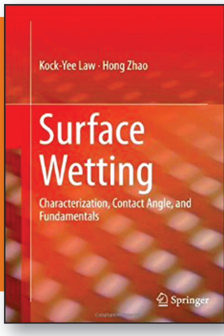


Surface Wetting: Characterization, Contact Angle, and Fundamentals

Kock-Yee Law and Hong Zhao

Springer, 2016
162 pages, $99.00 (e-book $69.99)
IBSN 978-3-319-25212-4

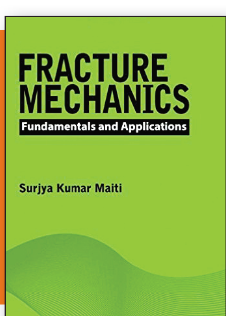
Although the authors humbly state in their preface that this book is "not intended for expert researchers, who may view the content as nothing new," I would recommend this book to anyone who thinks they understand (or would like to understand) the complexities in the seemingly simple matter of determining and deciphering wetting of solid surfaces. In their captivating way, the authors provide a very informative view on the state of the field. Through ample reference to key research works—some six to seven decades old or more but largely ignored, and others quite recent—they underscore common misconceptions about surface wetting while providing good insights into the physics behind the phenomenon.

The book begins with a short background on the history, importance, and basis for controversy in contact-angle measurements. The next chapter covers proper measurement of contact angles, including critical comparison of common instrumentation and techniques, and advice for best practices. The third chapter discusses Young's equation and what it means, and gets to the heart of why many use it improperly. They argue convincingly that the equation deals with mechanical equilibrium—not thermodynamic equilibrium, as many believe—and then describe the consequences of this formal understanding. In chapter 4, rough surfaces are considered, and some inadequacies of commonly used relations are discussed. Having broken many dogmas in the earlier part of the book, the fifth chapter tries to answer the question of what we actually learn from a contact-angle measurement.

Chapters 6 and 7 give some order to the confusion surrounding concepts of surface energy, surface tension, and Young's angle. In chapter 6, such terms as wettability, adhesion, hydrophilicity/-phobicity, and the related degree of affinity to oils (oleophilicity/-phobicity) are defined clearly and quantitatively. In chapter 7, different approaches to assessing surface tension are provided with emphasis on their shortcomings. The important take-home message is that while surface energy and tension may not be useful concepts in the realm of wetting, the related, practical quantities of wettability and adhesion can be obtained from the readily measured advancing and receding contact angles. The concluding chapter 8 summarizes the key messages of the book, including suggestions for proper experimental practice. Starting with this chapter is a good way to see in a glance what the book has to offer.

The book is well organized and easy to read. Each chapter begins with an abstract and list of keywords. Ample use of figures and tabulated data from the literature, as well as illustrative figures to emphasize certain concepts, enhance the text. Good use is made of cumulative knowledge in the field that has unfortunately been largely ignored. The book is very practical without being merely technical, as well as fundamental while still being accessible.

Reviewer: Sidney R. Cohen *of the Weizmann Institute of Science, Israel.*



Fracture Mechanics: Fundamentals and Applications

Surjya Kumar Maiti

Cambridge University Press, 2015
295 pages, $71.95
ISBN 9781107096769

Fracture mechanics is an essential discipline for predicting the safe operating limits of structures containing flaws such as small interior or surface cracks. It is originally based on the concept of stress amplification at the crack tip, first put forth by A.A. Griffith, with improvements in its underlying scientific basis by others, notably G.R. Irwin.

Maiti's book is an excellent overview textbook on fracture mechanics, with an emphasis on the mechanics perspective and without much emphasis on materials science. As such, it focuses on a mathematical approach to solving for the magnitudes and distributions of stresses in mechanical pieces in a wide variety of geometric configurations. The book is filled with partial differential equations, integral equations, and the occasional Jacobian matrix. There are tables listing the properties of specific metals, but no discussion or comparisons of material properties.

Coverage begins with the simplest case, which assumes the material is brittle, the concentrated stress is localized, and the stress is linearly related to strain. More complex cases are then considered as these assumptions are removed by extending calculations to nonlinear stress–strain, with plastic deformation occurring before the crack length is extended, and the distribution of stress surrounding the crack tip.

The book is divided into nine chapters. The first chapter introduces the topic of fracture mechanics, describes its applications, and sets the scope of the text.

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