

Stuff Matters: Exploring the Marvelous Materials That Shape Our Man-Made World
Mark Miodownik

Houghton Mifflin Harcourt, 2014
272 pages, \$15.95
ISBN 978-0544236042

I was a bit intimidated when I first realized the book that I was reviewing had also been reviewed by the *Wall Street Journal*, *New York Times*, and the *Guardian*, among others. As a PhD materials scientist, I already think that materials “matter.” What could I learn from a book on the science behind common materials that is geared toward the general public?

But I dived in and ... loved it. It is a great book. Miodownik is the head of the Materials Science Department of University College London. He loves materials and wants you to love them, too. He weaves together a delightful story of materials, told around events in his life and his fascination with common items—from chocolate to his mum’s tea-cups—with sheer imagination. The centerpiece of the book is a picture of him writing on his rooftop apartment, and he tells you about all the materials within

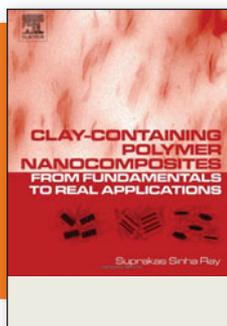
his touch (paper, graphite) and within his gaze (steel, a concrete and glass tower). The pondering of the objects in the picture are expanded with anecdotes—he was stabbed as a teenager with a razor blade, and then became so fascinated with steel that he went on to study metallurgy at Oxford. He crashed through his car window and so tells about standard glass and safety glass. He tore a ligament and so gives a tour of bioengineered materials.

Miodownik is almost desperate to get you to stop, look, and think about the materials around you. He makes this materials lesson easy with his fluid writing style and enthusiasm. You cannot help but be charmed by the materials as he describes them, as one might tell the life story of an old friend. SiO₂ aerogel is anthropomorphized as the author “worries that it wasn’t being treated right,” and he ponders why people generally have no affection for glass. Steel is “indomitable,” and paper is “trustful.”

The book is also playful, with the style of the book changing from chapter to chapter. For plastics, he writes a play about the discovery of plastic by John Wesley Hyatt involving a western pool hall, dentistry, and George Eastman strolling into Hyatt’s office to start the age of modern photography and film through the use of celluloid. With all of this outpouring of love, history, and science of materials woven into stories of common items and events, the book is an easy read.

I recommend this book to all materials scientists and engineers, because it’s a love story about materials, and you cannot help but feel great about your chosen profession as you read the book. I also learned quite a bit, even in parts that were quite obvious to me (metals are, in fact, made of crystals). The book is educational because of the history and beautifully simple language used to explain complex topics (e.g., diamond versus graphite versus graphene). It would also be a good book for a materials scientist to give to friends and relatives who are puzzled by their love of materials science—it might help to explain why your job is so cool.

Reviewer: Karen Swider Lyons
researches fuel cell and battery materials and their integration into naval systems in Alexandria, Va., USA.



Clay-Containing Polymer Nanocomposites: From Fundamentals to Real Applications
Suprakas Sinha Ray

Elsevier, 2013
416 pages
ISBN 978-0-444-59437-2

Clay-containing polymers are a new class of composite material that are gaining more importance in technological applications. These composites belong to the class of two-dimensional nanocomposites. The worldwide market for these materials today is estimated to be in the range of one billion US dollars;

within the next five years this figure is expected to at least double.

The book, divided into 13 chapters, discusses every aspect important in understanding the structure and applications of these materials. Most chapters start with the theoretical background, but the book is written in a way that makes

skipping these sections possible. This is of great importance for the wider readership. This is a book about polymers; therefore, a broad knowledge of polymer chemistry is an advantage but not necessary to understand the details of the properties of this type of nanocomposite. The topics treated in this book range from classification of different types of clays and polymers and the preparation of the composite, to properties and characterization. Looking at properties, the discussion starts with mechanical properties, leads to barrier properties and mechanical stability, then to the most important fire-retardant properties. Fire retardancy is the primary reason for the huge technical and economic

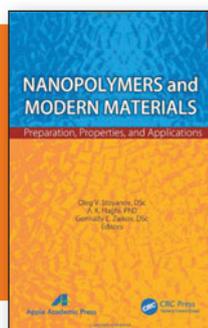
success of these materials, especially in the automotive industry. In regard to characterization, all types of microscopies, including electron microscopy, atomic force microscopy, and optical microscopy, are treated in detail. Also, methods for detailed analysis of the structure at different stages of synthesis (i.e., x-ray diffraction and small-angle x-ray scattering) are explained. For characterization of the organic phase, nuclear magnetic resonance and

infrared spectroscopy are discussed. Most importantly for the production of technical parts, the rheology of these composites is treated in detail.

At the end of each chapter, the author gives a long list of references as well as an adequate and helpful index at the end of the book. Independent of any scientific or technical background, the reader will be able to gain a huge amount of information from this excellent book. However, there are two deficiencies:

the author uses a lot of acronyms likely known only to the specialist, so the non-expert is always searching for the meaning of these letter combinations. Furthermore, considering the technological importance of these materials, four out of nearly 400 pages describing applications and suppliers are not adequate.

Reviewer: Dieter Vollath is CEO of NanoConsulting, Stutensee, Germany.



Nanopolymers and Modern Materials: Preparation, Properties, and Applications
Editors: Oleg V. Stoyanov, A.K. Haghi, and Gennady E. Zaikov

Apple Academic Press, 2013
\$49.95, 664 pages
ISBN 9781926895475

This book makes a clever attempt to discuss bio- and chemical interactions and modifications involving new polymer formation. At a high level, the book is poorly organized, with no flow or smooth transition from one chapter to the next. Most of the chapters are written keeping a specific journal in mind, and not considering either the quality of the end product, the book, or the end users/readers.

Chapter 1 talks about the Ni-based catalyst and its hydrogen bond stabilities. Chapters 2, 3, and 4 cover materials on new polymer processing and formation (PS-PPO, oxyethylated polytetrafluoroethylene, polypropylene, high-pressure phase equilibrium, and conductive electroactive polymers, quaternary ammonium salt-modified cellulose esters, and ethers), which is valuable for scientists with prior knowledge of

this field. However, for ordinary readers or students, the organization could have been more useful if all three chapters were instead merged into one, starting with theory or equations, then processing steps, and finally examples of specific applications.

Chapter 5 describes different aspects of transformations of high-energy bonds in ATP (adenosine triphosphate). Chapter 6 explains energy transfer processes in depth between carbocyanine and DNA. Chapter 7 talks about quantum chemical modeling, and chapter 8 discusses the kinetics model of methyl acetate hydrolysis. These chapters could have been condensed into one chapter for a smoother flow. Chapter 9 eloquently discusses the influence of a growth regulator to metabolic pathways of animal cells. Chapters 10 and 11 discuss biochemical treatments very

effectively, but these could have also been merged into one.

Chapters 12, 15, 16, and 19 cover useful information regarding electrospinning of new polymeric fibers, which shows the depth of knowledge and expertise of the respective authors; however, there is almost no discussion on why electrospinning was chosen over conventional spinning. There could be a strong case for electrospinning, but some explanation should have been provided for a broader audience. Again, all of these chapters on electrospinning could have been merged into one, starting with the theory of electrospinning, process details, and a few specific applications/case studies.

Chapters 17 and 18 discuss topics on bioactive substances, and the book ends at chapter 20 with an appropriate discussion on composites of these new classes of polymers.

This book contains useful information suitable for professionals with prior subject knowledge. It could have been improved for non-specialists if it were structured differently.

Reviewer: Sudip Mukhopadhyay is a Technology Fellow at Honeywell, Calif., USA.