Dr. Sudeshna Ray

Associate Professor
Department of Chemistry
Faculty of Science
AISECT University, Bhopal
E mail – sudeshnaled@gmail.com
Mobile – 91-7566416432

PROFESSIONAL OVERVIEW

My research at the interface of Chemistry and Material Science is focused on the development of Novel Inorganic based Luminescent materials for the application in white Light Emitting Diodes (LEDs) and as Spectral Converters in Solar Cell. The novel materials can be a single composition multi-centred phosphor or near UV/blue excitable blue, green, yellow and red emitting phosphor. The utilization of 'Green' solution based Synthesis Methodology for the precise control of the composition of the phosphors and achievement of a homogenous distribution of small amounts of activators in the host compounds is the main paradigm of my Research. In addition, to my previous focus on Synthesis, Characterization and Optical studies of size and shape tuned nanocrystalline Y_2O_3, YVO_4 and YPO_4 based phosphors, I am extensively involved into the research for the development of Advanced Luminescence Materials so called Quantum Cutters for the application in Solar Cell. A unifying theme of my research is the compositional tuning of the properties of extended solids through solid solution; sometimes referred to as the game of x and y, as, for example, in $Sr_{2(1-x-y/2)}Eu_{2x}La_ySi_{1-y}Al_yO_4$. Design of New phosphor for LEDs and fabrication of LEDs using the phosphors is an integral part of my Research. Currently, I am involved in the synthesis of Persistent Phosphors for the fabrication of Glow Bullet for Defense Application.

RESEARCH INTERESTS

- Exploration of New Phosphors by Mineral Inspired Methodology
- Development of water soluble silicon compound by alkoxy group exchange reaction
- Synthesis of Eu^{2+} and Ce^{3+} doped silicate phosphors using water soluble silicon compound
- Solution Synthesis of 'Size' and 'shape' tuned Nanomaterials
- Characterization of Nanocrystalline phosphors by XRD, TEM, FE-SEM and Raman spectroscopic measurement.
- Study of 'Up-conversion', 'Down-conversion', 'Down-shifting' phenomena by steady state photoluminescence and lifetime measurement and analysis.
- Measurement of 'Quantum Efficiency' and Thermal stability of phosphors.
- Development and optical study of 'Quantum Cutting' Materials as Spectral Converter for Solar cell

RESEARCH EXPERIENCE

Postdoctoral Fellow

Phosphor Research Laboratory, Department of Applied Chem. *September (2012) –July (2013)*
National Chiao Tung University, Taiwan
Advisor: Prof. Teng Ming Chen

- Study of Energy Transfer from sensitizer to activator by lifetime analysis.
- Measurement of Quantum Efficiency and Thermal Stability of phosphors
- LED Fabrication using synthesized phosphors
- Development of Quantum Cutting materials as spectral converters for Solar Cell

Postdoctoral Fellow

August (2010) –August (2012)

Design of Advanced Inorganic Materials
Institute of Multidisciplinary Research for Advanced Materials Tohoku University, Japan
Advisor – Prof. Masato Kakihana

- Exploration of New Phosphors for phosphor-converted LEDs by 'Mineral Inspired Methodology"
- Tuning of luminescence properties of existing phosphor by "Charge Compensated Aliovalent Element Substitution"

Postdoctoral Fellow *September (2009) –July (2010)*

Departamento de Física Aplicada
UPV Universitat Politècnica de València, Spain
Advisor: Prof. Francisco Javier Manjon Herrera

- High Pressure Raman studies of size and shape modulated nanocrystalline materials

EDUCATION

Ph.D. in Chemistry *(2004 - 2009)*

- Thesis Title: "Synthesis, Characterization and Photoluminescence Studies of Rare-earth based Nanocrystalline Materials"

Master of Science in Chemistry *(2001 - 2003)*
Presidency College, University of Calcutta, Kolkata, India

- Specialization: Physical Chemistry

Bachelor of Science *(1998 - 2001)*
University of Calcutta, Kolkata, India

- Honors in Chemistry
- Minors in Physics and Mathematics

AWARDS AND FELLOWSHIPS

- Qualified GATE with 91.18 percentile in 2003
- Awarded CSIR SRF Fellowship in 2006
- Vinita Rajput and **Sudeshna Ray**; **Best Poster Award** in National Conference on "Science & Technology for Human Development", in December 2014, at Bhopal.
- Prachi Dhote and Sudeshna Ray; First Prize for Oral Presentation in in National Conference on "Science & Technology for Human Development", in December 2014, at Bhopal.

SPONSORED INTERNATIONAL PROJECT AS Co-PI

Indo-Taiwan Project of Rs 31,48,500/- from DST, Project Reference No: **GITA/DST/TWN/P-65/2015** for 3 years entitled "Synthesis, Characterization of Lanthanide-based Phosphors as Spectral Converters in Solar Cells"; sanctioned by Global Innovation & Technology Alliance (GITA) in India and Ministry of S&T (MOST), Taiwan, on JULY 22, 2015

PI of the Project - Dr. Sameer Sapra, IIT Delhi, India
PI of the Project from Taiwan Side - Prof. Teng Ming Chen (**Postdoc Supervisor**), NCTU, Taiwan

NUMBER OF PhD SCHOLAR GUIDED (ONGOING) AS SUPERVISOR -3

Ms. Vinita Rajput, Ms Prachi Tadge and Ms. Nidhi Malviya

- Title of thesis of Ms. Vinita Rajput:
  "Synthesis, Characterization and photoluminescence studies of New Phosphors for phosphor-converted white LEDs".

- Title of thesis of Ms. Prachi Tadge:
  "Design, solution synthesis, characterization of Quantum Cutting Materials as Spectral Converters for Solar Cell

- Title of thesis of Ms. Nidhi Malviya:
  "Development of rare-earth based luminescence materials for Opto-electronic Devices".

PATENT FILED – 2

1. **An afterglow material for cold tracer and a process for the preparation thereof.**
2. **$BaKYSi_2O_7:Eu^{2+}$, a novel phosphor for UV-LED.**

PUBLICATIONS IN PROGRESS

1. **S. Ray**, Prachi Tadge and Teng Ming Chen; "Preferential Occupancy of Eu^{2+} in Cation-substituted $NaBaScSi_2O_7$ phosphor" (To be submitted).

PEER-REVIEWED PUBLICATIONS

1. Synthesis, luminescence and application of $BaKYSi_2O_7:Eu^{2+}$:A new blue-emitting Phosphor for near-UV White-light LED, by **Sudeshna Ray**, Prachi Tadge, Somrita Dutta, T. M. Chen, Govind Nair and S. J. Dhoble, "**Ceramics International"** (accepted in 2018).
   'Impact Factor' – **2.986**

2. Impact of Ga^{3+} on the phase transition and luminescence properties of substituted $Sr_2SiO_4:Eu^{2+}$ phosphor synthesized from a highly homogeneous oxide precursor based on a novel water-soluble silicon compound, by **Sudeshna Ray**, Prachi Tadge, Govind Nair and S. J. Dhoble, "**Ceramics International"** 44 (2018) 5506–5512.
   'Impact Factor' – **2.986**

3. Size and shape tailored hydrothermal synthesis and characterization of nanocrystalline $LaPO_4:Eu^{3+}$ phosphor, by **Sudeshna Ray**, Govind B. Nair, Prachi Tadge, Nidhi Malvia, Vinita Rajput, Vibha Chopra and S. J. Dhoble, "**Journal of Luminescence"** 194 (2018) 64. **'Impact Factor' – 2.686**

4. Analysis of growth kinetics and impact of NH_3 on the morphology evolution of hexagonal-prism shaped $Y_4O(OH)_9NO_3/Y_2O_3$ single crystals, **S Ray**, G. B. Nair, S. J. Dhoble, H Kato, M Kakihana and T. M. Chen, **Materials Research Bulletin**, 95 (2017), 597,
   'Impact Factor' - 2.446; '**Citation**' - 1

5. Structural and spectroscopic characterizations of a new near-UV-converting cyan-emitting $RbBaScSi_3O_9:Eu^{2+}$ phosphor with robust thermal performance" by **Sudeshna Ray**, Prachi Tadge, S. J. Dhoble, Govind B. Nair et *al*., **Journal of Alloys and Compounds** 713 (2017)138.
'Impact Factor' – 3.014

6. Pressure-induced amorphization of $YVO_4:Eu^{3+}$ nanoboxes" by Ruiz-Fuertes, Javier; Gomis, Oscar; Leon-Luis, Sergio; Rademacher, Nadine; Manjon Herrera, Francisco; **Ray, Sudeshna**; et *al.*, **"Nanotechnology"** 27 (2015) 025701,
'Impact Factor' – 3.821

7. Broadband, site selective and time resolved photoluminescence spectroscopic studies of finely size-modulated $Y_2O_3:Eu^{3+}$ phosphors synthesized by a complex based precursor solution method, **Sudeshna Ray**, Sergio Fabián León-Luis, Francisco Javier Manjón, Miguel Alfonso Mollar, Óscar Gomis, Ulises Ruymán Rodríguez-Mendoza , Said Agouram, Alfonso Muñoz and Victor Lavín **"Current Applied Physics"** 14 (2014) 72,
'Impact Factor' – 2.212; 'citations' – 7

8. $KSrScSi_2O_7:Eu^{2+}$: A new near-ultraviolet blue-emitting phosphor with high efficiency and excellent thermal stability, **Sudeshna Ray**, Y-C Fang and Teng-Ming Chen. "**RSC Advances**" 3, (2013), 16387,
'Impact Factor' – 3.84; 'citations' – 12.

9. Selective synthesis, characterization and photoluminescence studies of $YPO_4:Eu^{3+}$ nanorods and nanoparticles, **S. Ray**, A Banerjee and P Pramanik, **"Materials Research Bulletin"** 45 (2010) 870,
'Impact Factor' – 2.288; 'citations' – 9

10. High-pressure structural and lattice dynamical study of $HgWO_4$, F. J. Manjón, J. López-Solano, **S. Ray** et *al.* **"Physical Review B"** 82 (2010) 035212.
'Impact Factor' – 3.736; 'citations' - 10

11. High pressure structural phase transitions in $CuWO_4$, J. Ruiz-Fuertes, D. Errandonea, R. Lacomba-Perales, A. Segura, J. González, F. Rodríguez, F. J. Manjón, **S. Ray** et *al.***"Physical Review B"** 81 (2010) 224115,
'Impact Factor' - 3.736; 'citations' - 46

12. Shape-controlled synthesis, characterization and photoluminescence properties of $YVO_4:Dy^{3+}/Eu^{3+}$ phosphor, **S. Ray**, A. Banerjee and P. Pramanik "**Materials Science and Engineering B**" 156 (2009) 10 ,
'Impact Factor' – 2.169; 'citations' - 37

13. A novel rock-like nanoarchitecture of $YVO_4:Eu^{3+}$ phosphor: selective synthesis, characterization and luminescence behavior, **S. Ray**, A Banerjee and P. Pramanik "**Journal of Material Science**" 45 (2009) 259 ,
'Impact Factor' – 2.371 'citations' - 12

14. Photoluminescence properties of nanocrystalline Tb^{3+} doped Y_2O_3 phosphor prepared through a novel synthetic route, **S. Ray**, A Patra and P Pramanik "**Optical Materials**" 30 (2007) 608 ,
'Impact Factor' – 2.023; 'citations' - 25

15. Optical properties of nanocrystalline $Y_2O_3:Eu^{3+}$, **S. Ray**, P Pramaik, A Singha and A Roy "**Journal of Applied Physics"** 97 (2005) 094312 ,
'Impact Factor' – 2.276; 'citations' -71

16. High pressure theoretical and experimental study of $HgWO_4$, J. López-Solano, P. Rodríguez-Hernández, A. Muñoz, D. Santamaría-Pérez, F.J. Manjón, **S. Ray**, O. Gomis, M. Mollar, V. Panchal and D. Errandone "**High Pressure Research**" 31(2011) 58 ,
'Impact Factor' – 1.014 'citations' - 1

INVITED PRESENTATIONS

1. "Exploration of New Phosphors by Mineral Inspired Methodology" at **International Symposium Cum Workshop On Luminescence Materials** [ISWLM-2015], 18 - 20th December, 2015 at **Baroda**.

2. Tuning of Luminescence Properties of Phosphors by "**Charge Compensated Element Substitution Methodology**" in "**Third Two day National Conference on Applied Physics and Materials Science** (UNDER TEQIP –II)" organized by Department of Physics, Vasavi College of Engineering, **Hyderabad** on 7, 8th August, 2015.

3. "Development of a New Scandium Silicate Phosphor for Phosphor converted white LEDs" in "**5th International Conference on Luminescence and its applications** (ICLA, 2015)" organized by Luminescence Society of India at **Bangalore** in 9-12, February, 2015.

4. "Eu^{2+} doped phosphors for phosphor converted white LEDs" at "**National Seminar on Innovations for Science and Technology for Inclusive Development"**, organized by Indian Science Congress Association and Madhya Pradesh Council of Science and Technology, at **Bhopal** in March, 2014.

5. "Development of dual-ion based Quantum Cutting Materials" at "**3rd National Conference on Advanced Materials and Radiation Physics (AMRP-2013)**" in November 2013, at Sant Longowal Institute of Engineering and Technology, Sangrur, **Punjab.**

CONFERENCE PRESENTATIONS (ORAL)

1. "Impact of synthesis methodology on the photoluminescence properties of Eu^{2+} doped $NaBaScSi_2O_7$ phosphors", **13th International Meeting on Information Display** (IMID) 2012, **Korea** (IMID, 2012).

2. "Optical study of Ce^{3+} doped silicate phosphors synthesized using water soluble silicon compound" **13th International Meeting on Information Display** (IMID), 2012, at **Korea**.

3. "Impact of NH_3 on the morphology of hexagonal prism like Y_2O_3" **MRS Spring Meeting**, 2012, at **Sanfrancisco, USA**.

4. "Synthesis, Characterization and Optical Study of $NaScSi_2O_6$ Doped Eu^{2+} phosphor" **12th International Meeting on Information Display (IMID)**, 2011, at **Korea**.

5. "Color point Tuning in Ga^{3+} substituted $Sr_2SiO_4:Eu^{2+}$ phosphor" **The Phosphor Safari,** 2011, at **Niigata, Japan**.

POSTER PRESENTATION

1. "Photoluminescence Studies of Shape modulated $YVO_4:Eu^{3+}$ phosphor" ***International Conference on "Advanced Functional Materials***" 2005 at Department of Chemistry, **Indian Institute of Technology, Mumbai**.

TEACHING EXPERIENCE

August, 2013 - till date

- 'Inorganic Chemistry', 'Material Chemistry', 'Solid State Chemistry' and 'Nanotechnology' in Post Graduate level
- Chemistry in Under Graduate Level

REFEREEING FOR JOURNALS

1. Optical Materials
2. Journal of Material Science

AFFILIATIONS

- Life Member of "luminescence Society of India"
- Member of Editorial Board of "Indian Journal of Material Science"

REFERENCES

1. **Prof. Teng Ming Chen** [Post-doc Supervisor and Collaborator of Indo-Taiwan Project]
Professor, Department of Applied Chemistry, National Chiao Tung University, Taiwan,
E mail - tmchen@mail.nctu.edu.tw

2. **Dr. Sameer Sapra** [Collaborator of Indo-Taiwan Project]
Associate Professor, Department of Chemistry, Indian Institute of Technology Delhi, India,
E mail - sapra@chemistry.iitd.ac.in

3. **Prof. Panchanan Pramanik** [PhD Supervisor]
Professor [Retired], Department of Chemistry, Indian Institute of Technology Kharagpur, India,
E mail - pramanik1946@gmail.com

4. **Prof. Amitava Patra** [Research Collaborator]
Professor and Associate Dean, Department of Materials Science, Indian Association for the Cultivation of Science,
E-mail: msap@iacs.res.in

5. **Prof. Francisco Javier Manjon Herrera** [Post-doc Supervisor]
Professor, Dpto. de Física Aplicada Universitat Polytechnica de Valencia, Spain,
E mail - fjmanjon@fis.upv.es

6. **Prof. Victor Lavin Della Ventura** [Post-doc Supervisor]
Professor, Departamento de Física Fundamental y Experimental,
Electrónica y Sistemas, Universidad de La Laguna, Spain, E mail -
vlavin@ull.edu.es