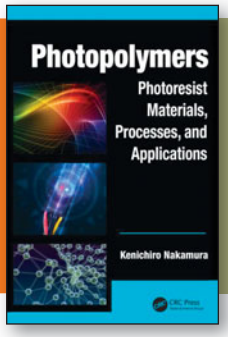
good read, with very complex phenomena explained in a fairly simple and straightforward way. As a whole, I enjoyed this book and learned quite a bit.

The examples draw mainly from high-temperature cases in thermodynamics, such as a droplet of molten nickel forming on the surface of an oxide layer. This is not surprising considering that Meier was trained as a metallurgical engineer. However, the reader could have benefited from more modern applications of thermodynamic surfaces, such as an ink droplet on a surface of graphene. The book lays a firm theoretical basis, so at the end of the book, you can extrapolate to more diverse research topics, but some broader examples would have been more helpful.

Unfortunately, the book does not include the answers to the study problems. For people who have been out of the classroom for a long time, these would be very helpful. The answers are available online as "instructor resources" from Cambridge, but they are locked for instructors. I attempted to sign up for an instructor resources account, but then stopped when they asked for my course name and my website for verification of my position as an instructor (which I am not). Having part of the book as a locked online resource seems to diminish both the long-term prospects for this as a hardcover book and the promise that the book could be a good self-study guide. While the book will certainly be a valuable tool for instructors looking for a lucid guide to classic surface thermodynamics, the lack of answers to the study problems creates an obstacle to readers outside the classroom.

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



Photopolymers: Photoresist Materials, Processes, and Applications
Kenichiro Nakamura

CRC Press, 2014
189 pages, $149.95
ISBN 978-1-4665-1728-8

This book is a toolbox for individuals needing practical knowledge in the area of photopolymers and photoresist materials. It contains practical guidance in chemistry, fabrication, and industrial reduction-to-practice of photopolymer technology. The volume is comprised of five chapters. A major theme of the book is the relationship between photopolymer technology and the increasing miniaturization of electronic and mechanical devices.

Chapter 1 discusses the basic idea of photopolymerization. After a brief introduction to photochemistry, there is a discussion of radical polymerization. The author gives extensive tables of monofunctional, bifunctional, and multifunctional monomers. There are similar lists of various initiators and inhibitors. There is also discussion of cationic polymerization, photocross-linking, and photoscission of polymers. Helpful tables giving representative photopolymer formulations are included. The chapter includes an extensive discussion of recommended polymers for various user needs, such as high or low refractive index, hardness, and hydrophobicity. If the reader has a specific application in mind, it is easy to search the chapter and find a system that will meet these requirements.

Chapters 2 and 3 address chemically amplified resists as a method for meeting the requirements for nanoscale resolution in photopolymerization. Chapter 2 provides a general discussion of the chemical amplification process parameters such as optical absorption coefficients, etching and dissolution rates, and their influence on pattern profiles. Tables of photoacid generators and their physical properties are included. Chapter 3 analyzes chemical amplification from the lithography perspective and describes the relationship between resolution and depth of focus as a function of numerical aperture and wavelength. The author then presents several lithography techniques, including immersion lithography, double patterning, extreme ultraviolet lithography, and direct self-assembly.

Chapter 4 describes nanoimprint techniques, detailing descriptions of thermal nanoprint and ultraviolet nanoimprint lithography as well as step and flash imprint lithography. Cationic polymerization of ultraviolet nanoimprinting is discussed, including monomers, photointiators, and stabilizers. Following a brief discussion of thiolene polymerization of ultraviolet nanoimprint lithography, the author describes the microcontact print method.

Chapter 5 focuses on industrial applications of photopolymer technology with descriptions of large-scale integrated circuits, transistors, and industrial reduction projection technology. Subsequently, there is a rundown of optical adhesives as ultraviolet hardening resins with many examples. A section on holography presents types of holography, recording materials, and recipes for fabrication. There is also a section on dental photopolymers followed by a discussion of microelectromechanical systems.

This short book has enough material to give a novice a good start in the field of photopolymer technology. It is written at a level appropriate for individuals with a chemistry or polymer engineering background.

Reviewer: Thomas M. Cooper *of the Materials and Manufacturing Directorate, US Air Force Research Laboratory, USA.*

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