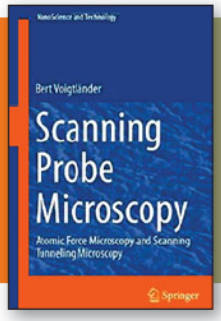
Sidney Cohen, MRS Bulletin, Vol. 41, February, 2016, p.165



Scanning Probe Microscopy: Atomic Force Microscopy and Scanning Tunneling Microscopy
Bert Voigtländer

Springer-Verlag, 2015
382 pages, $179.00 (e-book $139.00)
ISBN 978-3-662-45240-0

Considering the number of excellent books that have been written to date on this topic, one may ask what another book on scanning probe microscopy (SPM) fundamentals can add to the existing texts. The answer lies in the extent of this burgeoning field. No single work is likely to cover it all, but a good book should describe the relevant topics. Indeed, this volume is not simply a rehash of existing books with some recent developments. It is a nice blend of serious and in-depth presentations of many of the basic fundamentals of the technique, written—in Voigtländer's words—in an "easily digestible manner."

The book begins with a brief introduction, and then plunges into topics (24 chapters) necessary to understand how SPM really works, including in-depth discussions of very technical matters, such as characteristics of operational amplifiers and piezoelectric materials as well as an entire section on noise. Purely technical topics cover about one-third of the content. On the other hand, there is a more fundamental development of tunneling theory and an extended description of the mechanics governing different oscillating modes of atomic force microscopy. In order to make difficult concepts accessible, important and useful equations are developed clearly, with step-by-step explanations. Each chapter starts with a short introduction, and ends with a ½–1 page bulleted summary of the key points. In addition to the topics mentioned previously, there are chapters on artifacts, image analysis, and manipulation, and a few SPM applications such as contact potential measurements, manipulation at the atomic scale, mechanical characterization, and surface spectroscopy. Where necessary, brief discussions on related topics such as surface states and electrostatics are inserted. This is definitely not a "how to" book, and certainly not an exhaustive treatment of SPM: for instance, the vital practical topic of image processing is treated in a very cursory way, and data

analysis is limited to one page discussing line profiles. SPM lithography is mentioned only in the context of esoteric single-atom placement studies.

The 70 references given are very scant for a book of this scope, but Voigtländer has adapted the approach that original works are only cited where they add something to his own lucid treatment. Rather than supply an exhaustive accounting of the varied applications of SPM, the book attempts to provide a technical, theoretical, and conceptual framework to understand how SPM works and what can be done with it so that a reader wishing to further learn about newer topics will have the basis to do so. This book could thus serve as a useful reference and textbook for anyone desiring an advanced introduction to the fascinating world of SPM.

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