser Spot and Workpiece.....	318