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May, 2012

(Poonam Sharma)
VISITS ABROAD

1. Worked at "University of Maryland", College Park, USA as a "Faculty Research Assistant" at "Department of Chemical and Biomolecular Engineering" and "Department of Mechanical Engineering" from 12th November 2010 to 6th Dec 2011 under the DST-NSF Collaborative Research Project No. NSF DMR086610. There, I worked on carbon/iron oxide and graphene oxide/iron oxide based layered oxides for solar hydrogen production and determining its effects on structural, surface morphological, optical, electrical and photoelectrochemical properties. Attended a short term course on SEM and Raman instrument operation. Performed Raman depth profile measurements for interface study of bilayered metal oxides. SEM and XPS experiments were performed on the swift heavy ion induced modified TiO₂ and Fe₂O₃ thin films for solar hydrogen production.

2. Visited “Boston, Massachusetts, USA” for 2010 MRS Fall Meeting during 29th Nov–3rd Dec 2010 and presented a paper entitled “Nanostructured Fe-TiO₂ thin film modified by Zn-Fe₂O₃ for solar hydrogen generation” in the oral session.


PROFESSIONAL TRAINING

• Attended a one week workshop on "Electron Microscopy" organized by: Maryland Nanocenter, University of Maryland, College Park, USA. (May 11th-18th, 2011)

RESEARCH PROJECTS WORKED UNDER:

• Worked as JRF from Mar 1st 2008 to Mar 31st 2010 and as SRF from Apr 1st 2010 to Oct 30th 2010 in DST sponsored research project entitled, “A Study on Multilayered Nanostructured Metal Oxide Thin Films for Solar Hydrogen Production” at DEI, Dayalbagh, Agra

• Worked as Faculty Research Assistant on DST-NSF collaborative research project entitled, “Transition Metal Oxide Based Nanoarchitecture for Photoelectrochemical Hydrogen Generation” at UMCP, Maryland, USA (Nov 2010-Dec 2011)

AWARDS

• A Beam Time Account (BTA) of three runs of two shifts each was approved against the presentation made to Accelerator Users Committee of Inter University Accelerator Centre (IUAC), Delhi on Dec 17-18, 2009.
Publications: Research Articles (Published/Communicated)

Following is the list of research publications, which are the outcome of the work carried out by me.


3. PEC system for hydrogen generation using Zn doped Fe\textsubscript{2}O\textsubscript{3}/TiO\textsubscript{2} bicomponent. Proceedings of Int. Conf. on Nanotechnology in chemistry, Health, Energy and Environment, (NATCHEE-2010). (Conf. Proceedings)


11. Structural and morphological changes induced by swift heavy ions in spray pyrolytically deposited nanostructured iron oxide thin films. *J. Mat. Chem. Phys. (Communicated)*

12. A photoelectrochemical study on carbon coated nanoporous iron oxide thin films, *J. Electrochem Soc. (Communicated)*

13. Effect of swift heavy ion irradiation on photoelectrochemical properties of bilayered Zn-Fe\textsubscript{2}O\textsubscript{3}/Fe-TiO\textsubscript{2} thin films, *Int. J. Hydrogen Energy*, (Communicated)
1. Solar Splitting of Water using SHI Modified Nanostructured Hematite in International Conference and Workshop on Nanostructured Ceramics and other Nanomaterials ICWNCN-2012, Department of Physics and Astrophysics, University of Delhi, Delhi, India (13 Mar – 16 Mar, 2012).


10. Nanostructured Fe-TiO$_2$ thin film modified by Zn-Fe$_2$O$_3$ for solar hydrogen generation in MRS Fall Meeting, Boston, Massachusetts, USA (29 Nov- 3 Dec, 2010).

11. 100Mev Si$^{8+}$ ion beam induced modification on structural, optical, morphological and photoelectrochemical properties of electrodeposited iron oxide thin films” Swift Heavy Ion in Material Engineering and Characterization (SHIMAC-2010), IUAC New Delhi, (6 Oct -9 Oct, 2010).

12. 100 MeV Si$^{8+}$ ion beam induced modification on structural, morphological and photoelectrochemical properties of nanostructured Fe$_2$O$_3$/TiO$_2$ bilayered thin
films, Swift Heavy Ion in Material Engineering and Characterization (SHIMAC-2010), IUAC New Delhi, India (6 Oct – 9 Oct, 2010).

13. A Study on Structural, optical and morphological properties of α-Fe₂O₃, TiO₂ and TiO₂/Fe₂O₃ thin films for photoelectrochemical application, European Crystallographic Meeting ECM 26, Darmstadt, Germany (27 Aug – 30 Aug, 2010).

14. 120 MeV Ag⁺ ion beam induced modification on structural, morphological and photoelectrochemical properties of nanostructured Fe₂O₃/TiO₂ bilayered thin films, 17th International Conference on Ion Beam Modification of Materials, IBMM 2010, Montreal Canada (23 Aug - 27 Aug, 2010).


List of notations/abbreviations/symbols used

at.%  Atomic percentage
A  Surface area of the metal-semiconductor junction
a/m  Air mass ratio
AFM  Atomic force microscopy
B_M  FWHM value of material
B_S  FWHM value of standard material
C  Capacitance at semiconductor/electrolyte junction
c  Velocity of light
CB  Conduction band
CE  Counter electrode
α  Absorption coefficient
α-Fe_2O_3  α-phase of Fe_2O_3 (i.e. hematite)
γ-Fe_2O_3  γ-phase of Fe_2O_3 (i.e. magnetite)
DOS  Density of states
ε^-  Electron
ε_o  Permittivity of free space
E_c  Energy of the conduction band edge
E_f  Fermi level in the bulk of the semiconductor
E_FS  Fermi level at the semiconductor surface
E_g  Bandgap energy
E_redox  Redox potential
E_i  Energy at equilibrium
E_v  Energy of valence band edge
ε  Relative permittivity of the semiconductor
FWHM  Full width at half maxima
f(E)  Fermi-Dirac energy distribution function
h  Planck's constant
h^+  Holes present in semiconductor
JCPDS-ICDD  Joint Committee on Powder Diffraction Standards-
International Centre for Diffraction Data
I-V  Current-voltage
k                Dielectric constant
k_B              Boltzmann’s constant
L_D               Debye length
\lambda            Wavelength of radiation
M               Molarity
n               Electron concentration
L_h               Diffusion length of holes
N_d               Donor density
NHE               Normal hydrogen electrode
NSEI               Nanostructured semiconductor/electrolyte interface
PEC               Photoelectrochemical
pH^-             \log_{10}[H^+]
\Delta \Phi_{sc}       Total potential drop within the semiconductor
\theta             Angle of incidence of the X-ray beam
q              Electronic charge
r_o              Radii of very small semiconductor particles
SC               Semiconductor
SCE              Saturated calomel electrode
SEM              Scanning electron microscopy
STH              Solar to hydrogen conversion efficiency
TiO_2           Titanium dioxide
UV               Ultra violet
\mu_n            Mobility of electron
\mu_p            Mobility of hole
\mu_i            Mobility of ions
\nu              Frequency
V_{app}               Applied potential
VB               Valence band
V_{fb}           Flatband potential
V_{bias or E}    Applied bias voltage
V_{on}            Onset potential
\omega_d          Width of the depletion layer
XRD              X-ray diffraction
XPS              X-ray photoelectron spectroscopy
List of symbols used to express units of measurement

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