Editor's Note

Functional nanomaterials are the basis of newly emerging nanotechnologies for various device applications. Nanomaterials with many kinds of morphologies and compositions have been extensively investigated, and display various kinds of functionality in areas such as electronic structure, optical effects, spin dynamics, and gas sensing. Because of advanced characterization and new fabrication techniques, nanomaterials are now central to multiple disciplines, including materials science, chemistry, physics, engineering and medicine. This special volume under Solid State Phenomena series will present a detailed overview of recent research developments on functional nanomaterials, including synthesis, characterization, and applications.

This volume consists of nine chapters, including both review articles and research papers. Introductory chapter of this volume "Functional Nanomaterials: From Basic Science to Emerging Applications" is contributed by Ashok Kumar. His review article focuses on the fundamental aspects of nanoscale materials and devices: (i) definitions and different categories of nanomaterials, (ii) quantum scale physics and technology, (iii) self assembly of nanostructures, (iv) growth conditions and techniques of 0D, 1D, 2D, and 3D dimensions materials, (v) understanding of the multi-functionalities of the nanomaterials, (vi) nanoscale devices for low energy consumption and fast response, (vii) integration of nanoscale materials with Si-based systems, and (viii) major technical challenges.

Chapter two is contributed by Hardev Singh Virk, the Editor of this volume. Synthesis and characterization of metal and semiconductor nanowires has been described in full detail. The author has given stress on major synthesis techniques, for example, electrodeposition in anodic alumina and polymer templates, and VLS method for semiconductor nanowires. The main focus of the chapter is on experimental investigations undertaken by author's own group in case of metal and semiconductor nanowires, and heterojunctions.

Chapter 3 "Inorganic/Organic Hybrid Nanocomposite and its Device Applications" is contributed by Surya Kant Tripathi. The author reviews the present status of II-VI semiconductor nanocomposites synthesis using both in-situ and ex-situ techniques. Different characterization techniques like structural, optical and electrical have been described to characterize these nanocomposites. Properties of polymer nanocomposites and their use as semiconductor devices is the core of this chapter. CdSe nanorods dispersed in polyvinyl alcohol (PVA) matrix have been prepared by chemical routes.

Chapter 4 "Chemical Synthesis, Characterization and Optical Properties of Nanocrystalline Transition Metal Doped Dilute Magnetic Semiconductors (DMSs)" is contributed by Tokeer Ahmad and his colleagues. They describe the experimental developments and optical properties of the oxide based DMSs, including the recent results on ZnO, CdO and In_2O_3 based systems. Optical properties of transition metal (TM)-doped ZnO, CdO and In_2O_3 dilute magnetic semiconductor nanoparticles showed red shift in energy band gap. They discover that the solvothermal synthesis of transition metal doped metal oxides nanoparticles via oxalate precursor route is very useful technique since the particles formed show homogeneity and monodispersity.

Chapter 5 is based on "Applications of Nanostructured Materials as Gas Sensors". Gas detection instruments are increasingly needed for industrial health and safety, environmental monitoring, and process control. Structural parameters of metal oxides controlling gas-sensing characteristics, as grain size, have been discussed in detail both theoretically and experimentally. Experimental investigations of SnO_2 nanostructures reveal interesting results in support of theory. Sensor response of SnO_2 as a function of particle size, ethanol concentration, synthesis and sintering temperatures has been established.

Chapter 6 is based on fabrication of nanoflowers and exotic patterns prepared by electrodeposition, thermal treatment and hydrothermal methods. It has been discovered that nanoflowers have great potential for possible applications in nanotechnology. A comprehensive investigation is planned to exploit the industrial applications of copper nanoflowers, for example, field emission properties. The author has produced a variety of nanoflowers and other exotic patterns which find their analogue in nature. The beauty of these experiments is that no identical patterns are produced on repeating the experiment. It remains an enigma and defies scientific explanation.

Chapters 7-9 are research papers contributed by three different groups. Meera Ramrakhiani and Sakshi Sahare in chapter 7 report luminescence of ZnS:Cu nanoparticles and nanocomposites. They prepared three different nanostructures: mercaptoethanol capped ZnS:Cu nanoparticles, polyvinyl alcohol (PVA) capped ZnS:Cu nanoparticles and ZnS:Cu/PVA nanocomposites by chemical route. The authors conclude that high efficiency EL devices for display and lighting can be fabricated using ZnS:Cu nanocomposites with PVA matrix giving violet emission.

Chapter 8 by Sonal Singhal et al. describes the effect of magnetic field on the growth of aligned Carbon nanotubes. A low cost metal free arc discharge method has been used to synthesize MWCNTs. A magnetic field of 310 Gauss has been found to produce more pure carbon nanotubes. Chapter 9 is focused on antibacterial effects of Ag, Au and bimetallic (Ag-Au) nanoparticles synthesized from red algae. This study showed that the extracellular synthesis of silver nanoparticles using macroalgae, *Gracilaria* sp., was faster than that of other organisms. This process of nanoparticle production is eco-friendly as it is free from any solvent or toxic chemicals and is also easily amenable for large scale production.

All the Papers have been peer reviewed by at least two referees. Publishers and Editor consider it their moral duty to acknowledge the contribution of referees to improve the quality of this special volume.

Hardev Singh Virk
Editor