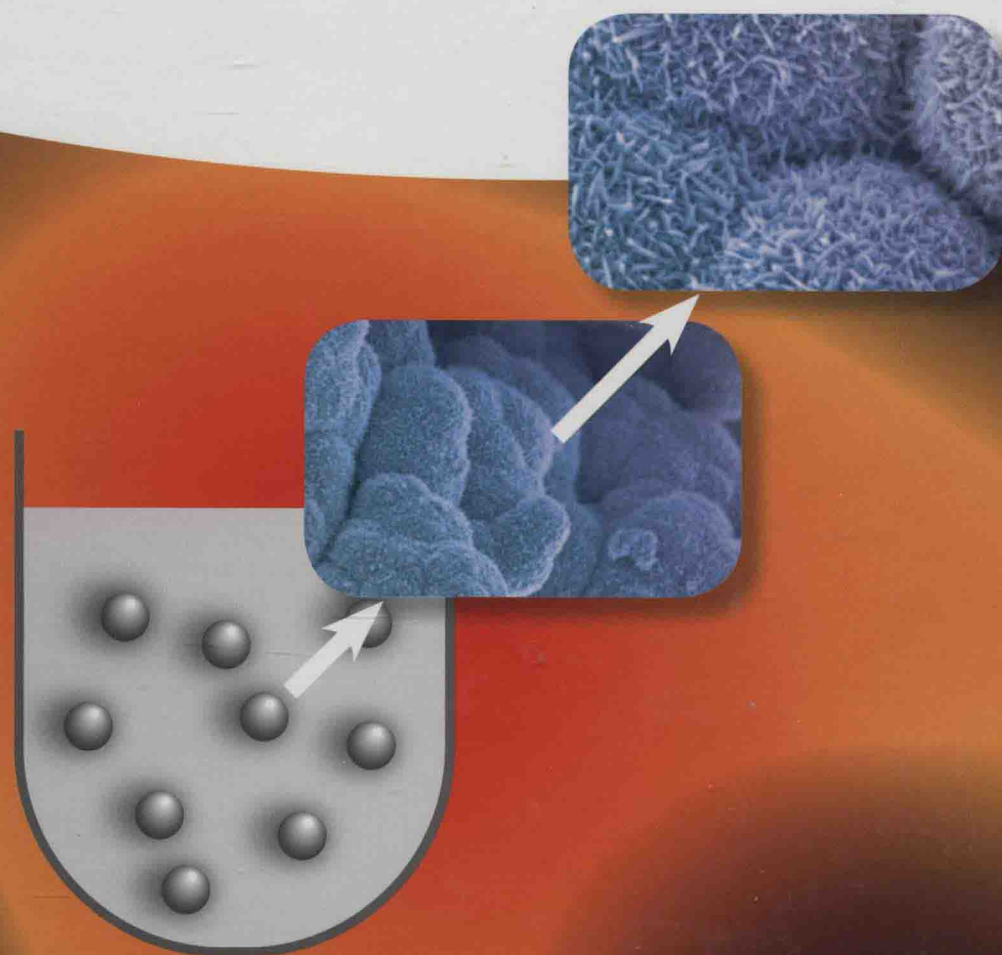


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Microwaves in Nanoparticle Synthesis

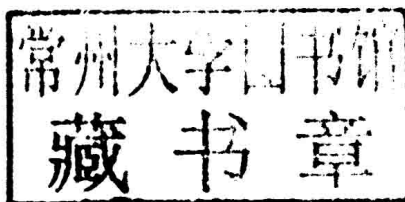
Fundamentals and Applications



Edited by Satoshi Horikoshi and Nick Serpone

Microwaves in Nanoparticle Synthesis

Fundamentals and Applications



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The cover picture shows Scanning
Electron Micrographs of γ -MnO₂
synthesized for 2 h, in lower
and higher magnification.
Taken from Chapter 10 of this
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Preface

The special optical characteristics imparted by metallic nanoparticles have been used in producing colored glass ever since the 4th century AD, even though the craftsmen were unable to see the nanoparticles and thus explain the true character of metallic colloids. The first scientific evaluation of a colloid (gold) was done by Michael Faraday in 1857; he remarked that colloidal gold sols have properties different from bulk gold (Chapter 1, Table 1.2). The history of nanomaterials dates back to 1959, when Richard P. Feynman, a physicist at Cal Tech, forecasted the advent of nanomaterials. In one of his classes he stated that “there is plenty of room at the bottom” and suggested that scaling down to the nano-level and starting from the bottom-up was the key to future technologies and advances. The remarkable progress in characterizing nanoparticles and unravelling novel physical and chemical properties of nanoparticles has opened the possibility of new materials. Simple preparation methods using various techniques to produce high-quality nanoparticles are now available (Chapter 1, Figure 1.4), one of which is the use of microwave heating that has attracted considerable attention worldwide. Several books have been written mostly on microwave-assisted organic syntheses in the past decade, yet none have dealt specifically with microwaves and inorganic materials except perhaps in the use of microwave radiation in the sintering of ceramics. The latter notwithstanding, research in nanoparticle syntheses with microwaves has seen a remarkable growth in the last several years.

The main purpose of this book is to give an overview of nanoparticle synthesis using the microwave method, with the first chapter providing an introduction to nanoparticles followed by two other chapters that explain some of the fundamentals of microwave heating (Chapters 2 and 3). In the remaining chapters several specialists in the field describe some of the specifics and variations in nanoparticle synthesis. As the data available in the literature were enormous, we had to make the difficult choice of including only the most relevant and up-to-date literature; we apologize to the reader if we missed to include other worthwhile contributions. Prominent in the book are abundant chemical information and some beautiful TEM data that define the structural features of nanoparticles. We are thankful to all the contributors who have answered the call, and also to the Wiley-VCH editorial staff for their thorough and professional assistance. The data presented would not have been possible without the fruitful collaboration of many university and

industrial researchers, and not least without the cooperation of students whose names appear in many of the earlier publications. We are indeed very grateful for their effort.

We hope this book becomes a starting point for researchers in other fields to become interested in pursuing microwave chemistry, in general, and microwave-assisted nanoparticle syntheses, in particular.

January 2013
Satoshi Horikoshi
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Contents

Preface *XI*

List of Contributors *XIII*

| | | |
|----------|--|-----------|
| 1 | Introduction to Nanoparticles | 1 |
| | <i>Satoshi Horikoshi and Nick Serpone</i> | |
| 1.1 | General Introduction to Nanoparticles | 1 |
| 1.2 | Methods of Nanoparticle Synthesis | 8 |
| 1.3 | Surface Plasmon Resonance and Coloring | 10 |
| 1.4 | Control of Size, Shape, and Structure | 12 |
| 1.4.1 | Size Control of Nanoparticles | 12 |
| 1.4.2 | Shape Control of Nanoparticles | 15 |
| 1.4.3 | Structure Control of Nanoparticles | 17 |
| 1.5 | Reducing Agent in Nanoparticle Synthesis | 18 |
| 1.6 | Applications of Metallic Nanoparticles | 19 |
| 1.6.1 | Application of Nanoparticles in Paints | 20 |
| 1.6.2 | Application in Chemical Catalysis | 20 |
| 1.6.3 | Application of Nanoparticles in Micro-wiring | 22 |
| 1.6.4 | Application of Nanoparticles in Medical Treatments | 22 |
| | References | 23 |
| | | |
| 2 | General Features of Microwave Chemistry | 25 |
| | <i>Satoshi Horikoshi and Nick Serpone</i> | |
| 2.1 | Microwave Heating | 25 |
| 2.2 | Some Applications of Microwave Heating | 26 |
| 2.3 | Microwave Chemistry | 29 |
| 2.3.1 | Microwaves in Organic Syntheses | 29 |
| 2.3.2 | Microwaves in Polymer Syntheses | 30 |
| 2.3.3 | Microwaves in Inorganic Syntheses | 31 |
| 2.3.4 | Microwave Extraction | 32 |
| 2.3.5 | Microwave Discharge Electrodeless Lamps | 32 |
| 2.4 | Microwave Chemical Reaction Equipment | 33 |
| | References | 36 |

| | | |
|----------|---|-----------|
| 3 | Considerations of Microwave Heating | 39 |
| | <i>Satoshi Horikoshi and Nick Serpone</i> | |
| 3.1 | General Considerations of Microwave Heating | 39 |
| 3.1.1 | Electromagnetic Waves and a Dielectric Material | 39 |
| 3.1.2 | Heating a Substance by the Microwaves' Alternating Electric Field | 40 |
| 3.1.3 | Heating a Dielectric by the Microwaves' Alternating Magnetic Field | 45 |
| 3.1.4 | Penetration Depth of Microwaves in a Dielectric Material | 45 |
| 3.1.5 | Frequency Effects in Chemical Reactions | 46 |
| 3.2 | Peculiar Microwave Heating | 47 |
| 3.2.1 | Special Temperature Distribution | 47 |
| 3.2.2 | Superheating | 49 |
| 3.2.3 | Selective Heating in Chemical Reactions | 50 |
| 3.3 | Relevant Points of Effective Microwave Heating | 52 |
| | References | 53 |
| | | |
| 4 | Combined Energy Sources in the Synthesis of Nanomaterials | 55 |
| | <i>Luisa Boffa, Silvia Tagliapietra, and Giancarlo Cravotto</i> | |
| 4.1 | Introduction | 55 |
| 4.2 | Simultaneous Ultrasound/Microwave Treatments | 58 |
| 4.3 | Sequential Ultrasound and Microwaves | 63 |
| 4.3.1 | Sequential Steps of the Same Reaction | 63 |
| 4.3.2 | Sequential Reactions | 69 |
| 4.4 | Conclusions | 72 |
| | References | 72 |
| | | |
| 5 | Nanoparticle Synthesis through Microwave Heating | 75 |
| | <i>Satoshi Horikoshi and Nick Serpone</i> | |
| 5.1 | Introduction | 75 |
| 5.2 | Microwave Frequency Effects | 76 |
| 5.2.1 | Synthesis of Ag Nanoparticles through the Efficient Use of 5.8-GHz Microwaves | 77 |
| 5.2.2 | Metal Nanoparticle Synthesis through the Use of 915-MHz Microwaves | 79 |
| 5.3 | Nanoparticle Synthesis under a Microwave Magnetic Field | 81 |
| 5.4 | Synthesis of Metal Nanoparticles by a Greener Microwave Hydrothermal Method | 84 |
| 5.5 | Nanoparticle Synthesis with Microwaves under Cooling Conditions | 85 |
| 5.6 | Positive Aspects of Microwaves' Thermal Distribution in Nanoparticle Synthesis | 87 |
| 5.7 | Microwave-Assisted Nanoparticle Synthesis in Continuous Flow Apparatuses | 90 |
| 5.7.1 | Microwave Desktop System of Nanoparticle Synthesis in a Continuous Flow Reactor | 91 |
| 5.7.2 | Synthesis of Metal Nanoparticles with a Hybrid Microreactor/Microwave System | 92 |

- 5.7.3 Other Examples of Continuous Microwave Nanoparticle Synthesis Equipment 94
- 5.7.4 Microwave Calcination Equipment for the Fabrication of Nanometallic Inks 95
- 5.7.5 Synthesis of Metal Nanoparticle Using Microwave Liquid Plasma 96
- 5.7.6 Compendium of Microwave-Assisted Nanoparticle Syntheses 96
- References 103

6 Microwave-Assisted Solution Synthesis of Nanomaterials 107

Xianluo Hu and Jimmy C. Yu

- 6.1 Introduction 107
- 6.2 Synthesis of ZnO Nanocrystals 110
 - 6.2.1 Synthesis of Colloidal ZnO Nanocrystals Clusters 111
 - 6.2.2 Controlled Growth of Basic and Complex ZnO Nanostructures 113
 - 6.2.3 Synthesis of ZnO Nanoparticles in Benzyl Alcohol 113
- 6.3 Synthesis of α -Fe₂O₃ Nanostructures 114
 - 6.3.1 α -Fe₂O₃ Hollow Spheres 115
 - 6.3.2 Monodisperse α -Fe₂O₃ Nanocrystals with Continuous Aspect-Ratio Tuning and Precise Shape Control 116
 - 6.3.3 Self-Assembled Hierarchical α -Fe₂O₃ Nanoarchitectures 118
- 6.4 Element-Based Nanostructures and Nanocomposite 118
 - 6.4.1 Silver Nanostructures 118
 - 6.4.2 Te Nanostructures 122
 - 6.4.3 Selenium/Carbon Colloids 123
- 6.5 Chalcogenide Nanostructures 125
 - 6.5.1 Cadmium Chalcogenides 125
 - 6.5.2 Lead Chalcogenides 129
 - 6.5.3 Zinc Chalcogenides 131
- 6.6 Graphene 132
- 6.7 Summary 135
- References 135

7 Precisely Controlled Synthesis of Metal Nanoparticles under Microwave Irradiation 145

Zhi Chen, Dai Mochizuki, and Yuji Wada

- 7.1 Introduction 145
 - 7.1.1 General Introduction—Green Chemistry 145
 - 7.1.2 Microwave Chemistry for the Preparation of Metal Nanoparticles 147
- 7.2 Precise Control of Single Component under Microwave Irradiation 152
 - 7.2.1 Spheres 152
 - 7.2.1.1 Au Nanoparticles 152
 - 7.2.1.2 Ag Nanoparticles 154
 - 7.2.1.3 Pt Nanoparticles 156

| | | |
|----------|--|------------|
| 7.2.1.4 | Pd, Ru, and Rh Nanoparticles | 157 |
| 7.2.1.5 | Other Transition Metals | 158 |
| 7.2.2 | Nanorods and Nanowires | 160 |
| 7.2.2.1 | Ag Nanorods and Nanowires | 160 |
| 7.2.2.2 | Au, Pt, Ni Nanorods and Nanowires | 161 |
| 7.2.3 | Other Morphologies | 162 |
| 7.2.3.1 | Au | 162 |
| 7.2.3.2 | Ag | 163 |
| 7.2.3.3 | Pt, Pd, Ni, and Co | 163 |
| 7.3 | Precise Control of Multicomponent Structures under Microwave Irradiation | 164 |
| 7.3.1 | Multicomponent Nanoparticles | 164 |
| 7.3.1.1 | Core–Shell Structures | 164 |
| 7.3.1.2 | Alloys | 168 |
| 7.3.2 | Metal Nanoparticles on Supports | 170 |
| 7.3.2.1 | Metal Oxide Supports | 170 |
| 7.3.2.2 | Carbon Material Supports | 171 |
| 7.3.2.3 | Other Supports | 176 |
| 7.4 | An Example of Mass Production Oriented to Application | 178 |
| 7.5 | Conclusion | 180 |
| | References | 180 |
| 8 | Microwave-Assisted Nonaqueous Routes to Metal Oxide Nanoparticles and Nanostructures | 185 |
| | <i>Markus Niederberger</i> | |
| 8.1 | Introduction | 185 |
| 8.2 | Nonaqueous Sol–Gel Chemistry | 186 |
| 8.3 | Polyol Route | 189 |
| 8.4 | Benzyl Alcohol Route | 191 |
| 8.5 | Other Mono-Alcohols | 197 |
| 8.6 | Ionic Liquids | 198 |
| 8.7 | Nonaqueous Microwave Chemistry beyond Metal Oxides | 199 |
| 8.8 | Summary and Outlook | 201 |
| | References | 202 |
| 9 | Input of Microwaves for Nanocrystal Synthesis and Surface Functionalization Focus on Iron Oxide Nanoparticles | 207 |
| | <i>Irena Milosevic, Erwann Guenin, Yoann Lalatonne, Farah Benyettou, Caroline de Montferrand, Frederic Geinguenaud, and Laurence Motte</i> | |
| 9.1 | Introduction | 207 |
| 9.2 | Biomedical Applications of Iron Oxide Nanoparticles | 208 |
| 9.3 | Nanoparticle Synthesis | 211 |
| 9.3.1 | Synthesis in Aqueous Solution | 211 |
| 9.3.1.1 | Coprecipitation Method | 211 |
| 9.3.1.2 | Forced Hydrolysis | 211 |

| | | |
|-----------|--|------------|
| 9.3.1.3 | Hydrothermal Method | 212 |
| 9.3.1.4 | Aqueous Sol–Gel Method | 212 |
| 9.3.1.5 | Direct Micelles Microemulsion Method | 212 |
| 9.3.2 | Synthesis in Non-Aqueous Solvent | 213 |
| 9.3.2.1 | Reverse Micelle Microemulsion Method | 213 |
| 9.3.2.2 | Non-Aqueous Sol–Gel Method | 213 |
| 9.3.2.3 | Polyol Synthesis | 213 |
| 9.3.2.4 | Thermal Decomposition | 214 |
| 9.4 | Nanoparticle Surface Functionalization | 214 |
| 9.4.1 | Hydrophobic Nanocrystals | 215 |
| 9.4.1.1 | Ligand Exchange | 215 |
| 9.4.1.2 | Surface Chemical Modification | 216 |
| 9.4.1.3 | Tails Interdigitation | 216 |
| 9.4.1.4 | Silica or Polymer Shell | 217 |
| 9.4.2 | Water Soluble Nanocrystals | 217 |
| 9.4.2.1 | Direct Surface Functionalization | 217 |
| 9.4.2.2 | Two-Step Surface Functionalization | 219 |
| 9.5 | Microwave-Assisted Chemistry | 222 |
| 9.5.1 | Microwave-Assisted Synthesis of Nanoparticles | 223 |
| 9.5.1.1 | Microwave-Assisted Hydrothermal Method | 223 |
| 9.5.1.2 | Microwave-Assisted Solvothermal Method | 227 |
| 9.5.2 | Microwave-Assisted Functionalization of Nanoparticles | 229 |
| 9.5.2.1 | Gold Nanoparticle Microwave Functionalization | 230 |
| 9.5.2.2 | Iron Oxide Nanoparticle Microwave Functionalization | 231 |
| 9.5.2.3 | Microwave-Assisted Silica Encapsulation of Iron Oxide Nanoparticles | 234 |
| 9.5.2.4 | Europium Oxide Nanoparticle Microwave Functionalization | 235 |
| 9.6 | Conclusions | 236 |
| | References | 236 |
| 10 | Microwave-Assisted Continuous Synthesis of Inorganic Nanomaterials | 247 |
| | <i>Naftali N. Opembe, Hui Huang, and Steven L. Suib</i> | |
| 10.1 | Introduction and Overview | 247 |
| 10.2 | Microwave-Assisted Continuous Synthesis of Inorganic Nanomaterials | 249 |
| 10.3 | Types of Microwave Apparatus Used in Continuous Synthesis | 250 |
| 10.4 | Microwave Continuous Synthesis of Molecular Sieve Materials | 253 |
| 10.5 | Microwave Continuous Synthesis of Metal Oxides and Mixed Metal Oxide Materials | 259 |
| 10.6 | Microwave Continuous Synthesis of Metallic Nanomaterials | 267 |
| 10.7 | Conclusions and Outlook | 268 |
| | References | 269 |