Nanotubes and Nanofibers

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Nanotubes and Nanofibers

Edited By
Yury Gogotsi
Drexel University,
Philadelphia, Pennsylvania, USA

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This book is dedicated to my father, Professor George Gogotsi,
who inspired me to become a scientist.

Preface

Nanomaterials, which are materials with structural units on a nanometer scale in at least one direction, is the fastest growing area in materials science and engineering. Material properties become different on the nanoscale: for example, the theoretical strength of materials can be reached or quantum effects may appear. One-dimensional and quasi-one-dimensional materials such as nanotubes and nanowires demonstrate many extreme properties that can be tuned by controlling their structure and diameter. Nanotubes, nanowires, and nanofibers are not only excellent tools for studying one-dimensional phenomena, but they are also certainly among the most important and promising nanomaterials and nanostructures. The role of nanomaterials in industries is growing. Nanofibers are already used for insulation and reinforcement of composites, and many materials and structures incorporating nanotubes and nanowires are under development. Extensions to other tubular and rodlike or wirelike structures provide the scope for new discoveries and novel applications.

This book describes a large variety of nanotubes, nanofibers, and related structures such as whiskers and nanowires. This area is very broad; it is impossible to cover all fibrous nanomaterials in a single volume. Carbon nanotubes (Chapters 1 and 2) receive special attention in this book because carbon is as important for nanotechnology as silicon is for electronics. Sumio Iijima's discovery of carbon nanotubes in 1991 stimulated the development of the whole nanotechnology field. Since then, a dramatic progress in synthesis and purification of nanotubes has been achieved and many applications have emerged. After carbon, many other materials have been produced in the tubular shape with nanometer diameters.

Designed specifically to provide an overview of nanotubes and nanofibers for today's scientists, graduate students, and engineering professionals, the book will offer a treatment of subjects using terms familiar to a materials scientist or engineer. The book consists of eight chapters selected from the recently published *Nanomaterials Handbook* and is written by the leading researchers in the field. Providing coverage of the latest material developments in the United States, Asia, Europe, and Australia, the book describes both commercially available and emerging materials.

Finally, I would like to acknowledge all the people who have been helpful in making this book possible. My family was very patient and understanding, and my students and postdocs did a great job allowing me to concentrate on the book project. The staff of Taylor & Francis helped immensely.

Yury Gogotsi
Philadelphia, PA

Editor

Dr. Yury Gogotsi is professor of materials science and engineering at Drexel University in Philadelphia, Pennsylvania. He also holds appointments in the Departments of Chemistry and Mechanical Engineering at Drexel University and serves as director of the A.J. Drexel Nanotechnology Institute and associate dean of the College of Engineering. He received his M.S. (1984) and Ph.D. (1986) degrees from Kiev Polytechnic and a D.Sc. degree from the Institute of Materials Science, Ukrainian Academy of Science, in 1995. His research group works on carbon nanotubes, nanoporous carbide-derived carbons, and nanofluidics. He has also contributed to the areas of structural ceramics, corrosion of ceramic materials, and pressure-induced phase transformations, creating a new research field called high pressure surface science and engineering. He has coauthored 2 books, edited 9 books, obtained more than 20 patents, and authored about 200 journal papers and 12 book chapters. He has advised a large number of M.S., Ph.D., and post-doctoral students at Drexel University and University of Illinois at Chicago.

Gogotsi has received several awards for his research, including I.N. Frantsevich Prize from the Ukrainian Academy of Science, S. Somiya Award from the International Union of Materials Research Societies, G.C. Kuczynski Prize from the International Institute for the Science of Sintering, and Roland B. Snow Award from the American Ceramic Society (twice). He has been elected a fellow of the American Ceramic Society, academician of the World Academy of Ceramics, and full member of the International Institute for the Science of Sintering.

Contributors

Ying Chen
Department of Electronic Materials Engineering
Research School of Physical Sciences and Engineering
The Australian National University
Canberra, Australia

Svetlana Dimovski
Department of Materials Science and Engineering
Drexel University
Philadelphia, Pennsylvania

Fangming Du
Department of Chemical and Biomolecular Engineering
University of Pennsylvania
Philadelphia, Pennsylvania

John E. Fischer
Department of Materials Science and Engineering
University of Pennsylvania
Philadelphia, Pennsylvania

Yury Gogotsi
Department of Materials Science and Engineering
Drexel University
Philadelphia, Pennsylvania

Frank K. Ko
Department of Materials Science and Engineering
Drexel University
Philadelphia, Pennsylvania

Eduard G. Rakov
D.I. Mendeleev University of Chemical Technology
Moscow, Russia

Jonathan E. Spanier
Department of Materials Science and Engineering
Drexel University
Philadelphia, Pennsylvania

R. Tenne
Department of Materials and Interfaces
Weizmann Institute
Rehovot, Israel

Karen I. Winey
Department of Materials Science and Engineering
University of Pennsylvania
Philadelphia, Pennsylvania

Hongzhou Zhang
Department of Electronic Materials Engineering
Research School of Physical Sciences and Engineering
The Australian National University
Canberra, Australia

Table of Contents