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Volumes 40–87 are listed at the end of the book.
Katharina Al-Shamery
Horst-Günter Rubahn
Helmut Sitter
Editors

Organic Nanostructures
for Next Generation Devices

With 221 Figures and 6 Tables
Preface

This book is concerned with organic nanoaggregates, showing how to master their growth and expanding on their ability to form central building blocks of next generation submicron-scaled devices. It samples reports and views of the central scientific groups working in this field and provides a complete overview of the state-of-the art of basic research and applications.

As compared to their inorganic counterparts, organic materials are by far superior in that they show extremely large design flexibility, very good possibilities for integration into devices, and brilliant performance. Organic molecules exhibit high luminescence efficiencies at low material densities, flexible spectroscopy and are easy and cheap to process.

The growth of organic matter into nanowires, nanotubes, or nanofibers with widths and heights in the lower nanometer regime and lengths up to several microns is a rather recent development. However, the number of studies on these topics has rapidly increased within the last few years. This development is parallel to that happening within the field of inorganic nanowires or carbon nanotubes. In both cases, the time span between the first discovery of how to grow those nanowired materials and their prototypical commercial application was no longer than a few years. Numerous examples can be found for carbon nanotubes. In the case of inorganic semiconducting nanowires, the number of examples such as simple logical gates, UV-light emitting nanolasers or sensors to detect explosives is also rapidly increasing. Such tendencies promise a huge consumer market.

In this volume the contributions focus on organic electroluminescent nanostructures, their fabrication as well as properties, use, and implications. Among the basic problems are those concerned with finding appropriate conditions for self-assembled growth, understanding the interaction with the support as well as neighbouring molecules, and detaching the resulting nanostructures from their growth templates. Anisotropic luminescence, wave-guiding, nonlinear optical response, random lasing, electrical mobility, and mechanical stability are subsequently discussed, thus paving the route from basic nanomaterials properties to optimized working devices.
The book starts with two tutorials aiming to make it easier for a broad readership to enter the literature of thin organic film growth as well as characterization methods of organic thin films. Part II (Chaps. 3–8) gives an overview on self-assembled growth of nanostructures from rod-like molecular building blocks as well as the crystallography of exemplary organic nanowires. This includes a chapter on how to chemically modify molecular building blocks to influence the linear and nonlinear optical properties as well as the fibre shapes. Lasing and nano-optical aspects are discussed in Chaps. 9 and 10 (Part III: Optics). The book ends with a part on first examples of device-oriented studies, enlightening the high potential of this new type of nanoscaled organic material. The editors would like to express their special thanks to Dr. Frank Balzer who did a tremendous work in assembling the manuscripts into a homogeneous book.

Oldenburg, Sonderborg, Linz, Katharina Al-Shamery
June 2007 Horst-Günter Rubahn
Helmut Sitter
Contents

List of Acronyms and Symbols .................................................. XVII

Part 1 Introduction

1 Fundamentals of Organic Film Growth and Characterisation
H. Sitter, R. Resel, G. Koller, M.G. Ramsey, A. Andreev, and C. Teichert ............................... 3
1.1 General .............................................................. 3
1.2 Nucleation Process and Growth Modes ......................... 4
1.3 The Surface Science Approach .................................... 7
   1.3.1 In Situ UHV MBE ........................................ 8
   1.3.2 Valence Band Photoemission (ARUPS) .................. 9
   1.3.3 Near Edge X-Ray Absorption
         Fine Structure Spectroscopy (NEXAFS) ............... 12
   1.3.4 Scanning Tunnelling Microscopy ...................... 14
1.4 Crystallographic Characterisation .............................. 15
1.5 Fundamentals of Atomic Force Microscopy .................. 16
References ............................................................... 18

2 Optical Characterization Methods for Ultrathin Nanoaggregates
H.-G. Rubahn ................................................................. 21
2.1 Dark Field and Fluorescence Microscopy .................... 21
2.2 Two-Photon Microscopy ....................................... 22
2.3 Scanning Near-Field Optical Microscopy .................. 24
2.4 Two-Photon Near-Field Microscopy ......................... 25
References ................................................................. 28
Part II Growth

3 Growth of Oriented Organic Nanoaggregates via Molecular Beam Deposition
F. Balzer .................................................... 31
3.1 Introduction ............................................. 31
3.2 Adsorbates ............................................... 32
3.3 Silicate Substrates ....................................... 34
3.4 Phenylens on Muscovite .................................... 36
   3.4.1 Para-Hexaphenylene ................................. 36
   3.4.2 Steps and Defects ..................................... 43
   3.4.3 Kinetics .............................................. 45
   3.4.4 Growth Model ......................................... 51
3.5 Thiophenes on Muscovite .................................. 53
3.6 Micorings ................................................. 56
3.7 Au-Mica Heterostructures .................................. 58
3.8 Conclusions ................................................ 60
References ...................................................... 62

4 Tailored Organic Nanoaggregates Generated by Self-Assembly of Designed Functionalised p-Quaterphenylenes on Muscovite Mica Substrates
K. Al-Shamery, M. Schiek, R. Koch, and A. Lützen .................. 67
4.1 Introduction ............................................. 67
4.2 Design ..................................................... 68
4.3 Synthesis of Oligomers ..................................... 70
4.4 Vapour Deposition Studies .................................. 72
4.5 Nanoaggregates from Symmetrically Functionalised Oligomers .. 73
4.6 Nanoaggregates from Non-Symmetrically Functionalised Oligomers .................................................. 78
4.7 Non-Linear Optical Properties .............................. 80
4.8 Quantum Chemical Calculations and Optical Properties ....... 82
4.9 Conclusion ................................................ 83
References ...................................................... 84

5 Hot-Wall Epitaxial Growth of Films of Conjugated Molecules
H. Sitter ........................................................ 89
5.1 Introduction: Why Highly Ordered Organic Thin Films? ........ 89
5.2 Experimental Setup ......................................... 90
   5.2.1 Hot-Wall Epitaxy ..................................... 90
   5.2.2 Source Materials and Substrates ....................... 93
   5.2.3 Characterization Methods ............................. 94
5.3 Pristine and Ba-Doped C_{60} Layers ............................ 95
   5.3.1 C_{60} Films on Mica Substrates ....................... 95
5.3.2 Doping of C\textsubscript{60} with Ba .......................... 98
5.4 Highly Ordered Films of Para-Sexiphenyl ......................... 100
5.4.1 Needles and Islands of p-6P on KCl Substrates ............. 102
5.4.2 Islands and Nanofibers of p-6P on Mica Substrates ....... 106
5.5 Conclusion ................................................... 114
References ....................................................... 116

6 Crystallography of Ultrathin Organic Films
and Nanoaggregates
T. Haber and R. Resel ............................................ 119
6.1 Overview .................................................. 120
6.2 Crystal Structure of Rodlike Conjugated Molecules .......... 122
6.2.1 Oligoacenes ............................................ 124
6.2.2 Oligophenylene ....................................... 124
6.2.3 Oligothiophenes ....................................... 125
6.3 Experimental Methods ....................................... 126
6.3.1 Fundamentals .......................................... 126
6.3.2 Specular Scans ........................................ 127
6.3.3 Rocking Curves ....................................... 128
6.3.4 Pole Figure Technique ................................ 130
6.3.5 Surface Diffraction ................................... 131
6.3.6 Line Profile Analysis ................................. 132
6.3.7 Transmission Electron Microscopy ...................... 134
6.4 Crystallographic Order within Nanoaggregates ............... 137
6.4.1 Out-of-Plane Order .................................... 138
6.4.2 In-Plane Order (Organic Epitaxy) .................... 140
6.4.3 Relation Between Crystal Structure
and Film Morphology ........................................ 145
6.4.4 Crystallite Size ....................................... 148
6.4.5 Polymorphism ........................................ 152
6.5 Early Stage Growth ....................................... 153
6.6 Conclusion ................................................ 158
References ....................................................... 159

7 Growth and Electronic Structure
of Homo- and Hetero-epitaxial Organic Nanostructures
G. Koller and M.G. Ramsey ....................................... 165
7.1 Introduction ............................................... 165
7.2 Organic Films on Inorganic Substrates ......................... 166
7.2.1 The Substrate as a Template ............................ 167
7.2.2 Structure and Morphology Determinants:
Sticking vs. Diffusion Anisotropy ............................ 171
7.2.3 The Electronic Structure ............................... 178
7.2.4 The Electronic Band Alignment
on Nanostructured Interfaces ............................... 182
7.3 Organic–Organic Heteroepitaxy ........................................ 185
  7.3.1 Growth on Closed –CH-terminated Organic Surfaces .... 186
  7.3.2 Growth on Open π-terminated Organic Surfaces ........ 187
7.4 Outlook ........................................................................ 191
References ....................................................................... 191

8 Mechanisms Governing the Growth
of Organic Oligophenylene “Needles” on Au Substrates
K. Hänel and C. Wöll .................................................. 195
8.1 Introduction ............................................................. 195
8.2 Experimental .......................................................... 197
8.3 The Importance of Molecular Conformations in P4P .......... 198
8.4 Molecular Orientation and Conformation
  within Ultrathin P4P Films Grown on Gold Substrates:
    Studies using Soft X-ray Absorption Spectroscopy .......... 198
  8.4.1 Ultrathin Layer Containing only the α-Species ....... 199
  8.4.2 Full Monolayer Containing α- and β-Species ........ 202
  8.4.3 Multilayers ..................................................... 202
8.5 The Orientation of Organic Oligophenylene “Needles”
  on Gold Substrates .................................................. 203
8.6 Manipulation of Organic Needles
  Using an STM Operated under SEM Control ................. 206
  8.6.1 STM Studies of P4P Needles ......................... 207
  8.6.2 Manipulation of STM Needles ...................... 211
  8.6.3 STM Investigations of the Former Contact Area ..... 214
References ....................................................................... 215

Part III Optics

9 Nanooptics Using Organic Nanofibers
K. Thilsing-Hansen, S.I. Bozhevolnyi, and H.-G. Rubahn ......... 219
9.1 Morphology and Optical Response ............................... 219
  9.1.1 Static Response .............................................. 219
  9.1.2 Dynamic Response ........................................ 220
9.2 Guiding of Electromagnetic Waves ................................. 225
9.3 Spatial Distribution of Molecular Emitters ..................... 228
9.4 The Optical Near Field of Nanofibers .............................. 231
  9.4.1 Single Photon Tunneling Microscopy ................ 231
  9.4.2 Two-photon Near Field Microscopy ................ 234
9.5 Conclusions ............................................................ 236
References ....................................................................... 237
## 10 Optical Gain and Random Lasing in Self-Assembled Organic Nanofibers

*F. Quochi, F. Cordella, A. Mura, and G. Bongiovanni* .............................................. 239

10.1 Introduction ................................................. 239
10.2 Overview on Random Lasing .................................. 240
10.3 Experimental Techniques ...................................... 241
10.4 Random Lasing and Amplified Spontaneous Emission in Close-Packed Organic Nanofibers ............................. 242
10.5 Optical Amplification and Random Laser Action in Single Organic Nanofibers ................................. 247
10.5.1 Coherent Random Lasing in Single Nanofibers ............... 247
10.5.2 Optical Amplification in Single Nanofibers ............... 252
10.6 Potential Applications of Self-assembled Organic Nanofibers ....................................................... 255
10.7 Summary and Conclusions ..................................... 257

References ........................................................ 258

### Part IV Applications

## 11 Fabrication and Characterization of Self-Organized Nanostructured Organic Thin Films and Devices

*A. Andreev, C. Teichert, B. Singh, and N.S. Sariciftci* .............................................. 263

11.1 Introduction .................................................. 263
11.2 Experimental Methods ......................................... 265
11.2.1 Organic Materials and Growth Techniques ..................... 265
11.2.2 OFET: Device Fabrication ................................... 266
11.2.3 Electrical Characterization Using an OFET (Operating Principle) ............................................. 267
11.2.4 Morphological Characterization of Organic Thin Films and Devices ........................................... 270
11.2.5 Optical and Structural Characterization of Organic Thin Films and Devices .................................. 270
11.3 Anisotropy of Self-Organized Organic Thin Films ............... 271
11.3.1 Anisotropic Epitaxial Growth of p-6P on Mica(001) ............... 271
11.3.2 Anisotropic Epitaxial Growth of p-6P on KCl(001) ............... 277
11.3.3 Anisotropic Epitaxial Growth of p-6P and p-4P on TiO<sub>2</sub> and Metal Surfaces ............................. 282
11.4 Luminescent and Lasing Properties of Anisotropic Organic Thin Films ............................................... 285
11.5 Devices Based on Organic Thin Films ............................... 288
11.5.1 OFETs Based on C<sub>50</sub> Thin Films Grown by HWE ............... 288
11.5.2 Anisotropic Current–Voltage Characteristics of p-6P Chains on Mica ........................................... 292
11.6 Conclusions ..................................................... 295

References ........................................................ 296
12 Device-Oriented Studies on Electrical, Optical and Mechanical Properties of Individual Organic Nanofibers

12.1 Introduction ................................................. 301
12.2 Toward Photonic Devices:
   The Optical Properties of Isolated Nanofibers ................. 303
   12.2.1 Preparation and Optical Detection .................. 303
   12.2.2 Nanofiber Tomography and Angular Light Emission .... 304
12.3 Studies on Electrical Properties .......................... 309
   12.3.1 Charge Injection and Transport ....................... 309
   12.3.2 Experiments on Single-Nanofiber Devices ............. 311
12.4 Nanofiber Mechanics ........................................ 315
   12.4.1 2-D Manipulation ..................................... 316
   12.4.2 3-D Manipulation ..................................... 320
12.5 Conclusions ................................................ 322
References ...................................................... 323

13 Device Treatment of Organic Nanofibers:
Embedding, Detaching, and Cutting
H. Sturm and H.-G. Rubahn .................................. 325
13.1 Introduction ................................................. 325
13.2 Coating of Organic Nanofibers on Mica ..................... 327
   13.2.1 Parameters Related to the Embedding of Organic Nanofibers:
         Thermal Conductivity and Thermal Expansion .......... 327
   13.2.2 Evaporation of Silicon Oxide ......................... 329
   13.2.3 Antibleaching Effect with SiO_x Coatings ............. 330
   13.2.4 Microscopical Analysis of Nanofibers on Mica, Covered by SiO_x .................. 330
13.3 Parameters Related to the Embedding of Organic Nanofibers:
   Preparation of Polymer Films .............................. 338
   13.3.1 Motivation for Encapsulation of Nanofibers in Polymers .......... 338
   13.3.2 Essential and Desirable Polymer Properties,
         Preparation Strategies ............................... 340
13.4 Cutting of Nanofibers ........................................ 342
13.5 Conclusions ................................................ 345
References ...................................................... 346

Index .......................................................... 347
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List of Acronyms and Symbols

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<td>Angular resolved UPS</td>
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HRXD  High resolution XRD
HWBE  Hot-wall beam epitaxy
HWE   Hot-wall epitaxy
ILC   Injection limited current
IR    Infrared
ITO   Indium tin oxide
KAP   Potassium acid phthalate
LEED  Low energy electron diffraction
LPA   Line profile analysis
LSM   Laser scanning microscope
LUMO  Lowest unoccupied molecular orbital
MBE   Molecular beam epitaxy
ML    Monolayer
MOCLP4 1-chloro,4′′′-methoxy-4,1′:4′,1″:4″,1‴-quaterphenylene
MOCNP4 1-cyano,4′′′-methoxy-4,1′:4′,1″:4″,1‴-quaterphenylene
MONHP4 1-amino,4′′′-methoxy-4,1′:4′,1″:4″,1‴-quaterphenylene
MOP4  1,4″-dimethoxy-4,1′:4′,1″:4″,1‴-quaterphenylene
NA    Numerical aperture
NC-AFM  Non-contact AFM
NEXAFS Near edge X-ray absorption fine structure spectroscopy
NLO   Nonlinear optics
NMeP4 1,4‴-bis(N,N-dimethylamino)-4,1′:4′,1″:4″,1‴-quaterphenylene
OFET  Organic field-effect transistor
OLED  Organic light-emitting diode
OMBD  Organic molecular beam deposition
OMBE  Organic molecular beam epitaxy
P2P   Biphenyl
p4P, P4P, p-4P para-quaterphenylene
p5P, P5P, p-5P para-quinquephenylene
p6P, P6P, p-6P para-hexaphenylene, para-sexiphenylene
PAX   Photoemission of adsorbed Xenon
PES   Photoelectron spectroscopy
PL    Photoluminescence
PMMA  Polymethylmethacrylate
PMT   Photomultiplier tube
PS    Polystyrene
PSP   para-sexiphenyl
PSTM  Photon-scanning tunneling microscope
PT    Piezoelectric tube
PTCDA Perylene-3,4,9,10-tetracarboxylic-3,4,9,10-dianhydride
PTFE  Hexafluoroethylene
PTV   Poly(2,5-thienylene vinylene)
RDS   Reflection difference spectroscopy
RFID  Radio frequency identification device
<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RHEED</td>
<td>Reflection high energy electron diffraction</td>
</tr>
<tr>
<td>RT</td>
<td>Room temperature</td>
</tr>
<tr>
<td>SAED</td>
<td>Selected area electron diffraction</td>
</tr>
<tr>
<td>SCL</td>
<td>Space-charge limited</td>
</tr>
<tr>
<td>SCLC</td>
<td>Space-charge limited current</td>
</tr>
<tr>
<td>SEM</td>
<td>Scanning electron microscope</td>
</tr>
<tr>
<td>SF-mode</td>
<td>Step flow mode</td>
</tr>
<tr>
<td>SFG</td>
<td>Sum frequency generation</td>
</tr>
<tr>
<td>SHG</td>
<td>Second harmonic generation</td>
</tr>
<tr>
<td>SK-mode</td>
<td>Stranski-Krastanov mode</td>
</tr>
<tr>
<td>SNOM</td>
<td>Scanning near field optical microscope</td>
</tr>
<tr>
<td>SPA-LEED</td>
<td>Spot profile analysis LEED</td>
</tr>
<tr>
<td>STM</td>
<td>Scanning tunneling microscope</td>
</tr>
<tr>
<td>TED</td>
<td>Transmission electron diffraction</td>
</tr>
<tr>
<td>TEM</td>
<td>Transmission electron microscope</td>
</tr>
<tr>
<td>TDS</td>
<td>Thermal desorption spectroscopy</td>
</tr>
<tr>
<td>TPI</td>
<td>Two-photon intensity</td>
</tr>
<tr>
<td>TPI-SNOM</td>
<td>Two-photon intensity near field optical microscope</td>
</tr>
<tr>
<td>UHV</td>
<td>Ultra high vacuum</td>
</tr>
<tr>
<td>UPS</td>
<td>Ultraviolet photoemission spectroscopy</td>
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<tr>
<td>UV</td>
<td>Ultraviolet</td>
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<tr>
<td>VM-mode</td>
<td>Volmer-Weber mode</td>
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<tr>
<td>XPS</td>
<td>X-ray photoemission spectroscopy</td>
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<tr>
<td>XRD</td>
<td>X-ray diffraction</td>
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