CURRICULUM VITAE

***Name*:** Dr. Dillip Kumar Panda

***Current Position*:** Post-Doctoral Fellow (PDF) Since March 2015
Supervisors – Prof. Bart M, Bartlett and Prof. Stephen Maldonado
Department of Chemistry, University of Michigan,
Ann Arbor, MI-48109-1055, USA

Previous Position: Post-Doctoral Fellow (PDF)
Supervisor – Prof. Sourav Saha
Department of Chemistry and Biochemistry
Florida State University, Tallahassee
Florida, USA.

***Future Position*:**

Education:

1. Doctor of Philosophy (2007-2011)

Institute	Intelligent Polymer Research Institute (IPRI), Dept of Chemistry
University	University of Wollongong, Australia
Thesis	**"Nanostructured Organic Solar Cells".**
Supervisor	Prof. Gordon G Wallace
Co-supervisor	Dr. Attila J. Mozer

2. Master of Science in Chemistry (2000-2002)

Institute	National Institute of Technology (NIT) Rourkela
University	Sambalpur University, Orissa, India
Class	**First Class, Gold medalist, First Rank in university**
Courses	Physical Chemistry, Inorganic chemistry, Organic Chemistry, Spectroscopy, Natural Products and Pericycle Reactions, Group Theory and Molecular Orbital, Coordination Chemistry, Instrumental Analysis &
Dissertation	An Assessment of Physico-Chemical Characteristics of Ground Water of Dolomite area in Orissa, India.

3. Bachelor of Science (1995- 1998)

Institute	Maharaja Purna Chandra College, Baripada
University	Utkal University, Orissa, India
Class	**First Class with Chemistry Honors**

Courses Chemistry as Honors (Physical Chemistry, Organic Chemistry, Inorganic Chemistry & Analytical Chemistry), Physics &Mathematics.

Work Experience:

1. Junior/ Research Fellow in Chemical Science division at Central Forensic Science Laboratory (Govt. of India) Hyderabad and deputed to IIT Kanpur (2004-2007).
2. Post-Doctoral Research Fellow at Department of Chemistry and Biochemistry, Florida State University (FSU), Tallahassee, Florida, USA, since 2011.
3. Working as research assistant at IPRI, University of Wollongong, 2010-2011.

Awards /Honours

1. **First class first** with **University Gold Medal** in Master of Science (M.Sc) in Chemistry (First Rank in university).
2. Awarded Junior/Senior Fellow of Central Forensic Science Lab (CFSL) Hyderabad, Directorate Forensic Science, and Govt. of India (2004-2007).
3. Awarded Australian Centre of Electrochemical Science (ACES) and Higher Degree Research Scholarship (2007-2011) to pursue PhD at IPRI, University of Wollongong, Australia.
4. Received Overseas Research Student Scheme Fellowship of UK to pursue PhD program at Herriot Watt University, Edinburgh, UK) in 2007.
5. Awarded **The Australian Research Council Nanotechnology (ARCN)** Network scholarship to attend and present poster at 17th International Photochemical Conversion and storage of solar energy (IPS-17th) at Sydney., Australia, July 2008.
6. Awarded the **Australian Research Network for Advanced Materials** (ARNAM) scholarship to attend the international conference (IUMRS-ICEM) on electronic materials, at Sydney., Australia, 28th July 1stAug 2008.
7. Awarded **European Doctorate in Physics and Chemistry of Advanced Materials (PCAM) Fellowship** to attend the "Chemistry and Physics of Materials for Energetic. A

European School in Materials Science" at University of Milano-Bicocca Milano, Italy**,** September 2009.

8. Awarded Equity Scholarship to attend the third annual student 4 student leadership conference (S4SNLC) of University of Wollongong, Sept 2009.

9. Awarded Australian Academy of technological Science and Engineering (ATSE) Early Career Symposium Fellowship to attend the 32nd ATSE National Symposium. "Future-Proofing Australia–Rising to the Challenge of Climate Change" at Sofitel Brisbane Grand Central, Queensland, Australia, 16 –17, November 2009.

10. Awarded many Prizes on debate, Essay writing both in English and Oriya languages during Master of Science at NIT Rourkela, India.

11. Awarded 1st and 2nd position in state level Essay completion both in English and Oriya languages on the topic of "Female Empowerment" and "Environmental Pollution", Bhubaneswar, Orissa.

12. Awarded University of Michigan Energy Institute Postdoctoral Fellowship and will join as PDF from 23rd March 2015.

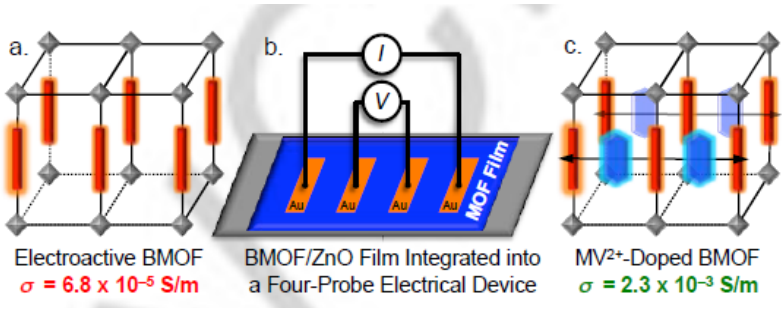
Examinations Qualified/ Nominated:

1. Qualified the IELTS **(**International English Language Testing System) exam in 2006.
2. Passed the national level chemistry written examination (2003) conducted by TATAINSTITUTEOFFUNDAMENTALRESEARCH (TIFR) MUMBAI, INDIA upon this examination, I was called for interview by TIFR as well as by NATIONAL CENTRE FOR BIOLOGICAL SCIENCES (N.C.B.S), BANGALORE, INDIA for PhD Program.
3. Nominated Vice-Chancellor debate (English and Oriya) competition by Director N.I.T Rourkela to Sambalpur University, India.
4. Selected for Guest faculty at NIT Rourkela to teach Master degree students of Chemistry in 2002.

Publications

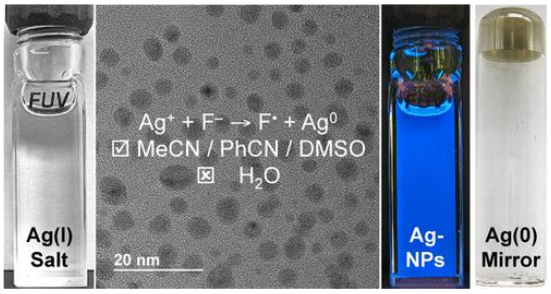
1. "Tuning electrical conductivity of Metal Organic Framework films with guest-mediated π-Donor/ Acceptor interactions".

Dillip K. Panda*, Z. Guo*, K. Maity, D. Lindsey, T.G. Parker, R. J. Clark, T.E. Albrecht-Schmitt, J. L. Barreda-Esparza, P Xiong, W. Zhou, S. Saha (***Angew Chem***, Wiley-VCH, Submitted on 16th Feb. 2015 (under Review),* Contributed equally).



2. "Fluoride-Induced Reduction of Ag(I) Cation Leading to Formation of Silver Mirrors and Luminescent Ag-Nanoparticles".

Krishnendu Maity, **Dillip K. Panda**, Eric Lochner, and Sourav Saha ***(J. Am. Chem. Soc.,*** 2015, 137, 2812–2815.



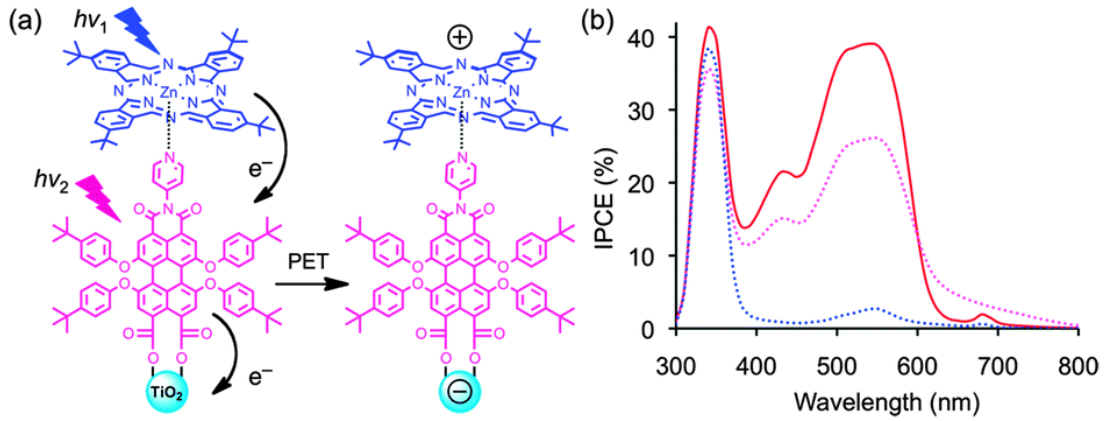
In aprotic solvents, Lewis basic F– anion reduces Lewis acidic Ag(I) cation to Ag(0), forming metallic silver mirrors on the inner surfaces of reaction vessels and luminescent Ag-nanoparticles (AgNPs) in supernatant solutions, which emit blue light upon UV irradiation. The F–-induced formation of silver mirrors and AgNPs was confirmed through X-ray photoelectron spectroscopy (XPS), transmission electron microscopy (TEM), energy dispersive X-ray spectroscopy (EDS), fluorescence spectroscopy, and mass spectrometry, whereas the Ag(I)-induced oxidation of F– to Ḟ radical, followed by its conversion to HF_2^- via H-abstraction and H-bonding, was evident from 19F NMR spectroscopy.

This redox reaction is deactivated in water, as the reducing power of hydrated F– diminishes drastically. Less Lewis basic Cl–, Br–, and I– ions do not reduce Ag(I) to Ag(0), instead they can only form Ag(I) halide precipitates irrespective of protic or aprotic solvents. The Ag-coated surfaces, luminescent AgNPs, and Ḟ radicals produced by this unprecedented redox reaction could be exploited as electrodes, light-emitting materials, and radical initiators, respectively.

3. "Dye Sensitized solar cells based on multichromophoric supramolecular light harvesting materials"

Dillip K. Panda, Flynt S. Goodson, Shuvasree Ray, and Sourav Saha ***(Chem. Commun.***, 2014**,** 50, 5358-5360).

Multichromophoric dye-sensitized solar cells (DSSCs) comprised of a supramolecular zinc-phthalocyanine···peryleneimide (ZnPc···PMI) dyad convert light to electrical energy with much higher power conversion efficiency (PCE = 2.3%) and incident-photon-to-current-efficiency (IPCE = *ca*. 40%) than the devices made of individual dyes.

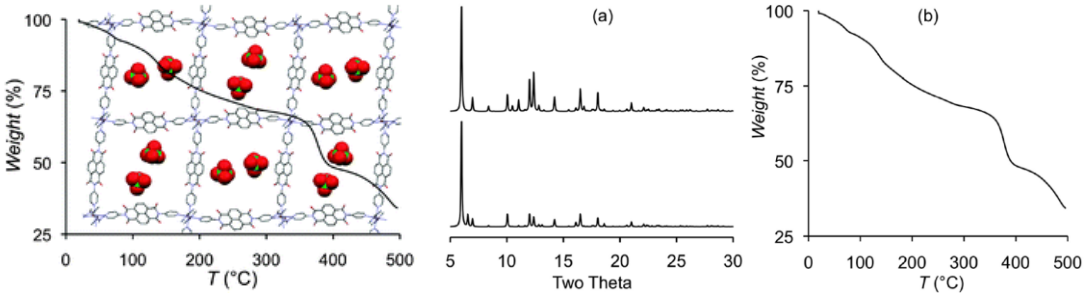


4. "Anion-directed assembly of non-interpenetrated square-grid metal-organic framework with nanoscale porosity"

Atanu Mitra, Christian T. Hubley, **Dillip K. Panda**, Ronald J. Clark and Sourav Saha, ***Chem.Commun.* , 2013,** 49, 6629-6631.

A non-interpenetrated square grid metal–organic framework (MOF) comprised of octahedral Zn(II) ions and linear *N*,*N*′-di(4-pyridyl)-1,4,5,8-naphthalenediimide (DPNDI) ligands was formed in the presence of noncoordinating perchlorate counterions that occupied the cavities of the porous network by forming CH···anion hydrogen bonds with DPNDI ligands, whereas a linear

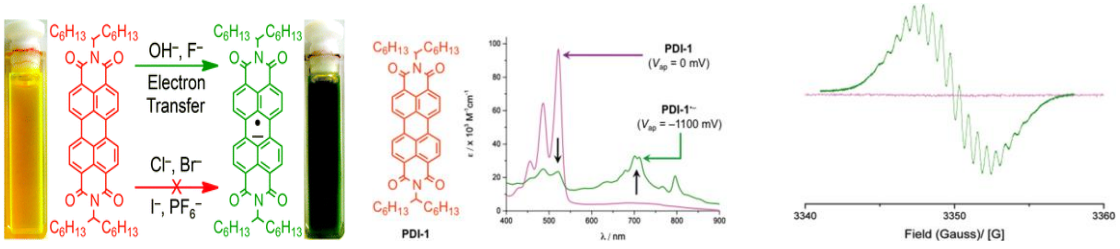
coordination polymer was obtained when Zn(II)-coordinated nitrate ions were present as counterions.



5."Tunable electronic interactions between anions and perylenediimide".

Flynt S. Goodson ,**Dillip K. Panda**, Shuvasree Ray, Atanu Mitra, Samit Guha and Sourav Saha, ***Organic and Bimolecular Chemistry,*** 2013, 11, 4797-4803.

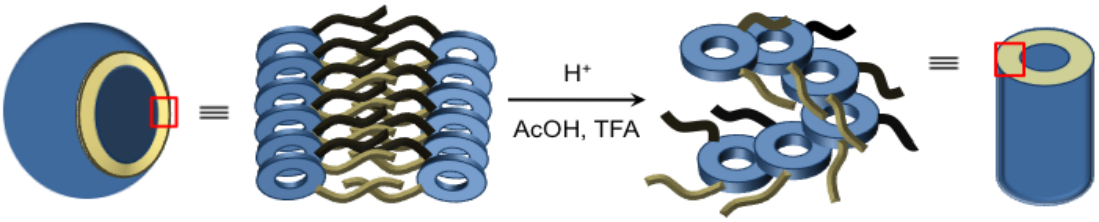
Over the past decade anion–π interaction has emerged as a new paradigm of supramolecular chemistry of anions. Taking advantage of the electronic nature of anion–π interaction, we have expanded its boundaries to charge-transfer (CT) and formal electron transfer (ET) events by adjusting the electron-donating and accepting abilities of anions and π-acids, respectively. To establish that ET, CT, and anion–π interactions could take place between different anions and π-acids as long as their electronic and structural properties are conducive, herein, we introduce 3, 4, 9,10-perylenediimide (**PDI-1**) that selectively undergoes thermal ET from strong Lewis basic hydroxide and fluoride anions, but remains electronically and optically silent to poor Lewis basic anions, as ET and CT events are turned OFF. These interactions have been fully characterized by UV/Vis, NMR, and EPR spectroscopies. These results demonstrate the generality of anion-induced ET events in aprotic solvents and further refute a notion that strong Lewis basic hydroxide and fluoride ions can only trigger nucleophilic attack to form covalent bonds instead of acting as sacrificial electron donors to π-acids under appropriate conditions.

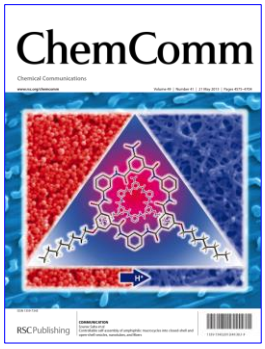


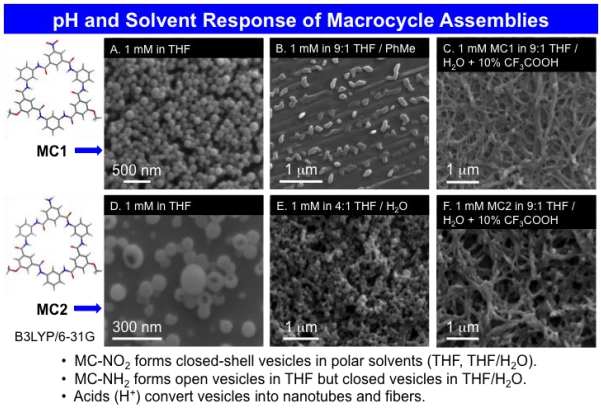
6. "Controllable self-assembly of amphiphilic macrocycles into closed-shell and open-shell vesicles, nanotubes, and fibers".

Dillip K. Panda, ‡ Atanu Mitra, ‡ Lucas J. Corson and Sourav Saha (***Chem. Commun.***, 2013**,** 49, 4601-4603) ***(featured on Chem Commun., in front Cover in May 2013).*****(‡ contributed equally)**

Depending on functional groups, amphiphilic hexaamide macrocycles self-assemble into closed-shell and open-shell vesicles in polar solvents. In the presence of water, open-shell vesicles morph into closed-shell vesicles, whereas acidification of the medium transforms vesicles into nanotubes and fibers.





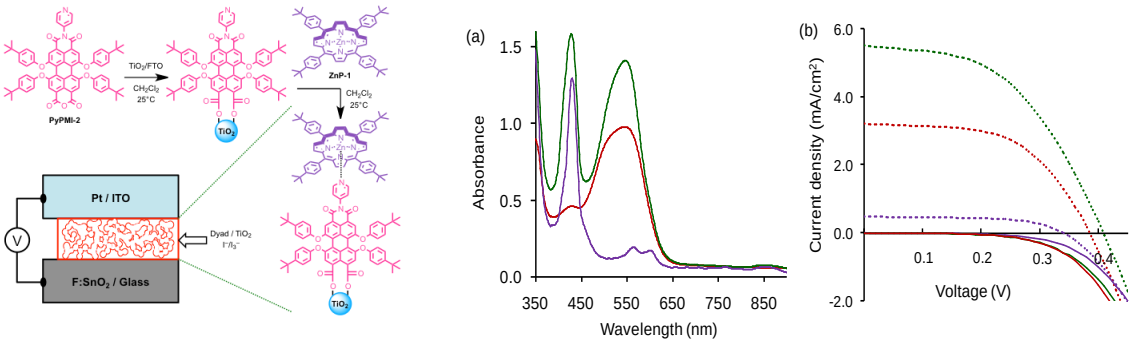


7. "Multichromophoric dye-sensitized solar cells based on supramolecular zinc-porphyrinperylene-imide dyads".

Dillip K. Panda, Flynt S. Goodson, Shuvasree Ray, Rachel Lowell and Sourav Saha**.** ***Chem. Commun.*****,** 2012, 48, 8775-8777. ***(Top ten most accessed articles in July 2012).***

Multichromophoric dye-sensitized solar cells (DSCs) based on self-assembled zinc-porphyrin···peryleneimide dyad on TiO_2 films display more efficient light-to-electrical energy conversion than DSCs based on individual dyes. Improved efficiency of multichromophoric dyes can be attributed to co-sensitization as well as vectorial electron transfer that lead to better

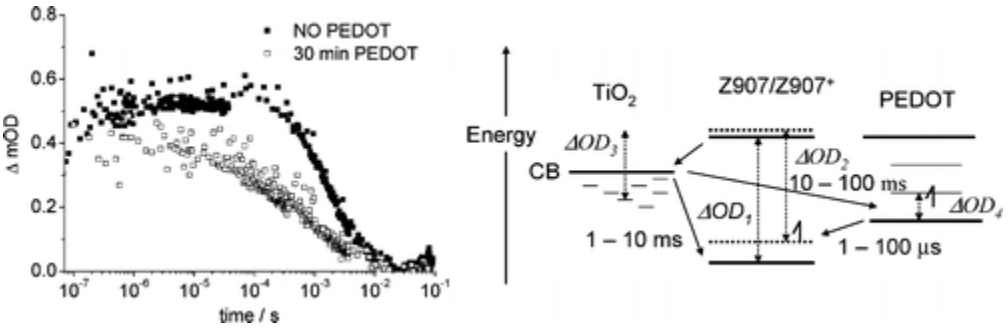
electron/hole separation in the device.



8. "Microsecond dye regeneration kinetics in efficient solid state dye-sensitized solarcells using a photo-electrochemically deposited PEDOT hole conductor".

Attila J. Mozer, **Dillip K. Panda**, Sanjeev Gambhir, Bjorn Winther-Jensen, Gordon. G Wallace**,** ***J. Am. Chem. Soc.,*** 2010, 132, 9543-9545.

Microsecond dye-regeneration kinetics was observed in efficient solid state dye-sensitized solar cells using photoelectrochemically deposited poly (3, 4-ethylenedioxythiophene (PEDOT) hole conductors using transient absorption spectroscopy. The dye-regeneration rate is orders of magnitude slower than the case using the I^-/I_3^- redox couple or commonly used small molecule hole conductor and is attributed to the low dye to PEDOT ratio within the films.

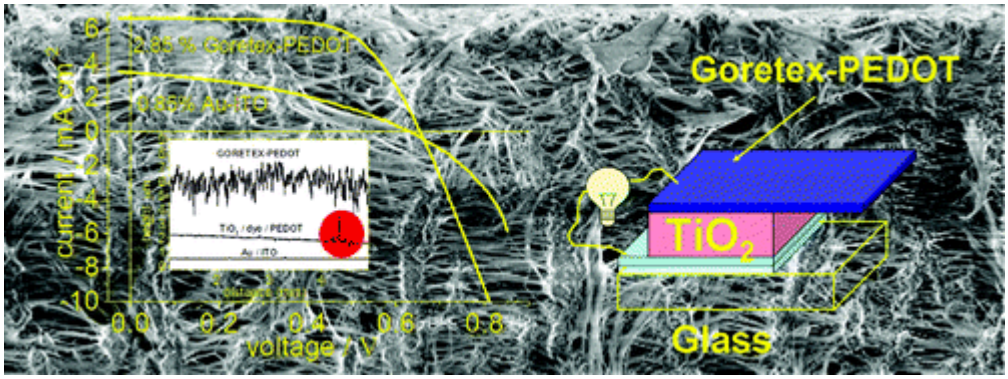


9."Flexible and compressible Goretex®-PEDOT membrane electrodes for solid state dye sensitized solar cells".

Attila J. Mozer, **Dillip K. Panda**, Sanjeev Gambhir, Tony C. Romeo, Bjorn Winther-Jensen, Gordon. G Wallace**,** Bjorn Winther-Jensen, Gordon G.Wallace, ***Langmuir***, 2010, 26(3), 1452–1455.

A porous, flexible electrode based on PTFE (Teflon) membrane (Goretex) coated with a metallic current collector and a conducting polymer poly (3, 4-ethylenedioxythiophene (PEDOT) has been

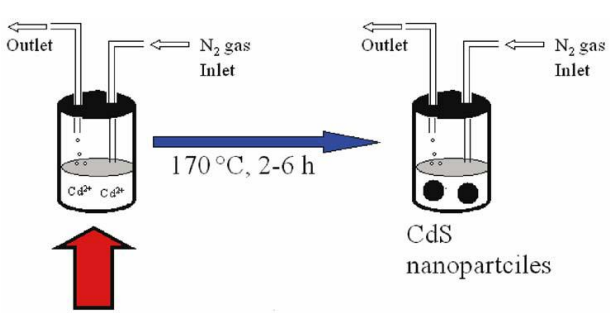
developed for applications in solid-state dye-sensitized solar cells. Its low sheet resistance and compressibility make it an ideal electrode on uneven TiO2 surfaces with high efficiency and reproducibility. The porous nature of the electrode enables the feed-through of reactants and treatment agents, which opens up exciting opportunities to interface these photoelectrochemical devices with electrolytic, energy conversion, and storage systems. Postfabrication bonding of the photoanode and the Goretex-Au-PEDOT electrode is demonstrated.

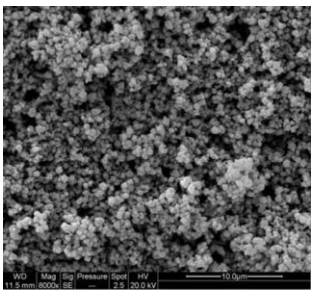


10. "Re-dispersible Li^{+1} and Eu^{+3} co-doped CdS nanoparticles: luminescence studies".

N. S. Gajbhiye, Raghumani Singh Ningthoujam, Asar Ahmed, **D. K. Panda**, S. S. Umare and S. J. Sharma, ***Pramana J. Phys.***(Springer), 2008, 70(2), 313-321.

Re-dispersible CdS, 5 at.% Eu3+-doped CdS, 2 at.% Li+ and 5 at.% Eu3+ co-doped CdS nanoparticles in organic solvent are prepared by urea hydrolysis in ethylene glycol medium at a low temperature of 170 C. CdS nanoparticles have spherical shape with a diameter of ~80 nm. The asymmetric ratio (*A*21) of the integrated intensities of the electrical dipole transition to the magnetic dipole transition for 5 at.% Eu3+-doped CdS is found to be 3.8 and this ratio is significantly decreased for 2 at.% Li+ and 5 at.% Eu3+ co-doped CdS (*A*21 = 2.6). It establishes that the symmetry environment of Eu3+ ion is more favored by Li-doping. Extra peak at 550 nm (green emission) could be seen for 2 and 5 at.% Eu3+ co-doped CdS. Also, the significant energy transfer from host CdS to Eu3+ is found for 5 at.% Eu3+-doped CdS compared to that for 2 at.% Li+ and 5 at.% Eu3+ co-doped CdS.

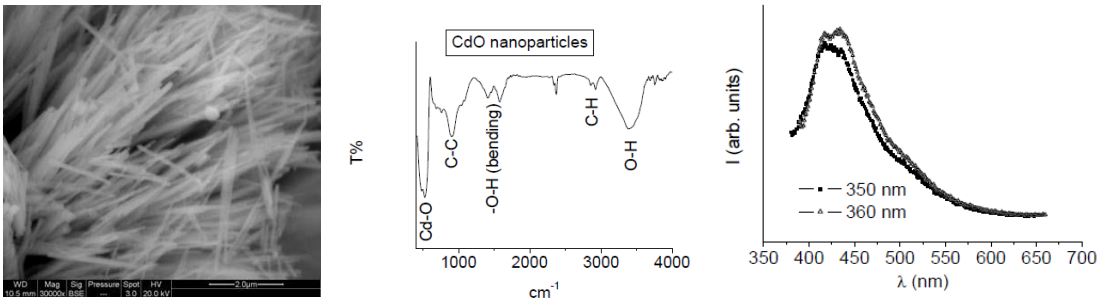




11."Re-dispersible Li^{+1} and Eu^{+3} co-doped CdO nanowires: luminescence studies"

N. S. Gajbhiye, Raghumani Singh Ningthoujam, Asar Ahmed, **D. K. Panda**, S. S. Umare and S. J. Sharma. ***Proc. of ASID*, 2006, 8-12 Oct, NewDelhi.(Proceeding paper).**

Re-dispersible CdO, 5 at.% Eu3+ doped CdO, 2 at.% Li+ and 5 at.% Eu3+ co-doped CdO nanowires in organic solvent are prepared by urea hydrolysis in ethylene glycol medium at low temperature of 150 °C. CdO nanowires have the apical ratio of 50 nm to 2 μm. CdO starts band gap edge at 360 nm and shows luminescence at 430 nm (blue emission). The asymmetric ratio (A21) of the integrated intensities of the electrical dipole transition to the magnetic dipole transition for 5 at.% Eu3+ doped CdO is found to be 1.2 and this ratio is significantly increased for 2 at.% Li+ and 5 at.% Eu3+ codoped CdO (A12 = 2.2). It establishes that the red emission can be enhanced by Li-doping. Also, the significant energy transfer from host CdO to Eu3+ is found for 2 at.% Li+ and 5 at.% Eu3+ co-doped CdO.



12. "Graphene sheet as a solid-state dye-sensitized solar cell counter electrode".

Dillip K. Panda, Attila J. Mozer, Sanjeev Gambhir, Lynn Dennany, David L. Officer and Gordon G. Wallace (**to be *submitted soon).***

13. **"**Zinc–Porphyrin (GD2) dye as a photo-sensitizer for PEDOT based solid state dye-sensitized solar cells" .

Dillip K. Panda, Attila J Mozer, Powel Wagner, Sanjeev Gambhir, Bjorn W Jensen, David L Officer and Gordon G Wallace (**under preparation**)

14. "Studies of morphology of photo-anodeprepared by Photo-electrochemical polymerization method".

Dillip K. Panda, Attila J. Mozer, Sanjeev Gambhir, Bjorn W Jensen and Gordon G Wallace. (Under preparation).

15. **"**Novel Metal Organic Materials with Iron (ii) and bis-pyridine linker".

Dillip K. Panda, Evan Vickers, and Sourav Saha (Under Preparations).

Oral Presentations:

1. Organic Solar Cells, INSI Mini symposium, Department of Chemistry, Florida State University, 16th Dec 2011.
2. Novel Hybrid Solar Cells, 21st Chemistry and IPRI conference of UoW, 28 th-30th Oct 2007 at Jerves Bay, Australia.
3. Solidstatedyesensitizedsolarcells, 22ndChemistryandIPRIconferenceofUoW, 26th-28th Oct 2008 at Jerves Bay, Australia.
4. Accepted the abstract for talk entitled "Highly efficient flexible solid state dye sensitized solar cells using photo electrochemically deposited PEDOT holeconductor**"**submitted to MRS fall2009 30Nov-4thDec 2009 ,Boston, USA but I could not attend this conference.

Poster Presentations:

1. "Multichromophoric supramolecular solar cells using Zinc-phthalocyanine...perylene-imide Dyad"

Dillip K. Panda, Flynt S. Goodson, Sourav Saha, FSU Postdoctoral Scholar's Symposium, 20th Sept 2013, Tallahassee, Florida,**USA.**

2. Comparison of Efficiency, fill factor, Jsc, V_{oc} of novel organic dyes as potential alternatives to *state –of- the-art* Ru-based black dye for dye sensitized solar cells"

Sydney Garick, SaurabhSudesh, **Dillip K. Panda**, Flynt S. Goodson, and Sourav Saha.Young Scholars Program 25th July, 2013 at FSU**,** Tallahassee, Florida,**USA.**

3. "Functional supramolecular materials: Sensor, solar cells and drug delivery".

Flynt S Goodson, AtanuMitra, Christian T. Hubley, Dillip K. Panda, and Sourav Saha (will be presented 89th Annual FAME-2013 (May 9-11) conference, Tampa, Florida., **USA.**

4. "Multichromophoric dye-sensitized solar cells based on supramolecular zinc-porphyrinperylene-imide dyads".

Dillip K. Panda, Flynt S. Goodson, and Sourav Saha **(**Presented on 7th-11th April 2013 in 245th ACS spring Meeting 2013, New Orleans,**USA)**.

5. "Light-harvesting Zinc-phthalocyanine···Perylene-imide Supramolecular Dyad for DSSCs".

Angela Jiang, Namrata Palsule, **Dillip K. Panda**, Flynt S. Goodson, Prof. Sourav Saha, Young Scholars Program July, 2012 at FSU**, USA**.

6. "Optimization of organic solar cell technology".

Brendan Klovekorn, Ryan McKinney, **Dillip K. Panda**, Flynt Goodson, Prof. Sourav Saha, Young Scholar Program July, 2011 at FSU, **USA**.

7. "Solid-state dye-sensitized solar cells"

Dillip Kumar Panda, Attila J Mozer, Gordon G Wallace, ACES End-User Technology Showcase**,** 14thOctober 2010, AIIM facility, Innovation Campus, University of Wollongong, Wollongong, **Australia**.

8. "PEDOT-based Solid State Dye-Sensitized Solar Cells with Carbazol Dye"

Yu Uemura, Lei Tong, **Dillip K. Panda**, Attila J. Mozer, Sanjeev Gambhir, Nagatoshi Koumura, 30th Sept 2011, The Society for polymer science, **Japan**.

9. "Graphene on Multi walled carbon nanotube composite counter electrode in DSSCs".

Josef Velten, Anvar Zakhidov, **Dillip Panda**,Lynn Dennay, Attila Mozer, David Officer, 2009 American Physical society (APS) March Meeting,March 16–20,2009;Pittsburgh, Pennsylvania, **USA.**

10. "PEDOT based solid state solar cells"

Dillip Kumar Panda, Attila J Mozer, Gordon G Wallace, at Australian Centre of Electro materials Science (ACES) Forum: Challenges in solar cells characterization: Theory, spectroscopy and devices,16th-17thNov 2009, Innovation campus, University of Wollongong,

Australia.

11"Inorganic./organic hybrid solar cells using photoelectrochemically deposited electro-active polymers HTM"

Dillip Kumar Panda, Attila J Mozer, Gordon G Wallace, at17th International Photochemical Conversion and Storage of Solar Energy (IPS 17th)Sydney,28thjuly 1stAug 2008,**Australia.**

12. "Conducting polymer based organic/ Inorganic Solar Cells"

Dillip Kumar Panda, Attila J Mozer, Gordon G Wallace**,** Full Centre workshop, Monash University, 3rd- 4thOctober, 2007, Melbourne, **Australia.**

13. "Solid State Dye sensitized solar cells".

Dillip Kumar Panda,Attila J Mozer, Gordon G Wallace, at A **European School in Materials Science" Milano, Italy,** fromSeptember14-19,2009. University ofMilano-Bicocca, Milan, **Italy**.

14."Re-dispersible L i $^{+}$andEu^{3+} co-dopedCdOnanowires: luminescence studies".

N. S. Gajbhiye, Raghumani Singh Ningthoujam, Asar Ahmed, **D. K. Panda,** S. S. UmareandS. J.Sharma,atInternationalsymposium (Asiansymposium on information display (ASID) From8th-12th2006,atIndia habitat center, NewDelhi, **India**.

15. "Re-dispersibleLi^{+} andEu^{3+} co-dopedCdSnanoparticles:luminescencestudies".

Physics of **Disordered and Macroscopic Materials (MESODIS) International Workshop.**

N. S. Gajbhiye, R.S.Ningthoujam, Asar Ahmed, **D K. Panda,** S.S.Umare and S.J. Sharma

4th-8th2006, at Indian Institute of Technology (**IIT)** Kanpur, **India**.

Training/Workshop:

1. Attended National level workshop on "GSR particle analysisTechnique using SEM-EDXA" November 24 – 25, 2004 at C.F.S.L, Hyderabad, **India**.

2. Participated seminar Application of Radio isotopes and Radiation Technology (SARRT). 21st -22nd Nov. 2002 organized by Institute of Physics (IoP), BBSR and SARRT, Mumbai, **India.**

3. Attended the joint workshop of ARC-CEES (UoW) and ARC-CEFN (University of Queensland), at UoW, Wollongong, **Australia**.

4. Attended the training program on fabrication of high performance DSSCs at Monash University.

(14^{th}-16^{th}July 2008), Melbourne, **Australia**.

5. Participated the Energy forum on27^{th}July 2008 at IPRI, UoW, Wollongong, **Australia**.

6. Attended 2 week lecture on "**Introduction to Electrochemistry"** by Prof. Dennis Tallman, NDSU, USA, 22^{nd} March - 1^{st}April 2010, at AIIM facility, Innovation Campus, UoW, **Australia.**

7. Attended NETZSCH Technical Seminar on Thermal Analysis on - April 16, 2013 atFSU, Florida, **USA**.

Career Plan:

To be a Professor/Scientist in a reputed institute/university in my research area after completion of Post-Doctoral Fellowship (PDF).

Current Research:

(1) Fabrication and characterization of various supramolecular dyad/triad based dye sensitized solar cells, conducting polymers and their applications as hole transporting material, Photochemistry, electrochemistry, photo-electrochemistry and semiconductor, and dye sensitized electrode driven water splitting.

(2) Flexible solid-state solar cells

(3) Hybrid DSSCs using Q-Dot as Donor and various PDI dyes as an acceptor chromophore molecule using FRET concept.

(4) Tunable electronic interactions between anions and perylenediimiespdeespecially looking for F-sensor by using PDI dye and other electron deficient molecule such as NDI etc.

(5) Structural evolution and morphological studies of macroc-nitrocycles for drug delivery (SEM, TEM, AFM and DLS done)

(6) Metal organic framework (MOF).

(7) To train Ph.D./under graduate along with young scholar program students in the lab.

(8) Will be joined as PDF on 23^{rd} March 2015 at the Dept of chemistry, University of Michigan, and will work on UM Energy Institute Postdoctoral Fellow Grant for "Synthesis, Modeling and Lab Testing of Hybrid Organic-Inorganic Perovskite Materials for High Efficiency Solar-to-Electrical Energy Conversion.

Experimental Characterization Capabilities:

1. Fabrication of solid-state dye-sensitized solar cells (DSSCs), Liquid-DSSCs, supramolecular based DSSCs, Polymer solar cells, and measurement of current-voltage (JV) curve of these Photovoltaic devices by solar simulator.
2. IPCE (Incident photon to current efficiency) measurement for sensitization effect of the materials within solar cells.
3. Electrochemistry and spectroelectrochemistry, photo-electrochemistry (CV for calculation of redox properties of materials and, Chronoammperometry, Potentostatic growth, electrochemical polymerization and photo-electrochemical polymerization etc.)
4. UV-Vis-NIR spectroscopy.
5. Fluorescence spectroscopy (steady state)
6. Time resolved single photon counting fluorescencespectroscopy.
7. FT-IR and Raman spectroscopy
8. Matrix-assisted laser desorption/ionization (MALDI)-ToF Mass spectrometry
9. Electrospray Ionization Mass Spectrometry (ESIMS)
10. Theromogravimetric Analysis (TGA)
11. Isothermal titration calorimetry
12. Dynamic Light Scattering (DLS)
13. Thin liquid chromatography (TLC)
14. Scanning electron microscope (SEM), SEM-EDXA (Morphology studies of photo-anodeand structural evolution of macrocycles)
15. Atomic force Microscope (AFM).
16. Transmission electron microscopy (TEM).
17. Thickness measurement by surface profilometer.
18. Conductivity measurement by four probe method.
19. Electrochemical Impedance Spectroscopy.
20. SLIM-PCV (Step Light induced photo voltage –Current) technique employed to measure diffusion coefficient of electron, electron life time and electron density.
21. X-ray Diffraction (XRD).
22. Basic knowledge of X-ray photoelectron spectroscopy(XPS)
23. Various coating such as magnetron sputtering, chemical vapor deposition, spin coating and spray pyrolysis.

24. Thin liquid chromatography (TLC).
25. Basic knowledge of NMR.
26. Basic knowledge of Electron paramagnetic resonance (EPR)
27. Brunauer-Emmett-Teller (BET) analysis (surface area and porosity)

Research Skills and Experience During PhD and PDF:

- Cleaning of FTO/ ITO glass by Snow cleaning and UVO_3 cleaning.
- Synthesis of TiO_2 nanoparticles.
- Preparation of TiO_2 and ZnO film by doctor-blading, spin coating, spray pyrolysis and screen printing method.
- Surface etching of conducting layer from FTO glass.
- Electro-chemistry (Cyclovoltametry (CV) growth, Potentiostatic-growth, Constant -current growth. Differential voltaomogram (DPV)) for determination of the redox properties of materials (Calculation of HOMO, LUMO and band gap energy of various monomers/ oligomers, different dyes etc).
- Spectro-electrochemistry
- Determination of the quantity of dye loading on various semi-conductor surfaces by UV-Vis Spectroscopy.
- Calculation of total polymerization charge.
- Fabrication and characterize the liquid dye-sensitized solar cell (Gratzel cells) using different kind of Ruthenium based dyes as well as different kind of Zinc-porphyrin dyes, perylene based dyes, Indoline dyes etc.
- Preparation of various Redox-mediators (electrolyte) and synthesis of monomer (EDOT).
- Fabrication and characterization of the Solid-state (PEDOT as well as spiro-OMeTAD based) dye-sensitized solar cells (using *in-situ* photo-electrochemical polymerization and spin-coating deposition method).
- Fabrication of polymer based solar cells (using tert-thiophene) and fabrication of liquid dye sensitized solar cells.
- Fabrication and characterization of Multichromophoric dye-sensitized solar cells based on supramolecular dyads.

- Preparation of wide range of different counter-electrodes by using chemical vapor deposition method (Vapor phase polymerization method) using different conducting polymer such as ploypyrrol, polythiophene, polyaniline on various substrate.
- Preparation of counter-electrodes by using electro-chemical polymerization such as ploypyrrol, polythiophene, polyaniline on various conductive-substrates.
- Sputter coating of Au and Pt on ITO/ FTO substrate to prepare counter-electrode.
- Gold deposition on photo-anode by Metal Evaporator Technique that used as a counter electrode.

Pre-Doctoral Research Experience:

Material chemistry at the Nano-scale especially working on noble metal and inorganic semiconductor nanoparticles for various applications in environmental sciences and opto-electronic materials etc.

Master of Science (Chemistry) Dissertation:

The title of dissertation ***"An Assessment of Physico-Chemical Characteristics of Ground Water of Dolomite area in Orissa, India".*** Environmental Chemistry was specialization paper during my M.Sc.

Affiliation

1. Member of ***American Chemical Society (ACS)***, USA, since 2013.
2. Member of ***Royal Society of Chemistry (RSC),*** UK, since 2013.
3. Member of ***Electrochemical Society (ECS),*** USA since 2014
4. Member of ***National Postdoctoral Association (NPA)*** USA, 2013-2014**.**
5. GSAS Scholar (2008) ***Global school for advanced studies***, training global leaders in science and engineering, Northwestern University, Evanston, Illinois, USA.
6. Ex-Student member in ***Australian Research Council of National nanotechnology (ARCNN***), Canberra, Australia.
7. Ex-Student Member of ***Australian Research Network for Advanced Materials (ARNAM)***, Canberra, Australia.
7. Ex-Student executive member in ***Research and Development (R &D) in the faculty of science, university of Wollongong*** from 2008 -2009.

8. Ex-Member of ***Global Nanotechnology Network. Platform for addressing Global challenges***, GNN Headquarters, Materials Research Institute, Northwestern University, Illions, USA.

9. Ex- Member in ***Society for Information Display (SID),*** California, USA.

10. Ex-Cultural secretary of ***Utkal Parishad at Indian Institute of Technology, Kanpur***, 2006-07.

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