

Preface

The aim of this book is to present the recent progress in the three most popular *Electrochemically Engineered Nanoporous Materials*, including porous silicon, nanotubular titania, and nanoporous anodic alumina. Electrochemical engineering based on anodization and etching processes is recognized as one of the most cost-effective and simplest approaches to engineer nanoscale materials with controllable dimensions and properties. The book covers a selected range of topics presented throughout 11 chapters, which cover the most significant aspects involved in the understanding, properties, preparation methods, and emerging applications of these outstanding nanoporous materials. The chapters are written by a selected group of expert scientists in the field and we believe that this book represents valuable contribution to this emerging and fast developing field, with direct implications for a plethora of disciplines, including electronics, optics and photonics, medicine, engineering, physics, and chemistry.

The first chapter presents the fundamental aspects involved in the fabrication of porous silicon structures, with special focus on the different concepts and approaches used to produce nanostructures with precisely engineered geometric features. A more detailed insight into the properties and applications of porous silicon is presented in the second chapter. The third chapter is devoted to the synthesis of nanotubular titania produced by electrochemical anodization of titanium substrates, and its subsequent application as a template material. The fourth chapter compiles a fresh insight into the combination of porous silicon structures with emerging capture probes aimed to develop highly sensitive and selective sensing systems. Porous silicon has been extensively used in biomedical applications during the past decade. The fifth chapter highlights the most outstanding advances in this emerging and exciting field and the sixth chapter compiles fundamental aspects of porous silicon in drug delivery applications. The seventh chapter compiles a variety of examples of applicability of nanoporous anodic alumina as optical biosensing platform, which is recognized as one of the most promising applications for this nanomaterial. The eighth chapter is devoted to the different chemical and electrochemical approaches used to engineer the structure of nanoporous anodic alumina to develop optical systems and applications. The different fundamental aspects of

nanotubular titania as a new material for solar cell applications are presented in the ninth chapter. Finally, the tenth chapter shows a detailed review on the recent advances in nanotubular titania for drug delivery applications.

As a result of the highly interdisciplinary nature of this book, it should be of profound and immediate interest for a broad audience, including undergraduate students, academics, and industrial scientists and engineers across many disciplines, ranging from physics, chemistry, engineering, materials science, bioengineering, and medicine. We believe that this book will also be valuable to many entrepreneurial and business people, who are in the process of trying to better understand and value nanotechnology and new nanomaterials for future high-tech emerging applications and disrupting industries.

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