

Preface

In recent years, materials science has emerged as one of the most important and exciting areas of research in the fields of science, engineering, and technology. This is mainly because of the fact that materials science has led to the recognition of the fundamental similarities underlying the structures, phenomena, and properties of a wide variety of interesting and technologically important materials. The identification and development of novel materials every decade has paved the way, in a very much large measure, for the advancement of knowledge in science.

The three fundamental constituents of materials science and engineering are perhaps crystal growth, thin film fabrications, and development of nanomaterials. Development of devices for technologically important applications such as sensors, detectors, and integrated circuits for data acquisition and analysis calls for the growth of crystals of suitable size and perfection. Similarly, continued technological advances in the fields of optoelectronic, photonic, gas sensors, solar cells, etc., which have spawned many emergent cutting edge technologies were made possible with the development of thin films made from newer materials. Further, the development of various novel nanostructured materials with highly remarkable properties appears to have taken the developments in science and technology to every conceivable sphere of human endeavor.

Taking cognizance of these variegated importances of research in materials science, the Department of Physics, Jamal Mohamed College, Tiruchirappalli, South India, an autonomous A-grade college, recognized as a college with potential for excellence by the National Accreditation and Assessment Council, constituted by the University Grants Commission (UGC) of the Government of India, organized an International Conference on Recent Trends in Materials Science and Applications (ICRTMSA 2016) during 29th February 2016. This proceeding is a compendium of the materials presented in the plenary sessions, invited lectures, and papers presented at this conference. It provides an overview of materials science, starting from the experimental and theoretical methods of preparation, processing etc., for the identification of the structural changes, properties, and applications. It contains a total of 58 chapters organized into six parts (Part I–VI including “Invited and Plenary Talk”).

Part I comprises of six chapters consisting of lectures delivered by the invited speakers on topics such as cavitation technology, biological applications of core shell nanoparticles, quantum dots and device fabrication, spectroscopic and quantum computation techniques, electrodeposition method for nanostructured thin film preparation, and the prospects and constraints of emerging nanotechnology.

Part II focuses on the significant advances in nanoscience and nanotechnology and covers topics including synthesis and annealing effects, and spectral, thermal, microstructural, magnetic, electrochemical, and dielectric properties of nanomaterials for wide range of applications including gas sensing, photocathode for solar cells, optical limiting, antibacterial, photocatalytic, super-capacitor electrode, optoelectronic, storage device, and window layer applications.

Part III is devoted to the studies of the electronic and optical properties related to the quantum dots, the artificial atoms. Stress is on Group II–VI and III–V ternary and quaternary semiconducting materials, as they are considered to be promising candidates due to their potential applications in short wavelength laser diodes, amplifiers, and switches. The size-dependent dots exhibit some exotic electronic and optical properties which can be applied for fabricating novel optoelectronic devices such as optical and electro-optic modulators, inter-band lasers, optical switches, optical amplifiers, and inter-subband long wavelength detectors. The experimental synthesis of the cadmium sulfide (CdS) quantum dots and their related optical properties is also discussed.

Part IV deals with the experimental understanding of surface and thin film materials, their deposition, processing and fabrication techniques, spectroscopic, surface, resistivity, AC impedance, conductivity and magnetic studies, sensing and optical properties that are used to produce optoelectronic, photonic, gas sensor, and solar cells, Li-ion battery and magneto-optic memory devices. It focuses specially on the solvent effect on the preparation and properties of thin films, preparation of nanostructured thin films for sensing application, studies on phase transformation behavior, and organic and potential material preparation for solar cell applications.

Part V discusses the synthesis and crystal growth of technologically important single crystals for nonlinear optical and electro-optic applications. In particular, it covers the synthesis, growth, spectral, thermal, mechanical, dielectric, and optical properties of organic, inorganic, and semi-organic single crystals grown by slow evaporation, top-seeded solution growth, and vertical Bridgman growth techniques, studies of the dielectric properties of organic single crystals and fluorinated anti-ferroelectric liquid crystal and ion irradiation studies on semi-organic single crystals. Also the X-ray crystallography studies of many biological compounds such as of E-methyl-2-(1,3-dimethyl-2,6-diphenylpiperidin-4-ylidene) hydrazinecarboxylate, 4-ethoxyanilinium hydrogen succinate, and 4-methoxyanilinium chloride 4-methoxy aniline crystallized by slow evaporation method are focussed. Their structures are solved and refined using full-matrix least squares technique by SHELX program package and their applications are presented.

Finally, Part VI elaborates on spectroscopy, an important tool in the field of pharmaceutical sciences. It emphasizes the structural design, highest occupied molecular orbital and lowest unoccupied molecular orbital (HOMO-LUMO),

thermodynamical parameters, etc., of some pharmaceutically and biologically active drugs using quantum computational chemistry methods and computer modeling techniques. The same chapter also discusses the theoretical and experimental evaluation of ultrasonic velocity in liquid mixtures and studies the effect of the variations in the ultrasonic velocity on the behavior of polymer systems, such as intra- and intermolecular association, dipolar interactions, complex formation, and structural changes which in turn are helpful in the production and use of polymers in pharmaceuticals and industry.

As this proceedings contains results of experimental and theoretical research, it will serve as an essential reading for a wider audience which includes students, teachers, professionals, researchers, and industrialists involved in all branches of materials science and engineering, particularly for those who are preparing for an entry into or are already associated with materials science, and nanoscience and technology.

Constructive suggestions for the betterment of the proceedings will be much appreciated and gratefully acknowledged.

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