
Preface

Micro to nanoscale preferment of advanced materials has open up a new horizon in science and technology. The new establishments in the manufacturing of micro and nano systems based on advance materials bring promising changes in various fields. The prime disciplines expected to be boosted by these technological advancements includes future energy, biosensing devices, communication and information system, health care and medicine, environment and climate change, cosmetics, food processing security and transportation.

This book provides a glance view at recent developments and innovation in the synthesis and application of advance materials. Particularly, synthesis of advanced nanomaterials, especially synthesis of nitrogen doped graphene and its fundamental aspects of the strain induced behavior has been covered in this book. Recently, Er doped silicate materials are rapidly increased in the last years. In this book, a brief review of the status of research on Er-Sc silicates and Er-Y silicates is presented. Moreover, Zinc silicates have a promising future, as advanced materials, as they are highly versatile luminescence materials. A brief review on the optical and dielectric properties of the transition metal doped Zinc silicates materials synthesized by a sol-gel method is covered in this book. Whereas, ZnO material display promising properties and have been applied for different applications. This book also covers recent research on ZnO as a thermoelectric material.

In addition, this book comprises a review of advanced nanomaterials and their medicated applications such as diagnosing the diseases and treatment of infectious diseases by nanoparticle-based biosensor and nanoparticle gel, respectively. Hereby, future insight regarding the development of drugs for cancer treatment and advanced biosensors development based on nanoporous materials are also covered in this book. This book also presents a focused review on limitations of biodegradable metals as well as their alloys, and on their surface functionalization aiming medical applications.

The salient segment of current book concise the current features of energy storage devices developed from advanced energy materials which enhance energy storage efficiency many folds. The nanomaterial-based supercapacitors synthesized from metal oxides are highly efficient for energy storage. Such high energy density storage devices are contributing to the energy solutions worldwide. However, supercapacitors are still facing challenges such as low energy density and problems in their synthesis. This book looks at the synthesis of porous nanomaterials, their applications in a supercapacitor, the problems in the synthesis and their relevant solutions, respectively. In addition, emerging mixed ionic-electronic conducting materials for electrolyte free fuel cell which enhance the efficiency of advanced energy devices are also covered in this book.

Likewise, energy storage devices, the authors also try to cover recent research on non-volatile memory (NVM) devices. These devices have diverse applications. Various metallic nanoparticles such as Au, Ag, Pt, and Al have been used as storage centers for NVM applications. In this book, recent developments in the synthesis of gold nanoparticles for their applications in NVM devices are also discussed briefly.

The substantial part of this book concise characterization of advanced materials using fundamental and advanced analytical techniques. Synchrotron grazing incidence X-ray diffraction (GIXD) are utilized for the analysis of Er-Sc silicates and Er-Y silicates. Whereas, Ion beam analysis techniques are thoroughly reviewed for advanced materials analysis.

The second to last chapter looks at how the uniform spherical silica nanoparticles can be produced using a novel solvent varying method based on the sol-gel Stöber process. The size and uniformity of the SNPs can be well controlled by only varying the initial volume of solvent ethanol.

The final chapter looks at the mechanisms of water transport through nanoporous Boron Nitride and Graphene Multilayers.

Resultantly, it is hoped that the present book, consisting of 15 chapters, will promote and enthuse researchers to work and find a better scope in the field of advanced materials science and engineering.

Finally, we wish to record our sincere appreciation to the researchers who're potentially contributed in this book undertaking Prof. Dr. *Rene Hernández-Delgado*, Prof. Dr. *Erika Cecilia Espinoza-Villarreal*, Prof. Dr. *Casiano Del Angel-Mosqueda*, Prof. Dr. *Osvelia Esmeralda Rodríguez-Luis*, Prof. Dr. *Claudio Cabral-Romero*, Prof. Dr. *P.Y. Chan*, Prof. Dr. *S.R. Majid*, Prof. Dr. *Khairunisak Abdul Razak*, Prof. Dr. *Noorhashimah Mohamad Nor*, Prof. Dr. *Nur Syafinaz Ridhuan*, Prof. Dr. *Randa Abdel-Karim*, Prof. Dr. *Saad El-Raghy*, Prof. Dr. *Ivan V. Komissarov*, Prof. Dr. *Nikolai G. Kovalchuk*, Prof. Dr. *Algirdas Lazauskas*, Prof. Dr. *Mindaugas Andrulevičius*, Prof. Dr. *Sigitas Tamulevičius*, Prof. Dr. *Nikolai I. Kargin*, Prof. Dr. *Serghej L. Prischepa*, Prof. Dr. *Mohammad Lukman Yahaya*, Prof. Dr. *Nor Dyana Zakaria*, Prof. Dr. *Rahmah Noordin*, Prof. Dr. *Khairunisak Abdul Razak*, Prof. Dr. *S. A. Ng*, Prof. Dr. *Adel Najjar*, Prof. Dr. *Hiroo Omi*, Prof. Dr. *Takehiko Tawara*, Prof. Dr. *B. Chandra Babu*, Prof. Dr. *B. Vengala Rao*, Prof. Dr. *G. Bhaskar Kumar*, Prof. Dr. *G. Hungerford*, Prof. Dr. *N. Sooraj Hussain*, Prof. Dr. *Artemis Stamboulis*, Prof. Dr. *C. Santos*, Prof. Dr. *M. M. Alves*, Prof. Dr. *M. F. Montemor*, Prof. Dr. *M. J. Carmezim*, Prof. Dr. *K. Mahmood*, Prof. Dr. *M. I Arshad*, Prof. Dr. *A. Ali*, Prof. Dr. *M. Ajaz un Nabi*, Prof. Dr. *N. Amin*, Prof. Dr. *M. Azhar Khan*, Prof. Dr. *F. Iqbal*, Prof. Dr. *M. Isa*, Prof. Dr. *Masahiro Saito*, Prof. Dr. *Rizwan Raza*, Prof. Mr. *Naveed Akhtar*, *Khurram Hashmi*, Ms. *Sophia Akhtar*, Prof. Dr. *Bin Zhu*, Dr. *Weihong Gao*, Dr. *Huw Owens*, Dr. *Muriel Rigout*, Prof. Dr. *Majid Shahbabaie* and Prof. Dr. *Daejoong Kim*.

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