


Brief Biodata

Name: Dr. Asit Patra

Designation:	Principal Scientist	
DP No. and Name:	# 4.01, Photovoltaic Metrology Section	
DU No. and Name:	# 4.0, Advanced Materials & Device Metrology	
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Date of Joining CSIR-NPL	8 th October 2012	
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Research Area/ Interest

Synthesis of π -conjugated polymers and small molecules for organic-electronics, organic solar cells, perovskite solar cells, structure-property relationship, organic electrochemistry, and computational methods to resolve the problems in organic chemistry

Academic / Research Experience

Grade / Post	Institute	Duration		Research Field
		From	To	
Principal Scientist	CSIR-National Physical Laboratory, New Delhi.	2016	--	Organic/perovskite solar cells, electronic materials, conjugated polymer and molecules,
Senior Scientist	CSIR-National Physical Laboratory, New Delhi,	2012	2016	electrochemistry, computational calculations
Marie Curie International Postdoc fellow	University of Cambridge, Cambridge, UK	2010	2012	Supramolecular chemistry, metallopolymers.
Postdoc fellow	University of California, Santa Barbara, USA	2009	2010	Organic solar cells, synthesis of conjugated polymers and small molecules
Postdoc fellow/ Feinberg Fellowship	Weizmann Institute of Science, Israel	2006	2009	Conducting polymers, conjugated system, electrochemistry, compilation calculations

Educational Qualifications

Degree	Subject	University/ Institute	Year
Ph. D.	Organic Synthesis	India Institute of Technology; Kharagpur	2000-2006
M. Sc.	Organic Chemistry	Vidyasagar University; WB	1997-1999
B. Sc. (H)	Chemistry	Vidyasagar University; WB	1994-1997

No. of Publications

No. of Publications in SCI Journals	No. of Publications in non-SCI Journals	No. of Publications in Conference Proceedings	Books	Total
65	Nil	--	2 (chapter)	67

Selected Publications

1. S Naqvi, N. Chaudhary, R.Kedia, P.Yadav, **A. Patra***, *Copper (I) selenocyanate (CuSeCN): Eco-friendly solution-processable deposition of hole transport layer for organic solar cells*, **Solar Energy**, 2022, 496-502
2. A Mishra, S Gupta, **A. Patra***, *Synthesis and properties of 3, 4-dioxythiophene and 1, 4-dialkoxybenzene based copolymers via direct C–H arylation: Dopant-free hole transport material for perovskite solar cells*, **Journal of Polymer Science**, <https://doi.org/10.1002/pol.20210466>
3. S Naqvi, **A. Patra***, *Hole transport materials for perovskite solar cells: A computational study*, **Materials Chemistry and Physics**, 2021, 258, 123863.
4. S Naqvi, N Chaudhary, S Singhal, P Yadav, **A. Patra***, *Hole Transport Materials by Direct C-H Arylation for Organic Solar Cells: Effect of Structure and Conjugation on Electrical, Optical and Computational Properties*, **ChemistrySelect**, 20121, 6, 131-139
5. P Yadav, **A. Patra***, *Recent advances in poly (3, 4-ethylenedioxythiophene) and related polymers*, **Polymer Chemistry**, 2021, 11, 7275-7292.
6. P Yadav, S Singhal, **A Patra***, *Electropolymerized poly (3, 4-ethylenedioxythiophene) on flexible substrate: A comparative study of electronic and electrochromic properties with sulfur analogue and rigid substrate*, **Synthetic Metals**, 2020, 260, 116264.
7. S Singhal, **A Patra***, *Benzothiadiazole bridged EDOT based donor–acceptor polymers with tunable optical, electrochemical, morphological and electrochromic performance: effects of solvents and electrolytes*, **Physical Chemistry Chemical Physics** 2020, 22, 14527-14536.
8. S. Gupta, **A Patra***, *Facile polymerization method for poly (3, 4-ethylenedioxythiophene) and related polymers using iodine vapour*, **New Journal of Chemistry**, 2020, 44 (17), 6883-6888.
9. R. Bhargav, N. Chaudhary, S. Rathi, Shahjad, D. Bhardwaj, S. Gupta, **A Patra*** *Copper Bromide as an Efficient Solution-Processable Hole Transport Layer for Organic Solar Cells: Effect of Solvents*, **ACS Omega**, 2019, 4, 6028.
10. D. Bhardwaj, Shahjad, S. Gupta, P. Yadav, R. Bhargav, **A. Patra***, *All Conjugated Poly (3-hexylthiophene)-block-poly (hexyl-3, 4-ethylenedioxythiophene) Copolymers*. **Chemistry Select**, 2017, 2(29), 9557-9562.
11. Shahjad, R Bhargav, D Bhardwaj, A Mishra, **A Patra***, *Synthesis and Characterization of Benzodithiophene–Chalcogenophene Based Copolymers: A Comparative Study of Optoelectronic Properties and Photovoltaic Applications*, **Macromolecular Chemistry and Physics**, 218 (14), 1700038.

12. V. Agrawal, Shahjad, D. Bhardwaj, R. Bhargav, R. K. Bhardwaj, G. D. Sharma, **A. Patra***, S. Chand, *Morphology and Doping Level of Electropolymerized Biselenophene-Flanked EDOT Polymer: Effect of Solvents and Electrolytes*, **Electrochimica Acta**, 2016, 192, 52-60.
13. **A. Patra***, V. Agrawal, R. Bhargav, Shahjad, D. Bhardwaj, S. Chand, Y. Sheynin and M. Bendikov, *Metal Free Conducting PEDOS, PEDOT and Their Analogues via an Unusual Bromine Catalyzed Polymerization*, **Macromolecules**, 2015, 48, 8760-8764.
14. N. Chaudhary, R. Chaudhary, J. P. Kesari, **A. Patra***, S. Chand, *Copper thiocyanate (CuSCN): an efficient solution-processable hole transporting layer inorganic solar cells*, **J. Mater. Chem. C**, 2015, 3, 11886-11892
15. **A. Patra***, M. Bendikov, and S. Chand, *Poly(3,4-ethylenedioxy selenophene) and Its Derivatives: Novel Organic Electronic Materials*, **Acc. Chem. Res**; **2014**, 47, 1465-1474.
16. E. Poverenov, N. Zamoshchik, **A. Patra**, Y. Ridelman, and M. Bendikov, *Unusual Doping of Donor-Acceptor-Type Conjugated Polymers Using Lewis Acids*, **J. Am. Chem. Soc.** 2014, 136, 5138-5149.
17. D. Asil, J. A. Foster, **A. Patra**, X. de Hatten, J. D. Barrio, O. A. Scherman, J. R. Nitschke,* R. H. Friend,* *Temperature- and Voltage-Induced Ligand Rearrangement of a Dynamic Electroluminescent Metallopolymer* **Angew. Chem. Int. Ed.** 2014, 53, 8388-8391.
18. **A. Patra**, M. Bendikov, "Polyselenophenes", **J. Mater. Chem.**, **20**, 422-433, 2010.
19. **A. Patra**, Y. H. Wijsboom, M. Bendikov, "Synthesis, Structure and Electropolymerization of 3,4-Dimethoxytellurophene: Comparison with Selenium Analogue", **Org. Lett.**, 2009, 21, 1487-1490.
20. **A. Patra**, Y. H. Wijsboom, S. S. Zade, M. Li, Y. Sheynin, G. Leitus, M. Bendikov, "Poly(3,4-ethylenedioxy selenophene)", **J. Am. Chem. Soc.**, 2008, 130, 6734-6736.

Patents

- Michael Bendikov, Asit Patra, Y. H. Wijsboom, S. S. Zade, Mao Li, Yana Sheynin, Selenophene and Selenophene-Based Polymers, Their Preparation and Used Thereof, *Publication No. US 2010/0283040*.
- Asit Patra, Vikash Agrawal, Shahjad, Ranoo Bhargav, Dinesh Bhardwaj, Rachana Kumar, Rajiv K Singh, Suresh Chand, *A Process For Electrochemical Deposition Of PEDOT And Its Derivative As HTL Useful In Organic Solar Cells*, 0108NF2016, patent application no 20161102779.

Technology Transfer

- Indian Reference Materials Development (BND)
Development of matte finished polystyrene film for the calibration of wavelength / wavenumber values of Fourier Transform Infrared (FT-IR) spectrophotometers
- Technology Transferred of process know how for the production of Poly(3,4-ethylenedioxythiophene) poly styrene sulphonate (PEDOT:PSS) as HTL for Organic Solar Cells.
- Technology Transferred on 'Development of Polystyrene Films.

Current Activities

- Synthesis and characterization of conjugated homopolymers, donor-acceptor polymers, block-polymers and random copolymers based on thiophene, selenophene, benzodithiophene, etc. for organic solar cells.
- Development of conjugated small molecules based on heterocyclic moieties such as benzothiadiazole, diketopyrrolopyrrole, thiophene and their selenium analogues.
- The studies of various polymerization methods i.e. radical polymerization Stille, Suzuki, C-H arylation polymerization.
- Electropolymerization for conducting polymers, and electrochemical, spectroelectrochemistry, Electrochromic studies.
- Development of inorganic and organic interfacial layer such as CuBr, CuI, CuSCN, PEDOT and PEDOS etc. for organic and Perovskite solar cells.
- Device fabrication of organic and perovskite solar cells.
- Computational studies of conjugated systems.

Honour(s)/ Award(s)/ Fellowship(s)

- **2000-** Junior Research Fellowship (NET-CSIR), New Delhi.
- **2000-** Graduate Aptitude Test in Engineering (GATE; 98.25 Percentile).
- **2003-** Senior Research Fellowship, CSIR, India.
- **2008-** Feinberg Postdoctoral Fellowship at Weizmann Institute of Science. Israel.
- **2010-** Marie Curie International Postdoctoral Fellowship at University of Cambridge, UK.

Contributions to AcSIR

Associate Professor at AcSIR, teaching following courses to PhD students

1. *CHE(NPL)-3-4621: Polymers and their Applications*
2. *AcSIR-32-ID-009 :Basic and applied chemical science*

Ph. D. students supervised

Completed: **09**; Submitted: **01**; Current: **03**

Membership of Professional Societies/ Institutions

Any other Information

Projects

- Semiconducting Thiophene Based Electronic Materials for Organic Solar Cells (PI; 32.76 lakhs; 2015-2018; SERB-DST, New Delhi)
- Advancing the efficiency and production potential for Excitonic solar cells (APEX) Phase II (PI; 58.0 lakhs; 2016-2018; DST-RCUK (indo-UK international collaborative project).
- Development of new interfacial layers for efficient and stable excitonic solar cells (PI; 98.8048 lakhs; 2017-2021; SERI-DST, New Delhi).
- Bulk preparation of p-type and n-type materials for Excitonic solar cells (PI; 58.2 lakhs; 2022-2024; DST, New Delhi).