



Editorial

Symposium on advances in semiconducting materials: XX International Materials Research Congress, Cancun, Mexico

The field of semiconducting materials is rapidly expanding with the use of nano-objects considered as building blocks for the elaboration of functional materials and various novel devices. Providing updated research information on the recent developments in various semiconducting materials will be of great interest for academicians and technologists interested in both fundamental research and industrial applications. This special issue contains selective peer reviewed work presented in symposium 5, "Advances in semiconducting materials" of XX International Materials Research Congress (IMRC2011), jointly organized by the Sociedad Mexicana de Materiales (SMM) and the Materials Research Society (MRS), USA. It was held in Cancun, Mexico from August 13–19, 2011; containing 24 symposia bringing together researchers, students and industrialist from 38 different countries with the submissions of approximately 2032 abstracts.

This symposium 5 on semiconducting materials is intended as a vehicle for the dissemination of research results on the recent developments in semiconducting materials while also providing an excellent opportunity for basic researchers and industrialists around the world to exchange their findings and initiate collaboration at the national and international level. Among the 174 abstracts received, 157 abstracts were accepted, which included 12 invited 33 oral presentations and the remaining as posters.

The main objective of the symposium was to ensure appropriate representation of the key issues such as growth, characterization, theoretical studies, device applications and problems related to semiconducting materials. The technical issues covered in this symposium varied from growth and properties of organic semiconductors (SC), inorganic SC, nanostructured SC, hybrid SC, oxide SC, magnetic SC, microscopy of SC materials, magnetic SC, etc. Another area emphasized during the symposium is the characterization techniques for structural and morphological assessments of the various semiconducting materials using XRD, FESEM, HRTEM, energy-dispersive X-ray spectroscopy (EDS) and X-ray photoelectron spectroscopy (XPS) studies, along with various electronic, photonic, photoconductive, optical and thermal analyses techniques. In addition to the above, the scope of the symposium extended to spectroscopy of SC, atomistic simulation of quantum optic and magneto-optic oxide materials, semiconductor quantum optoelectronics, quantum semiconductor devices and technologies, nitride semiconductors and devices, smart devices, etc.

Specifically, Invited lectures by leading researchers from various countries focused on different photovoltaic structures based on band engineering with semiconductor quantum wells, earth abundant hetero-junctions and multi-junction solar cells with

III–V materials designed to achieve ~37% efficiencies, etc. Also lattice-mismatched III–V semiconductors with Si for many device technologies, advances in Si and Ge quantum dot physics as well as the different applications of Si and Ge quantum dots in quantum electronics, such as Si QD light emitting diodes, Ge QD photoelectronic devices, Si QD solar cells and memory structures, Si QD based one electron transistors and double QD structures for spintronics were also presented. Additionally, comparison of optical parameters of crystalline and amorphous Si quantum dots embedded in the hydrogenated amorphous silicon (a-Si:H) were discussed. Furthermore, the correlations between the intensity of different PL bands and the volumes of Si nanocrystals (nc-Si) and/or an amorphous (a-Si:H) phase have been discussed based on X-ray diffraction (XRD) and photoluminescence (PL) methods. Diamond structures measured by scanning tunneling spectroscopy and methods to measure carrier concentrations in semiconductors using novel, non-destructive RCPCD technique were also presented. Further to enlightening topics in semiconductors, porous silicon nanostructures with inexpensive fabrication and its utilization in biomedical applications such as cancer therapy, targeting tumors and drug delivery were also presented. Finally, a non-conventional route (ionizing radiation) for the synthesis of conducting polymers such as in free radical polymerization to obtain polymers with a narrow distribution of molecular weight was presented along with synthesis of various types of semiconducting polymers and its characterizations by SEM, TGA, XRD, gel permeation chromatography (GPC), conductivity measurements, and spectroscopic characterization in the UV–vis and IR regions.

Combined with invited speakers, various students and researchers made attractive oral contributions that kept the symposium focus active for three days. Several works based on synthesis of nanostructured materials such as Ag-doped SnO₂ nanoparticles, oleate capped lead telluride quantum dots, CdTe nanocrystal inks, BiVO₄ nanoparticles, ZnO nano agglomerates with silver nanoparticles and In₂O₃ nanocrystals in alumina matrixes by hydrothermal method, colloidal process, drop-casting deposition, mechano-chemical synthesis, photoreduction and impregnation methods and co-pulverisation process, respectively were presented. Synthesized nanoparticles were investigated by XRD, HRTEM, XPS and FESEM and the same were also discussed. Synthesis of graphene on SiC substrates, Si nanorods, hydrogenated nano-crystalline-silicon, hydrogenated polymorphous silicon, graphene on Ni by one of the chemical vapor deposition technique were presented along with characterization techniques like XPS, PL and Raman spectroscopy.

Additional topics that were addressed included: Opto-electronic, doped semiconductor thin film, magnetic, photocatalytic materials such as Er–Yb co-doped nanocrystalline $ZrO_2-B_2O_3$, $TiO_2-Al_2O_3$ thin films, nitrogen doping in titanium oxide based nanostructures, chromium oxide thin films, indium and fluorine doped ZnO, Ag_2SnSe_3 and Ag_2SnTe_3 ; Epitaxy of near single crystalline compound semiconductors on flexible metal templates, Mg doped cubic GaN films, aluminum-doped zinc oxide films, III–V/Si heterostructure nanowires, SnO_2 ceramics doped with ZnO densification agent, nitrogen doped p-type SnO thin films, ZnO nano-rods and growth of GaInAs nano wires by sol–gel method, combining electrophoretic deposition with sputtering, charge transfer, thermal oxidation in air atmosphere, spray pyrolysis, rapid roll to roll ion beam assisted deposition, MOVPE; RF magnetron sputtering, vapor liquid solid growth mode from gold catalysts, microwave sintering; PVD, and liquid phase epitaxy were presented. Novel characterization techniques such as EPR, XPS, photocatalytic activity, behavior of hysteresis loop, PL, optical absorption and galvano-magnetic effects, RHEED, X-ray diffraction (pole diagrams), transmission electron microscopy analysis, optoelectronic properties, Hall measurements, thermoluminescence, and AFM were presented. Solar cell materials and their structures such as $SiO_2/np-HfO_2/SiO_x$ dielectric structure, InAs/GaAs quantum dot solar cells, photovoltaic cadmium selenide/cadmium telluride interface, CIGS thin films were also discussed. Finally, modeling of HIT and CIGS based solar cells were presented using numerical simulation tools to determine ways to improve efficiencies of these solar cells. All of the above presentations were received favorably by younger audience as well as new industrialists.

Enlightened presentation by the invited and oral speakers showed that the field of semiconductor engineering still has plenty of room for research, growth, development and expansion. This interaction between the researchers from educational institutions and industries has established a strong link for the creation of multinational thematic and research networks across the globe, as well as promoting interaction for future collaborative joint projects within some of the American and European Union funded projects.

I wish to express my deepest appreciation to the organizing committee and volunteers who have made this symposium successful. I would like to extend my sincere thanks to the Editor-in-Chief, his associates of Materials Science and Engineering B, contributed authors and reviewers who made this special issue a reality. Special thanks are due to my co-organizers Dr. Alex Freundlich, University of Houston, USA, Dr. Antonieta Garcia Murillo, IPN, Mexico, Dr. Vijay Singh, University of Kentucky, USA and members of the international Scientific Advisory committee. Also I wish to thank Dr. René Asomoza Palacio, General Director, Centro de Investigación y de Estudios Avanzados del IPN (CINVESTAV), Mexico and IMRC2011 organizers for their support.

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