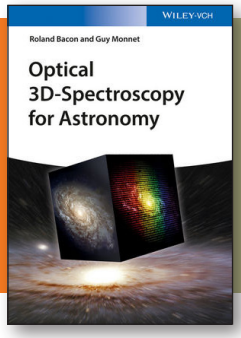


Optical 3D-Spectroscopy for Astronomy

Roland Bacon and Guy Monnet

Wiley-VCH, 2017
296 pages, $175.00 hardcover (e-book $140.99)
ISBN 978-3-527-41202-0

This book reviews the variants of three-dimensional (3D) spectroscopy techniques utilized in astronomy, although many of the topics are highly relevant to small-scale and earth-based spectroscopy applications as well. Of important note, the authors place their emphasis on the use of spectroscopy in the range of 300–2400 nm.

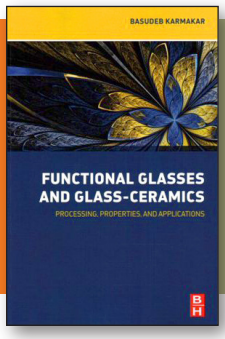
The book is split into two main sections: instrumentation and application of 3D spectroscopy. Chapter 1 opens with a discussion on the properties of optical components important to spectroscopy, which should be of interest to any spectroscopist. Chapter 2 delves into multi-object spectroscopy, which is a popular technique for spectroscopy through-the-telescope. Originally used for surveying multiple stars and galaxies at once, it is now employed for studying dark energy. Chapter 3 focuses on scanning spectroscopy, including discussion on Fourier transform and Fabry–Perót spectroscopy. Chapters 4 and 5 review the designs and trends in integral field spectroscopy, which is simply hyperspectral imaging by another name. Finally, chapters 6 and 7 compare the aforementioned techniques and discuss the future of 3D spectroscopy in astronomy. All of these topics are covered with sufficient depth, and the authors provide an authoritative explanation of the theory and applications of spectroscopy.

In Part II, the authors shift their focus to data and the impact of the atmosphere on data collection. Chapter 10 is intriguing, as it discusses data collection strategies. Astronomers have to consider the sun and weather when planning an experiment, but they must also keep in mind the variables that any spectroscopist is concerned with: noise, exposure time, and calibration. Chapters 11 and 12 focus on data handling and data analysis. These two chapters provide a very brief overview of analysis techniques and software packages that are available; they do not provide extensive details or mathematical insights into the actual analyses. For readers interested in detailed instructions on how to analyze spectroscopy data, the authors provide suggestions for other books on those topics.

From an aesthetic point of view, this book is well designed. Figures are informative, interesting, and colorful. Appropriate equations are included, and the authors do not overwhelm the reader with too much mathematics. Most chapters conclude with a series of thoughtful homework exercises with answers provided. The writing is very conversational in tone, making the content readable for specialists and nonspecialists alike. Finally, the references are adequate and up to date.

This book provides a wealth of information for anyone with a basic understanding of spectroscopy who is looking to dig a little deeper, or for anyone who is interested in using spectroscopy for astronomy or remote sensing purposes. This book could be used as a spectroscopy textbook or as an astronomy instrumentation text at the graduate level or senior undergraduate level, but instructors should keep in mind that the chapters on data analysis do not go into as much depth as the chapters in the first half of the book.

Reviewer: Anthony Stender *is an assistant professor of analytical chemistry at Ohio University, USA.*



Functional Glasses and Glass-Ceramics: Processing, Properties, and Applications

Basudeb Karmakar

Elsevier, 2017
416 pages, $170.00 (e-book $170.00)
ISBN 9780128050569

Functional glasses and glass-ceramics perform specific functions that are used to accomplish specific application needs or intelligent actions, according to the author. This book covers a wide range of materials synthesis, property evaluation, and applications for functional glasses and glass-ceramics and is organized into three main parts.

The first part of the book is an introduction to functional glasses and glass-ceramics. In sequence, chapter by chapter, a detailed description is provided for several glass and glass-ceramic systems, specific processing techniques, and applications. The second part of the book is an extensive and detailed description of functionalized oxide glasses and glass-ceramics.

Chapter 1 starts with basic concepts and the structure–property correlation of glasses and glass-ceramics, and ends with the classification of functional glasses and glass-ceramics and the outlook for these materials. Chapter 2 provides theoretical considerations, synthesis, processing, properties, and applications of glasses and glass-ceramics, ranging from

https://doi.org/10.1557/mrs.2018.251 Published online by Cambridge University Press

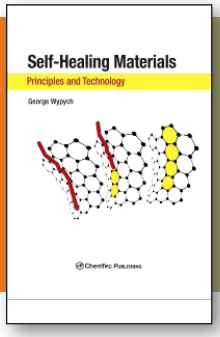
three-dimensional transition-metal oxides, including titanium, vanadium, chromium, manganese, iron, cobalt, nickel, and copper glasses. Rare-earth oxide glasses are described in chapter 3, including praseodymium, neodymium, samarium, and europium containing ones, among others. Chapter 4 describes functional glass-ceramics and their synthesis, processing, and applications. Examples are given for optical, electric, battery, glazes, and ultralow expansion applications. Chapter 5 deals with the functionalization of glasses by laser irradiation, including the modification of refractive index, crystallization, and reduction-oxidation. The functionalization of glasses by incorporation of semiconductors is given in chapter 6. Biomedical applications are described in chapter 7, including bioactive glasses and glass-ceramics (e.g., scaffolds, composites, coatings), antibacterial and drug delivery systems, and ionomer cements. Solid-oxide fuel-cell sealants are presented in chapter 8, including the requirements, classifications, and processing. Chapter 9 discusses glasses and glass-ceramics made from solid waste materials and their processing.

The third part of the book covers non-oxide systems. Chapter 10 describes functional chalcogenide glasses and glass-ceramics. Halide glasses and glass-ceramics are discussed in chapter 11. Finally, chapter 12 covers functional bulk metallic glasses.

Each chapter presents an up-to-date list of references, based on the author's knowledge and work experience. Figures and tables are vivid and well designed.

This book is recommended for postgraduate students, researchers, educators, scientists, and professionals of the glass industry. It can be used as a basic reference for the study of functional glass materials because it is richly detailed on the fundamentals, synthesis, properties, and applications of glasses and glass-ceramics.

Reviewer: Adriano Michael Bernardin *is a professor in the Materials Science and Engineering Graduation Program, University of the Extreme South of Santa Catarina, Brazil.*



Self-Healing Materials: Principles and Technology

George Wypych

ChemTec Publishing, 2017
262 pages, $285.00 (e-book $285.00)
ISBN 9781927885239

I confess that I knew almost nothing about the subject when I started to read this book. However, after finishing, I feel quite knowledgeable about this emerging field of self-healing materials, and therefore recommend the book to the nonspecialist with some constraints.

A self-healing material is one that, once damaged, can fix itself without any external control, much like a wound in the body repairs itself automatically. The topic immediately captures one's imagination—would it be possible to have a plastic part of an automobile body snap back into place with no damage after an accident? Or the car body repaint itself by having pockets of paint suspended in the coatings that are released when under the stress of an accident? Not quite yet, but the book showed me that research is well under way in these areas, and in the future, consumers might see plastics, rubbers, and even metals that heal with little human intervention.

The book starts with an overview of biological (wound) healing, and then progresses to the mechanisms and chemical processes for polymeric materials, including autonomic, click chemistry, cross-linking, and hydrogen bonding. Physical processes such as thermal and infrared healing are also covered. Other chapters cover methods to deliver "healants" to defect sites, as well as additives that induce healing. The main focus is on polymeric materials; 30 different polymers are highlighted. There is also a review of non-polymeric materials, such as cement, foam, and electronics. Other chapters cover methods for characterization.

The format is somewhat unique for a review book, as each topic is covered in brief and is followed by a thorough reference list of relevant journal articles. This is a departure from typical review books in which experts go in-depth into each topic.

I would strongly recommend this book to anyone with an interest in this growing field of self-healing materials. The chapters are brief, the references are excellent, though there are no problem sets. I found myself looking up several references that claimed my interest, and I credit the book with giving a clear and thorough overview of the field. Accordingly, readers should not expect details, but rather guidance toward future reading.

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

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