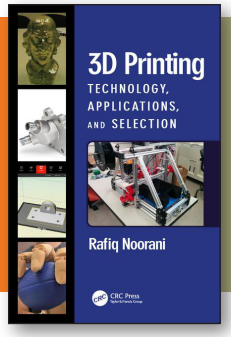
brookite, but the author discusses in detail the various structures of tungsten bronzes (first formed by Wöhler, but here referred to as Magnéli bronzes). He also states that there are distinct W^{5+} and W^{6+} ions in the bronzes, and that the electrons hop from one ion to another, rather than there being free electrons and the color is derived from the free electrons. Despite these weaknesses, this is overall a strong and readable chapter introducing most of the major structural types, including spinel, layered halides, perovskites, and pyrochlore.

Chapter 4 extends the discussion of chapter 3 into distorted structures, again using a polyhedral approach: Tilting, disorder, and superstructures, among others, are used as examples of nonideality. Point defects are briefly described. These are followed by a short description of extended defects, such as the shear planes found on reduction of the tungsten and molybdenum oxides.

The last three chapters are devoted mostly to different approaches of looking at and describing structures, including the net, rod, brick, and spin approaches. These are likely to be of most interest to the experienced chemist/crystallographer rather than the student. The book finishes with an appendix describing the various polyhedra, with all the angles and distances given; there are also drawings of the shapes necessary to construct the various polyhedra. At the end, there is a bibliography of "useful books" (dating from 1970 to 1996) and "some pioneering articles" (1948–2012) in the field.

As noted previously, this is a book for the lover of crystal chemistry written by one of the pioneers of solid-state chemistry. It is a personal viewpoint; therefore, it lacks the modern use of a computer in crystal chemistry, either for looking at structures or for the creation of new structures and materials. It also lacks a set of discussion questions that might be useful for the classroom.

***Reviewer: M. Stanley Whittingham**, Distinguished Professor, Chemistry and Materials Science & Engineering, Binghamton University, The State University of New York, USA.*



3D Printing: Technology, Applications, and Selection

Rafiq Noorani

CRC Press, 2017

271 pages, $99.95 (e-book $89.96)

ISBN 9781498783750

To serve current and future manufacturing needs, rapid prototyping by printing materials into complex shapes using advanced manufacturing is expected to realize an order of magnitude increase in its use and utility. This is true across multiple engineering and technical disciplines. This book contains details of three-dimensional (3D) printing as currently implemented, as well as how the technology is positioned to address current and future manufacturing, aerospace, and medical applications.

The book provides an entry-level introduction to the field of 3D printing, focusing significantly on the software and hardware implementation of current printers in the market. This includes the technical details of designing, engineering, and using an actual printer. Among the vast number of emerging additive manufacturing texts, this book is unique in its intention to educate the inexperienced reader or hobbyist on 3D printing for design and manufacturing purposes.

The book starts with an introduction to 3D printing and how a printer works, in chapters 1 and 2. Chapters 3–5 are comprehensive overviews of how to design and calibrate a printer, including details on configuring software, hardware, automation, and materials (e.g., metals and oxides). The text differentiates itself from previous literature by educating the reader on the technology and programmatic setup of a 3D printer, providing details on hardware and programming routines at a beginner's level. The author utilizes instructive figures, tables, and a detailed appendix, which includes MATLAB routines for implementing 3D printing. At the conclusion of each chapter, a summary and questions are provided to recapitulate each chapter in the context of fundamental principles and engineering. These summaries also form the foundation for later chapters focused on combining 3D printing with the rapid prototyping cycle.

The final chapters (6–10) logically extend the text to provide advice and insight on combining techniques in tandem for reverse engineering and rapid prototyping. Each of the basic implemented approaches are well explained, and the author guides the reader on how to effectively combine 3D printing technology with reverse engineering. The utility of the text shines in these later chapters, guiding the reader on how to utilize advanced imaging tools, considering both surface and volumetric replications, with a basic familiarity of the limitations and advantages of each to meet prototyping and fabrication goals. Although full-scale production and fabrication are not discussed in detail, logical extensions are provided throughout the later chapters that can address these challenges in complex part design.

The author indicates that 3D printing is well positioned for selective rapid prototyping. This text provides a foundational education to the reader on the implementation of printing, as well as on technical skills required to use the latest generation of printers. I recommend this book as a monograph that goes beyond textbook material for any individual currently looking into or working toward using 3D printing.

***Reviewer: Jeffery Aguiar**, Idaho National Laboratory, USA.*

https://doi.org/10.1557/mrs.2018.141 Published online by Cambridge University Press