Dr. Sumanta Kumar Padhi
Associate Professor
Department of Chemistry and Chemical Biology
Indian Institute of Technology (ISM), Dhanbad
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Academic Profile:

- **Doctorate Degree (PhD): 2008**
  - Institution: Indian Institute of Technology Guwahati, Guwahati
- **Postgraduate Degree (M.Sc., Chemistry): 2003**
  - University: Utkal University, Odisha, India
  - 1st Division (Inorganic Chemistry Specialization)
- **Bachelor's Degree (+3 Science, Chemistry Honors): 2001**
  - Institution: Godavaris Mahavidyalaya (Utkal University), Banpur, Odisha
  - University: Utkal University 1st Class with Distinction in Chemistry Honors and Best Graduate of the Year 2001-2002

Academic Positions Held:

- **Associate Professor, 12th April 2021 -Continue**
  - *Department of Chemistry, Indian Institute of Technology (ISM), Dhanbad*
- **Assistant Professor (PB4), 8th July 2016 - 11th April 2021**
  - *Department of Chemistry, Indian Institute of Technology (ISM), Dhanbad*
- **Assistant Professor (Grade I), 8th July 2013 - 7th July 2016 July**
  - *Department of Chemistry, Indian Institute of Technology (ISM), Dhanbad*
- **Professor for Special Appointment, April 2013 - June 2013**
  - *Bio-Redox System Research Center, Ewha Womans University, Seoul, South Korea*
- **World Class University (WCU) Program Postdoctoral Fellow, April 2012-April 2013**.
  - *Department of Bio-inspired Science, Center for Biomimetic Systems, Ewha Womans University, Seoul, South Korea*
  - **Prof. Antony Llobet (ICIQ, Spain) and Prof. Wonwoo Nam (Korea) Group**
- **MEXT Postdoctoral Fellow, Dec 2008-March 2012**
  - Institute for Molecular Science, Okazaki, JAPAN

- **Prof. Koji Tanaka Group**

Scholarships/Fellowships:

- World Class University (WCU) Program Postdoctoral Fellowship 2012-2013
- MEXT Postdoctoral Fellowship (IMS, JAPAN) 2008-2012
- Dr. Radhanath Rath Memorial Scholarship (2001-2003)
- National Merit Scholarship (2002)
- National Scholarship (2001)
- Dr. Radhanath Rath Memorial Scholarship (1999-2000)

Awards and Honors:

- Visiting Professor LUND UNIVERSITY, SWEDEN, June 2024.
- Visiting Professor EWHA WOMANS UNIVERSITY, South Korea, Dec 2023.
- Visiting Professor LUND UNIVERSITY, SWEDEN, May-June 2023.
- Visiting Professor LUND UNIVERSITY, SWEDEN, 2023
- International Travel Support by SERB(DST) for 67th JSCC at Hokkaido University, JAPAN
- Biography included in the 10th Anniversary Edition (2007) of Who's Who in Science and Engineering.
- Best Graduate of the year 2002 (Honored by Honorable Chief Minister of Odisha)

Membership of Societies:

- Lifetime member of the Chemical Research Society (INDIA), (2020 Onwards)
- Patron Member Odisha Chemical Society, (2018 Onwards)
- Member American Chemical Society, (2017 Onwards)
- Lifetime member of the Indian Council of Chemists (2014 Onwards)
- Member of Japan Society of Coordination Chemistry (2009 Onwards)

Teaching Experience:

M.Sc.; M. Phil. & Ph.D.:

Transition Metal Chemistry, Coordination Chemistry, Group Theory, Group Theory & Electronic Spectroscopy, Electro & Photo-chemical Energy Systems, Physical Chemistry – V, Instrumental Techniques in Chemistry I, Instrumental Techniques in Chemistry II, Characterization Techniques for Inorganic Chemists.

Undergraduate Level:

Chemistry-II, Chemistry for Chemical Engineers, Instrumental methods for environmental analysis Physical Chemistry

Reviewer:

- Reviewer of several journals of American Chemical Society, Royal Society of Chemistry, Springer, Wiley, and Elsevier.

Administrative Activity:

External

- Editorial Board Member. Journal of Chemical Reactions and Catalysis Research (JCRC) 2024-Continue
- International Expert and Thesis evaluation committe member LUND University, SWEDEN.
- External Subject Expert for Guest Faculty Selection in Govt. College of Engineering , Kalahandi, Odisha.
- Reviewer of several journals of ACS, RSC, Wiley, Elsevier, Springer and Taylor & Francies.

Institute Level

- Alumni Coordinator, Department of Chemistry and Chemical Biology, June 2024-Continue.
- Warden, JASPER Hostel, (July 2020-July 2022).
- Member, Dean's Advisory Council (Academic), (2019-2020).
- Member, T&P Cell, Department of Chemistry (2016-2017).
- Member, International Relations & Alumni Affairs (IRAA) (2014-2018).
- Faculty Coordinator for CONCETTO, Department of Chemistry (2014-2017).

Department Level

- DFSC Member, Department of Chemistry and Chemical Biology, Nov 2024-Continue.
- Coordinator BS-MS Programme, Department of Chemistry and Chemical Biology, June 2024-Continue.
- DUGC Member, Department of Chemistry and Chemical Biology, Oct 2022- Oct 2024.
- Training & Placement In-charge, Department of Chemistry (2017-Present).
- M.Sc. Course Coordinator, Department of Chemistry (2014-2017).
- Coordinator & Member, Board of Courses & Studies, Department of Chemistry (2015).
- Seminar in-Charge, Department of Chemistry (2014-2017).

- Convenor IIT(ISM) Chemical Society, 2015-Present.
- Moderation Board Convenor & Chairman for Postgraduate Programme, Department of Chemistry (2016-2018).

Area of Expertise: Inorganic Chemistry

The current area of Research:

The following Domains of research are focused in the Artificial Photosynthesis Group.

- CO_2 reduction and CO_2 Hydrogenation
- Dehydrogenation of HCOOH
- NH_3 Oxidation
- Proton reduction
- Water Oxidation
- Electrochemical Transformations of Organic Compounds

Ongoing/Completed PhD and M.Sc./M.Phil. Students:

Continuing PhD Students:

1. Mr. Dev Raj, Joined in the group (2019-July)
2. Mr. Thillai Natarajan M (2022 August)
3. Ms. Madhusmita Sahoo (2023 August)
4. Ms. Palak Jaiswal (2023 Dec)
5. Ms. Tanushree Dutta (2024 Dec)

Continuing MSc Students:

1. Mr. Milan Subudhi
2. Ms. Ishika Singha
3. Ms. Saachi Sood

List of Ph.D students awarded: 08

Sl. No.	Name of the student	Thesis Title	Year of Completion	Role	Present status of the Students
1	***Dr. Jully Patel*** *Admission No. 2013DR0141*	*Molecular Catalytic Approach by Single-site Ruthenium(II)-Polypyridyl complexes towards Water Oxidation*	March 2017	Guide	**Assistant Professor, Lebanon Valley College, Pennsylvania, USA**
2	***Dr. Karunamay Majee*** *Admission Number: 2014DR0087*	An Approach towards Proton Reduction by First row Transition Metal Complexes	Nov 2018	Guide	**Assistant professor, Galgotias University, INDIA**

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3	***Dr. Ejaz Ahmad*** *Admission Number: 2013DR0216*	Ligand dechelation effect on Proton reduction by Molecular Catalysts having mer-$[M(Terpyridine)_2]^{2+}$ Scaffolds: M = Co and Ni	March 2020	Guide	**Assistant Professor, Pataliputra University, BIHAR**
4	***Dr. Surabhi Rai*** *Admission Number: 2014DR0137*	Proton and Water reduction by Cobalt and Copper based Molecular Catalysts	October 2020	Guide	**Postdoctoral Felow, University of California, Davis, USA**
5	***Dr. Aditi Vatsa*** *Admission Number: 2015DR0080*	Catalytic Water Oxidation and Dehydrogenation of Formic Acid by Ruthenium-based Molecular Catalysts	Dec 2021	Guide	**R&D Chemist in SAM ENVIRO, Nasik**
6	***Dr. Manaswini Raj*** *Admission Number: 2015DR0156*	Co, Cu and Mn-based molecular catalysts for electrocatalytic proton reduction and water oxidation	Oct 2022	Guide	**Assistant Professor, Presidency University**
7	***Dr. Aman Mishra*** *Admission Number: 2017DR0408*	First-row transition metal complex-assisted CO_2 hydrogenation and HCOOH dehydrogenationhydrogenation and HCOOH	Aug 2024	Guide	**Postdoc, LUND University, SWEDEN**
7	***Dr. Sk Samim Akhter*** *Admission Number: 2017DR0430*	Homogeneous electro-catalytic reduction of CO_2.	Aug 2024	Guide	**Postdoc, Kumoh National Institute of Technology, South Korea**

List of M.Phil. Students Awarded: 01

Sl. No.	Name of the student	Thesis Title	Year of Completion	Role
1	**Mr. Sunil Kumar**	"Mimicking of $NAD^+/NADH$ Model Function in Transition Metal Complexes"	2014	Guide

List of Post Graduate Students Supervised: 31

1. Ms. Sabari Ghosh, 2014
2. Ms. Sonam Kumari, 2014
3. Mr. Rutesh Vallabhbhai Savalia, 2014
4. Miss. Bipasa Samanta, 2015
5. Mr. Pritam Gupta, 2015
6. Mr. Mayanka Gupta, 2015
7. Mr. Sudhir Kumar Pandey, 2016
8. Miss. Sandhya Kumari, 2016

9. Miss. Santa Mondal, 2016
10. Ms. Sukanya Ghosh, 2017
11. Mr. Motahar Sk, 2017
12. Mr. Souvik Panja, 2017
13. Ms. Banalata Maji, 2018
14. Mr. Sourav Bhowmik, 2018
15. Ms. Reha Panigrahi, 2019
16. Ms. Rumika Oraon, 2019
17. Mr. Rupak Chaterjee, 2020
18. Mr. Rahul Kumbhakar, 2020
19. Mr. Sudip Malborman, 2022
20. Mr. Rudra Sarkar, 2022
21. Mr. Kishore Sahoo, 2022
22. Ms. Swarnasree Pasupalak, 2023
23. Ms. Tanya Pattnaik, 2023
24. Mr. Rohan Mahapatra, 2023
25. Mr. Arun Biswas, 2023
26. Ms. Sucheta Gorain, 2023
27. Ms. Aditi Upadhyaya, 2023 (Intern)
28. Mr. Ratik Das, 2024
29. Ms. Riya Hazra, 2024
30. Ms. Rupsa Pramanik, 2024
31. Ms. Ashma Baxla, 2024

Ongoing and Completed projects:

Sl. No. 1	**Details of the project**	
	Title	Electrocatalytic and photoelectrocatalytic reduction of protons or carbon dioxide
	Sanctioning authority	STINT, INDIA Initiation Grant, SWEDEN, Oct 2024-2027 Oct.
	Duration	3 Years
	Status	Ongoing
	Role	INDIAN PI and Prof. Ebbe Nordlanader Swedish PI
Sl. No. 2	Details of the project	
	Title	Electrocatalytic proton and carbon dioxide reduction
	Sanctioning authority	STINT, SWEDEN

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	Duration	1 Year
	Status	Completed
	Role	INDIAN PI and Prof. Ebbe Nordlanader Swedish PI
Sl. No. 3		Details of the project
	Title	Development of molecular catalysts for CO2 reduction, Water oxidation and reduction
	Sanctioning authority	CSIR
	Duration	23rd Aug 2021 – 22nd Aug 2024
	Status	Ongoing
	Role	Principal Investigator
Sl. No. 4		Details of the project
	Title	Synthesis and Catalytic Investigation towards H_2 evolution by 1st Row Transition Metal based Molecular Catalysts
	Sanctioning authority	DST, SERB (EMR)
	Duration	19th August 2017- 18th August 2020
	Status	Completed
	Role	Principal Investigator
Sl. No. 5		**Details of the project**
	Title	Synthesis and Catalytic Proton Reduction Activities of BPI (BPI = Bis(pyridylimino)isoindoline) Transition Metal Complexes
	Sanctioning authority	TEQIP-III
	Duration	2018-2020
	Status	Completed
	Role	Principal Investigator
Sl. No. 6		**Details of the project**
	Title	Kinetics and Mechanistic Approach towards Water Splitting by Ruthenium Complexes having Polypyridyl Ligands
	Sanctioning authority	DST (SERB)
	Duration	2014-2017
	Status	Completed
	Role	Principal Investigator
Sl. No. 7		**Details of the project**
	Title	Synthesis and Functionalities of Metal Complexes having NAD^+/NADH Model ligands,
	Sanctioning authority	IIT(ISM) Dhanbad
	Duration	2013-2016
	Status	Completed
	Role	Principal Investigator

OUTREACH PROGRAMMES/EDP Courses Conducted as coordinator:

Sl. No. 1	**Details of the OUTREACH PROGRAMME**	
	Title	"National Conference on Recent Advances on Materials for Sustainable Energy-2018 (RAMSE-2018)"

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	Date	**3-5 March, 2018.**
	Role	**Coordinator**
Sl. No. 2	**Details of the OUTREACH PROGRAMME**	
	Title	**"1st Annual Workshop on Catalysis"**
	Amount	**NA**
	Date	**6-9 March, 2017**
	Role	**Treasurer**
Sl. No. 3	**Details of the OUTREACH PROGRAMME**	
	27 Departmental Seminars and 01 Workshop.	

Invited Talks Delivered:

- Evaluating Cu(II)-Catalyzed Electrochemical CO2 Reduction: Insights into Proton Reduction Interference, 13th to 17th Dec 2024, MTIC-XXI, IIT Kharagpur, India.
- Homogeneous Catalysts in activating HCOOH and CO2, 26th June 2024, University of Southern Denmark (SDU), Odense, Denmark
- Molecular Catalysis Towards Energy through Small Molecule Activation: Highlights and Challenges? 27th Dec 2023, EWHA WOMANS UNIVERSITY, SEOUL, SOUTH KOREA.
- Invited lecture on "H_2O, HCOOH, and CO_2 utilization as future prospects", on 28th July 2023, at Department of Chemistry, Berhampur University, Odisha (Faculty Development Programme: Online Mode)
- Invited lecture on "Half Sandwich and Sandwich Type Molecular Catalysts towards Small Molecule Activation: The Pros & Cons", on 1st June. 2023, Department of Chemical Physics, LUND University, SWEDEN.
- Invited lecture on "Sandwiched and Half-sandwiched catalysts in Energy Conservation" in MTIC XIX, 15th-17th Dec. 2022, BHU.
- Invited lecture on "Electro- & photo-catalytic activity for H_2 evolution by polypyridyl copper complexes" in MTIC XVIII, 11th-14th Dec. 2019, IIT Guwahati.
- Plenary lecture on Electro-catalytic activity for H_2 evolution by a polypyridyl copper complex, 10th International Conference on Photosynthesis and Hydrogen Energy Research for Sustainability – 2019 (ICPRS 2019), During 22nd -28th JUNE, 2019 at St. Petersburg, RUSSIA.
- Electro- and Photo-catalytic Proton Reduction by a μ-pyridine bridged Copper Complex, AMEEA2018, during 12th -14th December, 2018 at NIT Rourkela.
- An introduction to Pourbaix Diagram, Refresher Programme in Chemistry Under FDC During 8th -28th JUNE, 2018 at IIT (ISM) Dhanbad.
- Effect of Pendant Base on Catalytic Proton Reduction. 67th JSCC at Hokkaido University (JAPAN), 17th September 2017.

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- Beyond VSEPR Theory: Molecular Orbital Theory & Crystal Field Theory. DPS Bokaro, 28th November 2015.
- An Introduction to Symmetry and Group Theory. Department of Applied Physics, IIT(ISM) Dhanbad, 12th November 2015.
- An Approach towards Artificial Photosynthesis by Ru(II) Complexes having (NAD^+/NADH) Model Ligands. At IIT Patna, 13th August 2012.
- Proton Induced Dynamic Equilibrium between Cyclometalated Ru(II) and rNHC (remote N-Heterocyclic Carbene) Ru(IV) Tautomers with an NAD^+/NADH Function in Okayama University of Science, JAPAN (61st CCCO), 2011.
- Redox Behavior of a Cyclometallated Ru(II) Complex Having NAD^+/NADH Model Analogue. At 60th Anniversary Conference on Coordination Chemistry in OSAKA, JAPAN (60CCCO), 27-30 September 2010.
- An Approach towards the Catalytic Reduction of CO_2 to Methanol by Ru(II) Complexes having (NAD^+/NADH) Model Ligands. At IIT Kharagpur, 10th February 2010.

Selected Publications at IIT(ISM) Dhanbad:

1. Akhter, S. Sk.; Srivastava, D.; Mishra, A.; Patra, N.; Kumar, P.; **Padhi, S. K.***, Cover Feature: Physicochemical Analysis of Cu(II)-Driven Electrochemical CO_2 Reduction and its Competition with Proton Reduction. *Chem. Eur. J*. **2024**, *30,* e202487004.
2. Akhter, S. Sk.; Srivastava, D.; Mishra, A.; Patra, N.; Kumar, P.; **Padhi, S. K.***, Physicochemical Analysis of Cu(II)-Driven Electrochemical CO_2 Reduction and its Competition with Proton Reduction. *Chem. Eur. J*. **2024**, *30*, e202403321.
3. Mishra, A.; Srivastav, D.; Raj, D.; Patra, N. and **Padhi, S. K.*** Formate Dehydrogenase Activity by a Cu(II)-based Molecular Catalyst and Deciphering the Mechanism by DFT studies, ***Dalton. Trans., 2024,*** *53,* 1209-1220.
4. Raj, M.; Makhal, K; Raj, D.; Mishra, A.; Mallik, B. S. and **Padhi, S. K.*** Electrocatalytic Hydrogen Evolution by a Dinuclear Copper Complex and Mechanistic Elucidation through DFT Studies, ***Dalton Trans., 2023,*** *52,* 17797-17809*.*
5. Raj, M.; Makhal, K.; Mishra, A.; Mallik, B. S. and **Padhi, S. K**.* Ligand-mediated Hydrogen Evolution by Co(II) Complexes and Assessment of the Mechanism by Computational Studies, **Inorg. Chem**., **2023**, *62*, 10993-11008.
6. Vatsa, A. and **Padhi, S. K.*** Formic Acid Dehydrogenation by [Ru(η^6-benzene)(L)Cl] catalysts: L = 2-methylquinolin-8-olate and quinolin-8-olate, ***New J. Chem*., 2022,** *46,* 15723 – 15731.
7. Akhter, S. Sk.; and **Padhi, S. K.***, Electro-catalytic CO_2 reduction to Syngas and HCOOH by Homogeneous $FcNAP_2$, ***Eur. J. Inorg. Chem.,* 2022,** *2022(20),* e202200206.

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8. Raj, M. and **Padhi, S. K.***, Water Oxidation by a Neoteric Dinuclear Mn(II) Electrocatalyst in Aqueous Medium, ***Eur. J. Inorg. Chem.*, 2022,** *2022(21),* e202200238.

9. Raj, M. and **Padhi, S. K.***, Electrocatalytic proton reduction by dinuclear cobalt complexes in nonaqueous electrolyte, ***New J. Chem***., **2022**, *46*, 6027- 6038.

10. Raj, D. and **Padhi, S. K.*** The sporadic μ-pyridine bridge in transition metal complexes: A real bond or an interaction?, ***Coord. Chem. Rev.*** , **2022**, 450, 214238.

11. Vatsa, A. and **Padhi, S. K.*** Catalytic Water Oxidation by a Ru^{II} Half Sandwich Complex, ***Eur. J. Inorg. Chem.*, 2021,** 2021(34), 3499-3505. (**Highlighted in ChemViews Magazine**)

12. Rai, S.; and **Padhi, S. K.***, Effectual electrocatalytic proton and water reduction by Cu^{II} terpyridine scaffolds, ***Electrochim. Acta***, **2020**, *364*, 137277.

13. **Padhi, S. K.***; Rai, S.; Akhter, S. Sk.; Redox induced structural switching through sporadic pyridine bridged $Co^{II}Co^{II}$ dimer and electrocatalytic proton reduction, ***Inorg. Chem***. **2020**, *59*, 7810-7821.

14. Majee, K.; Rai, S.; Panda, B. and **Padhi, S. K.***, A flexible homoleptic pentadentate Cu(II) molecular catalyst for effective proton and water reduction, ***Electrochim. Acta***, **2020**, *354*, 136614.

15. **Padhi, S. K.***, Ahmad, E.; Rai, S., Kinetics and the Potential Well in Electrochemical Hydrogen Evolution by $[Co(4\text{-tolyl-tpy})_2]^{2+}$, ***Electrochim. Acta***, **2020**, *340*, 136000.

16. Ahmad, E.; Rai, S.; and **Padhi, S. K.***, Proton Reduction by a Ni(II) Catalyst and Foot-of-the Wave Analysis for H_2 evolution, ***Int. J. Hydrog. Energy***, **2019**, *44*, 16467-16477.

17. Majee, K. and **Padhi, S. K.***, Ligand Dechelation effect on a $[Co(tpy)_2]^{2+}$ Scaffold towards Electro-catalytic Proton and Water Reduction, ***New J. Chem***., **2019**, *43*, 3856-3865.

18. Majee, K.; Patel, J.; Das, B.; and **Padhi, S. K.***, μ-Pyridine bridged Copper Complex with Robust Proton Reducing Ability, ***Dalton Trans***., **2017**, *46*, 14869-14879.

19. Ahmad, E.; Majee, K.; Patel, J.; Das, B.; and **Padhi, S. K.***, Competent Electro- and Photo-Catalytic Proton Reduction by a $[Co(Tpy)_2]^{2+}$ Scaffold, ***Eur. J. Inorg. Chem***., **2017**, *2017*, 3409-3418.

20. Patel, J.; Majee, K.; Ahmad, E.; Das, B.; and **Padhi, S. K.***, Effect of Pyridyl substitution on Chemical and Photochemical Water Oxidation by $[Ru(tpy)(bpy)(OH_2)]^{2+}$ Scaffolds, ***Eur. J. Inorg. Chem***., **2017**, *2017*, 160-171.

21. Majee, K.; Patel, J.; Rai, S.; Das, B.; Panda, B.; and **Padhi, S. K.***, Proton Reduction by a Nickel Complex with Internal Quinoline Moiety for Proton Relay, ***Phys. Chem. Chem. Phys***., **2016**, *18*, 21640-21650.

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22. Patel, J.; Majee, K.; Ahmad, E.; Tanaka, K.*; and **Padhi, S. K.*,** [Ru^{V}(NCN-Me)(bpy)(=O)]$^{3+}$ Mediates Efficient C-H bond Oxidation from NADH Analogs in Aqueous Media rather than Water Oxidation, ***Dalton Trans.***, **2015**, *44 (3)*, 920-923.

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