

Preface

Medical devices and surgical tools that contain micro- and nanoscale features allow surgeons to perform clinical procedures with greater precision and safety in addition to monitoring physiological and biomechanical parameters more accurately. While surgeons have started to master the use of nanostructured surgical tools in the operating room, the impact and interaction of nanomaterials and nanostructured coatings has yet to be addressed in a comprehensive manner.

Nobel Laureate Richard Feynman's revolutionary vision on nanotechnology was captured in a paper published in the February 1960 issue of Caltech's journal, *'Engineering and Science'*. In this paper, Feynman speaks about manipulating atoms and constructing products atom-by-atom, and molecule-by-molecule. Feynman describes the scaling down of lathes and drilling machines, and talks about drilling holes, turning, molding, and stamping parts. Even in 1959, Feynman describes the need for micro- and nanofabrication as the basis for creating a microscopic world that would benefit mankind. Nanotechnology encompasses technology performed at nanoscale that has real-world applications. Nanotechnology will have a profound effect on our society that will lead to breakthrough discoveries in materials and manufacturing, medicine, healthcare, the environment, sustainability, energy, biotechnology, and information technology.

President Bill Clinton talked about the exciting promise of nanotechnology in January 2000, and later announced an ambitious National Nanotechnology Initiative (NNI) that was enacted in 2001 with a budget of \$497 million to promote nanoscale research that would benefit society. The purpose of this book is to present information and knowledge on the emerging field of surface-engineered biomedical devices and surgical tools. The book is written in the spirit of scientific endeavor outlined by Richard Feynman, who stated that one of the greatest challenges to scientists in the field of miniaturization is the manufacture of objects for medical applications using techniques such as turning, molding, stamping, and drilling. The book presents information on surface-engineered surgical tools and medical devices that looks at the interaction between nanotechnology, nanomaterials, and tools for surgical applications. Chapters of the book describe developments in coatings for

heart valves, stents, hip and knee joints, cardiovascular devices, orthodontic applications, and regenerative materials such as bone substitutes. Also some chapters are dedicated to the performance of surgical tools and dental tools and describe how nanostructured surfaces can be created for the purposes of improving cell adhesion between the medical device and the human body.

The structure of the book is based on the matter provided by many colleagues and has been updated to reflect changes made to the subject area since the first edition published in 2006. The authors wish to thank the contributors of this book for helping construct a source of knowledge and information on surface-engineered medical devices and surgical tools and for granting the editors permission to use such matter.

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