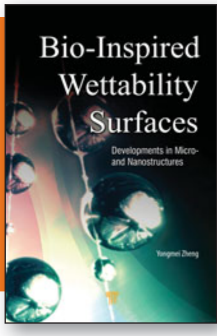


Bio-Inspired Wettability Surfaces: Developments in Micro- and Nanostructures

Yongmei Zheng

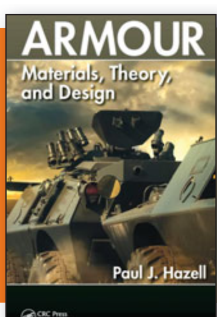
Pan Stanford, 2015
216 pages, $134.96 (e-book $104.97)
ISBN 9789814463607

This monograph unveils a series of natural phenomena for scientists to design and discover novel micro- and nanostructure patterns built by exploiting surface features of various microheterogeneous systems. It comprises slightly more than 200 pages structured in four chapters, each starting with a theoretical background on the natural phenomena involved, and following with their translation to methods specific to nanofabrication in promising applications. The work is well illustrated with figures, including relevant scanning electron microscope images and contact-angle measurements provided from recent bibliographic references.

Being at the boundary of classical physical chemistry of colloids and the emerging fields of nanosciences and nanotechnologies, four examples of wettability surface effects provided by some plants and animals are explained in detail and exploited to create novel artificial surfaces and functions: ultrahydrophobic water repellency on a lotus leaf (chapter 1), direction adhesion of a super-hydrophobic butterfly wing (chapter 2), directional water collection on wetted spider silk (chapter 3), and the fog-collecting hydrophilic/hydrophobic pattern on a beetle's back (chapter 4). These concepts represent strong and versatile tools to imagine template-mimicking methods able to transfer nature's intelligence into valuable smart bioinspired materials and nanostructures. Indeed, the key points of this monograph stand in the wide applicative potential and development perspectives in various key-enabling technologies, such as stimuli-responsive superoleophobic materials (pH, thermal, ultraviolet, electric, magnetic) for lab-on-chip systems, biosensors, drug delivery, and nanodevices, to benefit human health, energy, and environment in the near future.

This book particularly addresses specialists in materials science, colloidal chemistry, physics, chemical and metal engineering, polymer science, mechanics, energy fuels, and environmental science and technology who have an interest in bioinspired wettability of surfaces.

Reviewer: Aurelia Meghea *is emeritus professor at the University Politehnica of Bucharest, Romania.*



Armour: Materials, Theory, and Design

Paul J. Hazell

CRC Press, 2015
395 pages, $125.96 (e-book $97.97)
ISBN 9781482238297

There are few materials-based technologies that have had a larger impact on human society and civilization than armor, as its robustness and ability to either be defeated or withstand defeat has decided the course of nations. However, I cannot recall thinking of armor during my studies and research as a materials scientist before reading Paul J. Hazell's book on the topic. But I am now grateful to have the opportunity to understand it better.

Hazell is a professor from the University of New South Wales (UNSW), Australia. He presently serves as the professor of impact dynamics in the School of Engineering and Information Technology at UNSW Canberra. In the book preface, he also claims a history of teaching at defense academies in both the United Kingdom (UK) and Australia.

Hazell's experience and clear understanding of the topic of armor is apparent in his book. The author easily demystifies how armor is used and behaves and its interactions with munitions. After a basic introduction to the mechanics of materials, the book describes the basic mathematics associated with bullets, blast, jets, and fragments. From there, chapters are focused on penetration mechanics and stress waves before the book returns to its materials focus with chapters on the structure and performance of metallic, ceramic, woven fabric, and reactive armors. Numerous examples are given on how to calculate the damage, fragments, or failures that occur with different materials combinations, ballistic designs, and structures for different penetration and stress conditions. The book wraps up with chapters on human vulnerability and testing techniques. Each chapter contains questions to technical problems along with answers. The book also gives the origin of many of the calculations used with the science and engineering of armor, as much of the math was determined over a century ago and is semi-empirical. The result is a critical perspective on the errors associated with many of the semi-empirical calculations.

As someone who was not very knowledgeable about armor at the onset of reading, I found the book extremely informative. While the actual design of armor and the defeat of it has the basis in much deeper mathematics and studies

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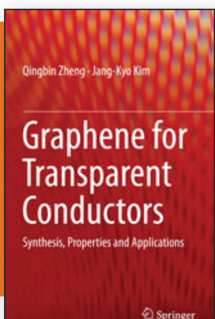
than covered in the book, it provides the full overview and references needed for a full perspective.

This book will be highly useful to materials scientists and engineers beyond those explicitly interested in armor and munitions, as the mathematics and mechanics of materials presented in the book are of immediate use to anyone researching impact-absorbing materials. Relevant fields range from medical implants to civil and automotive engineering. The classical knowledge of armor and impact could also find relevance in fields of ion bombardment and nanomanufacturing techniques. I can also see this as a good short-course textbook for undergraduate and even graduate mechanics of materials classes, as it clearly illustrates practical examples of how the mechanics, composition, and formulation of materials affect their ability to damage or withstand damage from another material. Additionally, the book contains useful charts and tables that summarize the mechanical attributes (e.g., fracture toughness, Young's modulus). It falls short of being a comprehensive mechanics of materials book because it does not address all mechanical attributes of materials behavior, such as time-dependent creep, and the materials focus is on those used for armor. The only small drawback of the book is that the references clearly emphasize innovations derived from the UK, and a broader source of resources would have brought more balance. However, it fully meets its purpose of describing the materials, theory, and design of armor, and most materials scientists (and even some military historians) would greatly benefit from reading it to gain a grounded perspective on how the mechanics of materials has affected the survivability of armies, and thus largely determined the path of history.

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



Graphene for Transparent Conductors: Synthesis, Properties and Applications
Qingbin Zheng and Jang-Kyo Kim
Springer, 2015
220 pages, $129.00 (e-book $99.00)
ISBN 978-1-4939-2768-5

After reading this book three times, I found it to be a valuable resource and easy to read. This book gives a quick overview for anyone who wants to know all that is happening in the indium tin oxide (ITO) replacement space, and where graphene could fit in if and when a suitable application and a willing and able market are met. To the credit of the authors, no outrageous claims are made either in terms of its potential or to find real applications.

Chapter 1 nicely introduces all of the ITO replacement options, including transparent conductive oxides with reduced amounts of indium, transparent conducting polymers, transparent conducting metals, and transparent conducting carbon, including graphene.

Chapter 2 eloquently describes the synthesis, structure, and properties of graphene and graphene oxide. It includes discussions of the electronic/electrical, thermal, optical, and mechanical properties of these films. It also includes useful detailed information of characterization tools that are commonly used in laboratories, such as atomic force microscopy, electron microscopy, scanning tunneling microscopy, and Raman spectroscopy.

Chapter 3 includes adequate information on different practical fabrication or deposition techniques, such as electrophoretic deposition, spin coating, spray coating, dip coating, rod coating, and even inkjet coating with valuable details of each approach.

Chapter 4 discusses improving electrical conductivity and transparencies by chemical doping, adding nanofillers, including other ITO replacement materials such as single-wall carbon nanotubes, Ag nanowires, ZnO nanorods, and metal grids. Graphene oxide is also considered and described in these contexts.

Chapter 5 briefly describes potential applications in display touchscreens, light-emitting diodes, solar cells, transistors, electromagnetic interference shielding, and functional glass for transparent solutions looking for a killer application.

Chapter 6 is a prospective chapter that clearly mentions all the potential challenges ahead and possible applications.

This book does not include worked examples or homework problems for use as a textbook. Instead, due to the emphasis on applications rather than fundamentals, this is more appropriate for readers in industry. It is an enjoyable read with rich and valuable references to original works. It can be used as a fantastic learning tool for anyone who wants to get an overview of where graphene research is heading in terms of finding real applications, or for anyone looking for an application that could create and serve a niche market.

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