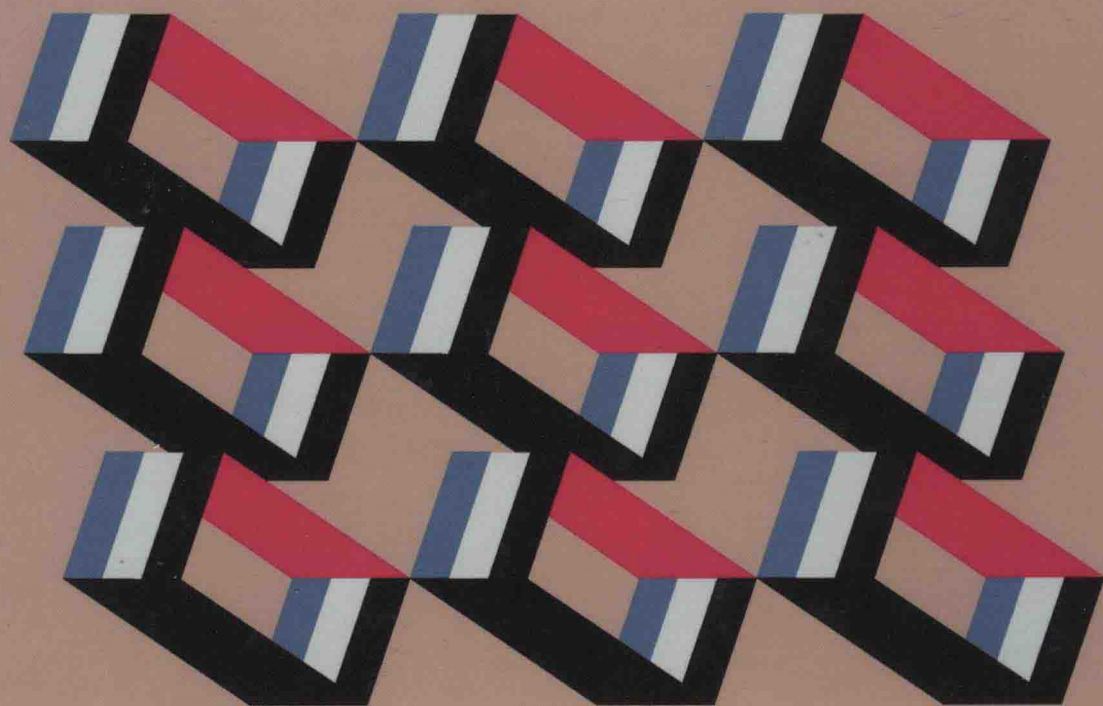


Nanomaterial Characterization

An Introduction



Edited by **Ratna Tantra**

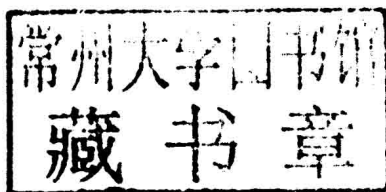
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RATNA TANTRA



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NANOMATERIAL CHARACTERIZATION

This book is gratefully dedicated to my father, I Wayan Tantra

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EDITOR'S PREFACE

To measure is to know. If you cannot measure it, you cannot improve it

Lord Kelvin (1824–1907)

Since joining the National Physical Laboratory (NPL) (UK's national measurement institute) in 2004, I have been fortunate enough to have worked in numerous projects related to nanoscience and nanotechnology. During this time, the nature of my research activities varied widely across different disciplines, from the applications of nanomaterials in surface-enhanced Raman spectroscopy to understanding their potential toxicological implications. A critical part of the research throughout the years, however, has been the need to characterize physicochemical properties of the nanomaterials. This has not always been trivial.

The idea for this book came from my involvement in a European Commission Framework 7 research project entitled MARINA (Managing Risks of Nanomaterials). One of the goals of this project was to harmonize activities and to establish a common platform to ultimately support the scientific infrastructure for risk management of nanomaterials. Although the relevance of MARINA is for nanosafety, the idea of having a common approach can be extended to other application areas. This, coupled with my interest in measurement science, ultimately laid the foundation for this multi-authored book.

The book begins with a general introduction, which aims to give the reader a solid foundation to nanomaterial characterization. Chapters 2 and 3 focus on two principal topics: nanomaterial synthesis and reference nanomaterials, which serve as useful background for the rest of the book. Chapters 4–10 constitute the very heart of this book, dedicated to key physicochemical properties and their measurements. Undoubtedly, it is beyond the scope of the book to cover all properties and only

several key properties, such as particle size distribution by number, solubility, surface area, surface chemistry, mechanical/tribological, and dustiness, are covered. Chapters 11–13 are devoted to state-of-the-art techniques, in which three very different sets of characterization tools are presented: (i) scanning tunneling microscopy operated under extreme conditions; (ii) novel strategy for biological characterization of nanomaterials; and (iii) methods to handle and visualize multidimensional nanomaterial characterization data.

Most of the chapters this book begin by giving an overview of the topic area before a case study is presented. The purpose of the case study is to demonstrate how the reader may make use of background information presented to them and show how this can be translated to solve a nano-specific application scenario. Thus, it will be useful for researchers to help them design experimental investigations.

The book is written in such a way that both students and experts in other fields of science will find the information useful. My intention is that it will appeal to a range of audience outside the research field, whether they are in academia, industry, or regulation and is particularly useful for readers whose analytical background may be limited. There is also an extensive list of references associated with every chapter, to encourage further reading.

Finally, it has taken me just less than 2 years to complete this book and so, I must say a few words of thanks. First, I am grateful to all of the authors for their chapter contributions. Second, I thank the many people who have encouraged me to publish this book: my Wiley editor, my husband Keith F. E. Pratt, family, and friends. Special thanks go to Sinta Tantra, for her generosity in donating her artwork, which has been used for the cover of this book. The cover is abstract art that depicts the image of a nanomaterial surface at atomic resolution!

Portsmouth, England
16 December, 2015

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