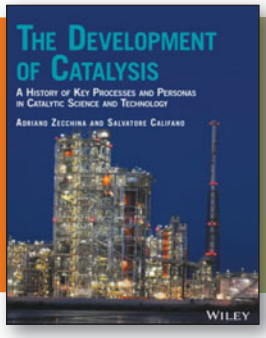


The Development of Catalysis: A History of Key Processes and Personas in Catalytic Science and Technology

Adriano Zecchina and Salvatore Califano

Wiley, 2017
352 pages, $125.00 (e-book $100.99)
ISBN 978-1-119-18126-2

Catalysis covers a vast field of academic to industrial research and has undoubtedly changed the world, as it has allowed the introduction of modern fuels, chemicals, and plastics. This book describes the history of catalysis and its path to modern-day catalysis research. The authors are well-qualified to write this history, as they have dedicated their careers to catalysis.

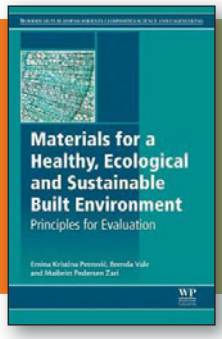
The chapters are focused on the following: the first large-scale industrial processes, historical development of theories, catalytic processes associated with the petroleum industry, surface methods, heterogeneous catalysis, materials science, photocatalysis, and enzymatic catalysis. With these topics, the book covers most of the important industrial processes used today, or the precursors to the present processes, and their historical impact on industry. The chapters logically follow the increasing complexity of catalysis from early homogeneous catalysis processes to modern heterogeneous-based ones, which are highly dependent on materials and surfaces. The final chapters are dedicated to more emergent areas of catalysis.

Even though I have worked in catalysis, the amount of material covered by the authors quickly became overwhelming. The authors seem intent on discussing a wide breadth of catalysis history. Because of this attempt, most fields are scantily covered. For instance, a page and a half is dedicated to hydrodesulfurization, a key catalytic process required to remove sulfur from oil. The revolutionary olefin polymerization process, which earned Ziegler and Natta a Nobel Prize, is covered in five pages. I found it difficult from the short synopsis of each process to get any in-depth scientific understanding—more of a brush stroke.

The authors focus heavily on researchers involved in catalysis research, their academic training, and research associates. With the focus on the personae, many chapters are filled with photographs of the researchers, and their chemistry is simply described in the text. A few of the chapters attempt to illustrate the content more in chemical terms—for instance, the chapter on materials science and catalysis design is well illustrated. The book assumes that the reader has a strong understanding of chemistry.

I surmise that the authors' goal was to cover catalysis as broadly as possible and provide excellent references (historical and contemporary) so the reader could follow up in more detail. The book is thorough in its breadth and is geared toward a highly technical audience. It will likely not appeal to a nontechnical reader, and even undergraduate students might struggle with the content. However, it serves as a good reference for researchers in the field of catalysis who wish to understand their heritage and would like a good starting resource for their research.

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



Materials for a Healthy, Ecological and Sustainable Built Environment: Principles for Evaluation

Emina Kristina Petrović, Brenda Vale, and Maibritt Pedersen Zari

Woodhead Publishing, 2017
416 pages, $161.25 (e-book $161.25)
ISBN 9780081007075

This book contains technical information relevant to contemporary architecture and the environmental impact from the construction materials for various ecosystems under different conditions. It is focused on proposing principles for the evaluation of building materials in relation to their suitability for sustainable construction, for example, materials that are grown (grasses, hemp, bamboo, vines, and goods), materials that are extracted (earth, stone, brick, and concrete), materials that are made (glass, metals, steel, cooper, aluminum, zinc, and lead), and plastics or composites. The book is comprised of four parts: Part I—Selecting Building Materials for Reduced Impacts on Ecosystem Services, Part II—Choosing Sustainable Materials, Part III—Indoor Toxicity from Building Materials, and Part IV—Case Studies.

Part I discusses the selection of building materials for reducing "ecosystem services," which are carried out for different types of materials using sustainability analyses. The topic can be complex, as a building material can be considered sustainable or not when understood in the context of the design, climate, and culture.

Part II is about the sustainable materials selection by professionals engaged in design and specifications. There is an interesting description of the usage of construction materials, applications, and, most importantly, sustainability recommendations to minimize the ecological impact when designers and architects select the most suitable materials (those with a long life, low maintenance, and low-embodied energy).

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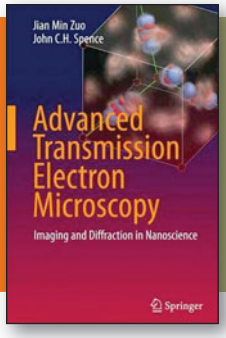
Readers should pay special attention to Part III. Every material releases pollution as a result of its interaction with environment conditions (indoor or outdoor). This must be taken into account during the lifetime of every material, because the pollution affects human health. As expressed in the book: "What is the point in saving energy and protecting the natural habitat if the same choice damages the health of the building's users?" This section makes an important and novel contribution due to its proposal of a new approach to this problem by evaluating the pattern in existing recognition of issues associated with the toxicity of building materials, such as lead and asbestos. A table lists the substances that are regulated in the building industry (e.g., formaldehyde, phthalate plasticizers in polyvinyl chloride) and their possible effects on human health. Another table presents a comparison between regulated levels of volatile organic compounds in carpets and the classification of the same chemicals for impact on human health.

Part IV reviews case studies. Notable examples include traditional building in Serbia, palm-thatched building in Mexico, and the New Zealand House. These case studies are useful to compare and develop similar projects regarding sustainable building.

References are complete and appropriate for each section. A specific technical background is not necessary to understand the content. This book focuses on the ontological considerations of building materials and is relevant for all those interested in sustainable building, including professionals in the construction industry.

Reviewer: Miriam Sánchez Pozos *of the Department of Mechanical Engineering and Sustainable Energy Engineering, Universidad Autónoma del Estado de México, Mexico.*



Advanced Transmission Electron Microscopy: Imaging and Diffraction in Nanoscience

Jian Min Zuo and John C.H. Spence

Springer, 2017
729 pages, $139.00 (e-book $109.00)
ISBN 978-1-4939-6605-9

Transmission electron microscopy (TEM) and associated techniques are essential tools for materials science students and professionals. Modern TEM has become more capable and reveals a lot of information. However, the interpretation demands knowledge of the interaction between electrons and materials, which is the focus of this book. This book was developed based on the authors' previous classic book, *Electron Microdiffraction* (Plenum, New York, 1992), with some extension to reflect recent progress in TEM.

The book starts with a brief introduction to the fundamentals of matter–electron interactions and historical development of TEM and electron diffraction, particularly microbeam diffraction. Chapter 2 explains the electron wave and its propagation and lays the theoretical foundation for the following chapters. Chapter 3 elucidates diffraction geometry of crystalline materials. The more theoretical aspects of electron diffraction and the kinematical and dynamic theories are introduced in chapters 4 and 5. Chapters 6–9 describe the electron optics and the instrument, including lens design (chapter 6), lens aberration and correction (chapter 7), and electron sources and detectors (chapters 8 and 9). Chapter 10 covers the experimental techniques, but these techniques are still more theoretical, so this chapter is by no means an operations manual. However, it is rewarding to understand the fundamental principles behind each step of alignment. Crystallography is covered in chapters 11 and 12; chapter 11 includes symmetry of crystals, while crystal structures and their atomic bonding are elucidated in chapter 12. The impact of temperature and the imperfection of crystals on diffraction, as well as diffuse scattering, is discussed in chapter 13. Chapter 14 explains atomic resolution imaging, both high-resolution TEM and scanning transmission electron microscopy.

Although most of the first 14 chapters lay a solid foundation for electron microscopy and the interaction between electrons and matter, chapters 15–17 are more practical and vital for researchers working on microstructure characterization of materials. These chapters explain the theory and experimental techniques in defect analysis (chapter 15), strain measurement (chapter 16), and nanomaterials study (chapter 17). They are also good references for researchers in these fields, as very recent progress is also reviewed. The appendices are useful for data analysis.

This book is more about imaging and diffraction; although the knowledge covered makes it easier to understand energy-dispersive spectroscopy and electron energy-loss spectroscopy, these topics are not included. In comparison with other books on TEM, this one is written at a more advanced level and is targeted at materials science or physics graduate students. The content leans more on the theoretical than the experimental aspects of TEM. This book would be a good choice for students or researchers who have some knowledge and experience and are seeking a better understanding of TEM or are planning in-depth microstructural analysis work. However, as a textbook, there is a lack of worked examples and homework problems. All figures and tables are helpful for the readers to understand the associated topics. The book is largely self-contained, but previous exposure to quantum mechanics and related mathematics is highly desired.

Reviewer: Wanfeng Li*, research engineer of Research & Advanced Engineering, Ford Motor Company, USA.*

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