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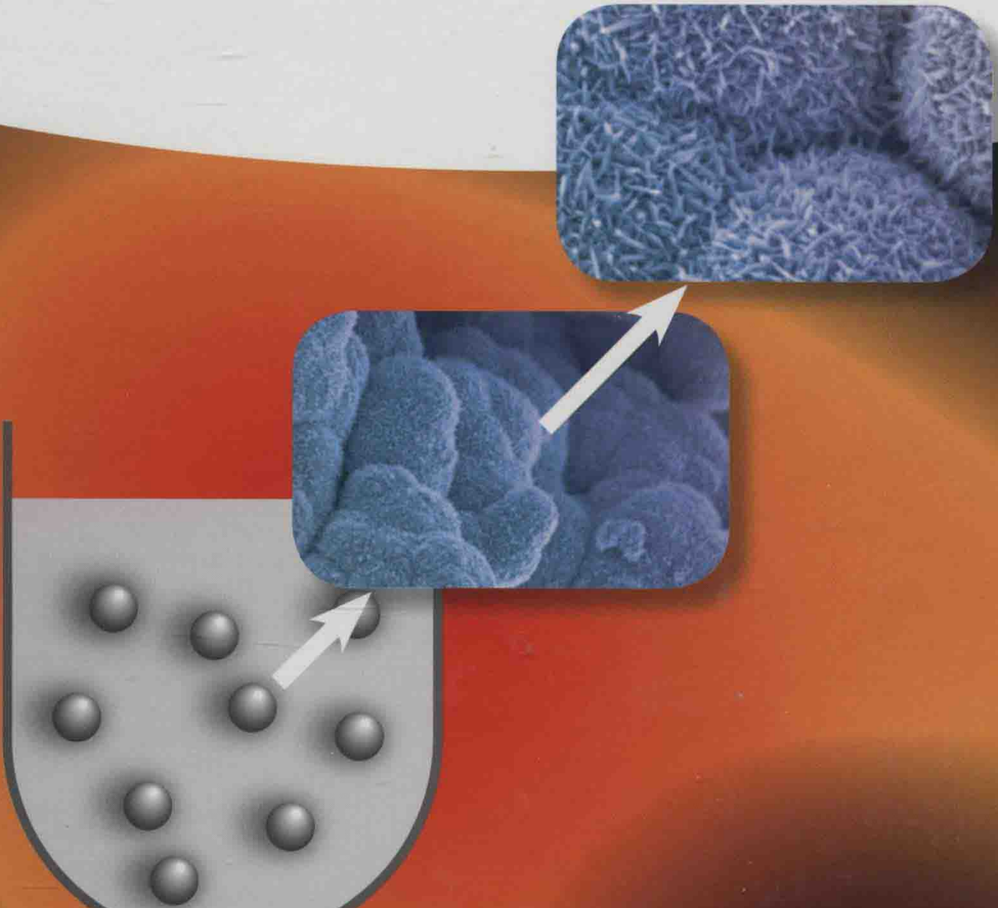
Edited by
Satoshi Horikoshi and Nick Serpone

Microwaves in Nanoparticle Synthesis

Fundamentals and Applications



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The Editors

Prof. Satoshi Horikoshi
Sophia University
Dep. of Materials and
Life Sciences
7-1 Kioicho, Chiyodaku
Tokyo 102-8554
Japan

Prof. Nick Serpone
Visiting Professor
Universita di Pavia
Dipartimento di Chimica
Gruppo Fotochimico
Via Taramelli 10
Pavia 27100
Italy

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 book, Figure 18, with permission.

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Preface

The special optical characteristics imparted by metallic nanoparticles have been used in producing colored glass ever since the 4^{th} 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
Nick Serpone

List of Contributors

Farah Benyettou
UMR 7244 CNRS, University of Paris 13
CSPBAT Laboratory
74 rue Marcel Cachin, 93017 Bobigny
France

Luisa Boffa
Università di Torino
Dipartimento di Scienza e Tecnologia del Farmaco
via P. Giuria 9
10125 Torino
Italy

Zhi Chen
Tokyo Institute of Technology
Department of Applied Chemistry
Graduate School of Science and Engineering
2-12-1 Ookayama
Meguro, Tokyo 152-8552
Japan

Giancarlo Cravotto
Università di Torino
Dipartimento di Scienza e Tecnologia del Farmaco
via P. Giuria 9
10125 Torino
Italy

Caroline de Montferrand
UMR 7244 CNRS, University of Paris 13
CSPBAT Laboratory
74 rue Marcel Cachin, 93017 Bobigny
France

Davide Garella
Università di Torino
Dipartimento di Scienza e Tecnologia del Farmaco
via P. Giuria 9
10125 Torino
Italy

Frederic Geinguenaud
UMR 7244 CNRS, University of Paris 13
CSPBAT Laboratory
74 rue Marcel Cachin, 93017 Bobigny
France

Erwann Guenin
UMR 7244 CNRS, University of Paris 13
CSPBAT Laboratory
74 rue Marcel Cachin, 93017 Bobigny
France

Satoshi Horikoshi
Sophia University
Faculty of Science and Technology
Department of Materials and Life Sciences
7-1 Kioicho
Chiyodaku, Tokyo 102-8554
Japan

Xianluo Hu
Huazhong University of Science and Technology
College of Materials Science and Engineering
State Key Laboratory of Material Processing and Die & Mould Technology
Wuhan 430074
China

Hui Huang
University of Connecticut
Department of Chemistry
55 North Eagleville Road
Storrs, CT 06269-3060
USA

Yoann Lalatonne
UMR 7244 CNRS, University of Paris 13
CSPBAT Laboratory
74 rue Marcel Cachin, 93017 Bobigny
France

Irena Milosevic
UMR 7244 CNRS, University of Paris 13
CSPBAT Laboratory
74 rue Marcel Cachin, 93017 Bobigny
France

Dai Mochizuki
Tokyo Institute of Technology
Department of Applied Chemistry
Graduate School of Science and Engineering
2-12-1 Ookayama
Meguro, Tokyo 152-8552
Japan

Laurence Motte
UMR 7244 CNRS, University of Paris 13
CSPBAT Laboratory
74 rue Marcel Cachin, 93017 Bobigny
France

Markus Niederberger
ETH Zürich
Laboratory for Multifunctional Materials
Department of Materials
Wolfgang-Pauli-Strasse 10
8093 Zürich
Switzerland

Naftali N. Opembe
University of Connecticut
Department of Chemistry
55 North Eagleville Road
Storrs, CT 06269-3060
USA

Nick Serpone
Universita di Pavia
Dipartimento di Chimica
Gruppo Fotochimico
Via Taramelli 10
Pavia 27100
Italy

Steven L. Suib
University of Connecticut
Department of Chemistry
55 North Eagleville Road
Storrs, CT 06269-3060
USA

Silvia Tagliapietra
Università di Torino
Dipartimento di Scienza e Tecnologia del Farmaco
via P. Giuria 9
10125 Torino
Italy

Dorothée Vinga Szabó
Karlsruhe Institute of Technology
Institute for Applied Materials – Materials Process Technology
Hermann-von-Helmholtz-Platz 1
76344 Eggenstein-Leopoldshafen
Germany

Yuji Wada
Tokyo Institute of Technology
Department of Applied Chemistry
Graduate School of Science and Engineering
2-12-1 Ookayama
Meguro, Tokyo 152-8552
Japan

Jimmy C. Yu
The Chinese University of Hong Kong
Department of Chemistry
Shatin, New Territories, Hong Kong
China

Contents