Curriculum Vitae

Name	Dr. Nishu Devi
Qualifications	Ph.D. in Chemistry, M.Tech. & B.Tech. in Chemical Engineering
Current Position	Postdoctoral Research Associate, ORNL, USA
Nationality	Indian
Gender	Female
Email	devin@ornl.gov
Web Links	LinkedIn Google Scholar Web of Science ORCID Research Gate

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Profile

A doctorate in Chemistry from the University of Johannesburg, Auckland Park Kingsway Campus, Johannesburg, South Africa in the Department of Chemical Sciences (Formerly Department of Chemistry) and a Master's (M.Tech.) & Bachelor (B.Tech.) in Chemical Engineering from DCR University of Science and Technology Murthal, India, currently working as a postdoctoral researcher in Subsurface Opportunities and Innovations Laboratory (SOIL) in the Department of Civil and Environmental Engineering, Northwestern University, Evanston, USA. This unique blend of chemistry and chemical engineering drives a passion for innovative scientific discovery.

A dynamic researcher and problem-solver with a proven track record in material synthesis, composites, nanocomposites focused on electrochemistry. Skilled in in-situ polymerizations, purification, characterization, and optimization of chemical processes, focusing on both nano and macromolecules. Proficient in managing analytical instruments, ensuring seamless method development, data collection, and analysis.

Research interests encompass material science, electrochemistry, and surface chemistry of electrodes. Dedicated to advancing electrochemical mineralization, carbon sequestration, and electrochemical energy storage solutions.

Education

Degree	Duration	University	Major	GPA/%
Ph.D.	March 2017-April 2020	University of Johannesburg, Johannesburg, South Africa	Chemistry	NA

Thesis Title: *Performance of bismuth-based materials for electrochemical energy storage devices (Advisor: Prof. Kaushik Mallick)*

M.Tech.	July 2013-June 2015	D. C. R University of Science & Technology, Murthal, Haryana, India	Chemical Engineering	9.01/10

Dissertation Title: *Combined process for transesterification and selective hydrogenation for biodiesel production from non-edible vegetable oils (Advisor: Dr. Umesh Kumar, Co-advisor: Prof. DP Tiwari)*

B.Tech.	July 2009-June 2013	D. C. R University of Science & Technology, Murthal, Haryana, India	Chemical Engineering	8.42/10

Dissertation Title: *Analysis of various samples of water and study of their purification techniques (Advisor: Dr. Priyanka Lahot)*

Sr. Sec.	June 2008	Swami Nitanand Senior Secondary School, Rohtak, Haryana, India	Physics, Chemistry, Mathematics	84.00%

Professional Experience Timeline

Duration: 12st May 2025- present
Position, Place: Postdoctoral Research Associate, Oak Ridge National Laboratory, Oak ridge, Tennessee, USA
Project Title: Electrocatalysis for CO_2 Capture and Conversion
Mentor: Dr. Juliane Weber
Supervisor: Dr. Andrew G Stack
Project Funding: EFRC, DOE
Job responsibilities:

- **Experimental Design and Execution:** Perform electrochemical kinetics measurements in CO_2 reduction
  Perform electrocatalysts synthesis and characterization, and in situ studies of electrocatalytic CO_2 reduction using atomic force microscopy
  Utilize nuclear magnetic resonance and gas chromatography to identify reaction products.
- **Data Analysis and Report Writing:** Analyze experimental data collected for kinetic and mechanistic understanding
  Responsible for presenting and reporting research results and publishing scientific results in peer-reviewed journals in a timely manner
  Ensure compliance with environment, safety, health and quality program requirements
  Maintain strong commitment to the implementation and perpetuation of valued and ethics.

Duration: 1st March 2022- 30th April 2025 (**3 years 2 months**)
Position, Place: Postdoctoral researcher, Northwestern University, Evanston, Illinois, US
Project Title: Electrochemically storage of carbon-dioxide into solid aggregates using seawater while reducing the environmental threats of concrete
Principal Investigator: Prof. Alessandro F. Rotta Loria
Project Funding: CEMEX Innovation Holding AG
Job responsibilities:

- **Experimental Design and Execution:** Develop, plan, and conduct experiments in the laboratory to achieve research objectives, ensuring accurate and reproducible results.
- **Characterization and Evaluation:** Perform material and system characterization using advanced analytical techniques, interpreting data to assess performance, quality, and functionality.
- **Data Analysis and Report Writing:** Analyze experimental results, draw conclusions, and compile comprehensive reports, including data visualization and documentation for internal and external communication.
- **Mentorship and Guidance:** Supervise and mentor graduate students, providing technical guidance on research projects, assisting with experimental design, and reviewing progress to ensure successful project outcomes.
- **Laboratory and Equipment Management:** Oversee the maintenance and operation of laboratory equipment, ensure safety protocols are followed, and manage laboratory resources efficiently to support ongoing research activities.

Duration: 1st May 2020- 28th February 2022 (**1 year 10 months**)
Position, Place: Postdoctoral Researcher, University of Johannesburg, DFC campus, South Africa and Visiting researcher at CSIR, Pretoria, South Africa (Registered at the University of Johannesburg, Johannesburg, however worked at Nano center, Building 19, CSIR, Pretoria because PI is a visiting faculty at the university and director at Nano center, CSIR)
Project Title: Synthesis and characterization of polymer nanocomposite for electromagnetic interference shielding applications
Advisor: Prof. Suprakas Sinha Ray
Project Funding: PI's research funds
Job responsibilities:

- **Literature Review:** Conduct comprehensive reviews of scientific literature to identify knowledge gaps, stay informed on current research trends, and ensure the relevance and novelty of ongoing projects.
- **Review Writing and Publishing:** Author, co-author, and publish scientific reviews in peer-reviewed journals, synthesizing research findings and providing insights into specific fields of study.
- **Research Proposal Writing:** Develop and write research proposals for funding agencies, outlining objectives, methodology, and expected outcomes to secure financial support for future research projects.

Duration: 21st April-30th April: Break, Home, India

Duration: 16th March 2017- 20th April 2020 (**3 years**)
Position, Place: Research Scholar (PhD), University of Johannesburg, APK campus, Johannesburg, South Africa
Project Title: Performance of bismuth-based materials for electrochemical energy storage devices
Advisor: Prof. Kaushik Mallick
Project Funding: GES Scholarship
Job responsibilities:

- **Teaching Assistance:** Provided academic support to professors in delivering lectures and organizing coursework for undergraduate students in Physical Chemistry, Material Science, and Polymer Science, assisting with lesson planning and classroom management.
- **Laboratory Course Management:** Managed and supervised undergraduate Physical Chemistry laboratory courses (CEM 2A10, CEM 3A20, and CEM 1B01), overseeing lab activities for two groups of 80 first-year university students, ensuring a productive learning environment and adherence to safety protocols.
- **Assessment Preparation and Evaluation:** Prepared, administered, and graded examinations, laboratory assignments, reports, and term papers, providing detailed feedback to help students improve their academic performance.
- **Tutoring Experience:** Delivered three years of tutoring in the Department of Chemistry at the University of Johannesburg, South Africa, for courses in Physical Chemistry, Material Science, and Polymer Science at the undergraduate level, offering personalized support and guidance to students to enhance their understanding of complex topics.

Duration: 1st January – 15th March 2017 **(2 months)**
During this period, I was on a break at home in India while preparing to commence my PhD position at the University of Johannesburg, South Africa, starting on 15th March 2017.

Duration: 1st September 2016 - 31st December 2016(**One quarter**)
Position, Place: Visiting Faculty, D. C. R University of Science & Technology, Murthal, Haryana, India-131039
Job responsibilities:

- **Course Instruction:** Taught undergraduate courses on Equipment Design and Optimization of Chemical Processes, focusing on the principles of designing efficient chemical process equipment and optimizing chemical engineering systems for improved performance and sustainability.
- **Invigilation and Evaluation:** Supervised exams, assessed student progress through evaluations, and provided feedback to ensure a thorough understanding of course material.
- **Lecture and Presentation Preparation:** Created and delivered lectures, presentations, and course materials, tailoring content to meet the academic needs of students while incorporating real-world industry examples.
- **Laboratory Assistance:** Provided guidance and support to students in laboratory sessions, assisting them with practical experiments.

Duration: 19th August-31st August: Break, Home, India

Duration: 1st July 2015- 18th August 2016 (**1 year**)
Position, Place: Project Fellow at CSIR- Indian Institute of Petroleum, Dehradun- 248005 India
Project Title: Synthesis and optimization of fixed-bed sweetening catalyst
Advisors: Dr. Indrajit Kumar Ghosh and Dr. Sudeep Kumar Ganguly
Project Funding: Bharat Petroleum Corporation Limited (BPCL)
Job responsibilities:

- **Catalyst Synthesis:** Synthesized catalysts for the fixed bed sweetening process, focusing on optimizing catalyst properties to enhance process efficiency and effectiveness in industrial applications.
- **Performance Evaluation:** Conducted performance evaluations of the synthesized catalysts with varying solubility, analyzing their impact on the sweetening process and identifying key parameters for improvement.
- **Pilot Plant Screening:** Screened potential catalyst formulations based on pilot plant evaluations using industrial feedstock, ensuring practical applicability and scalability of the catalysts for large-scale operations.
- **Kinetic and Process Development Data Generation:** Generated essential data required for kinetic and process development studies, providing insights into reaction mechanisms and process optimization strategies to improve overall process performance.

Duration: 1st Jan 2015- 30th June 2015 (**1 semester**)
Position, Place: Project Trainee at CSIR- Indian Institute of Petroleum, Dehradun- 248005, India
Project Title: Combined process for transesterification and selective hydrogenation for biodiesel production from non-edible vegetable oils
Advisors: Dr. Umesh Kumar and Prof. DP Tiwari
Job responsibilities:

- **Literature Review:** Conducted an extensive literature review to identify existing research, relevant methodologies, and knowledge gaps in the field of Biodiesel production, ensuring the research project was grounded in current scientific understanding.
- **Laboratory Experiments:** Designed and conducted experiments in the laboratory, following established protocols and innovative approaches to explore chemical processes and reactions relevant to the research objectives.
- **Characterization and Analysis:** Performed material characterization using advanced analytical techniques, and conducted data analysis to interpret experimental results, identify trends, and draw meaningful conclusions for the research study.

Duration: 1st Aug 2013- 31st Dec 2014 (**3 semesters**)
Position, Place: Teaching & Lab Assistant while doing M.Tech., D. C. R University of Science & Technology, Murthal, Haryana, India-131039
Job responsibilities:

- **Teaching Assistance:** Assisted in teaching B.Tech. students under the TEQIP scheme at DCR University of Science and Technology, Murthal, Haryana, India. Supported professors in delivering lectures and tutorials for a class of 60 students, ensuring concepts were clearly understood.
- **Laboratory Support:** Supervised and guided students during laboratory sessions, providing hands-on assistance with experiments, troubleshooting technical issues, and ensuring proper use of lab equipment and adherence to safety protocols.
- **Student Mentorship:** Provided academic support to students, helping them understand complex engineering concepts, assisting with coursework, and offering feedback on assignments and lab reports to enhance their academic performance.

Area of Research Interest:

Keywords: Material science, Electrochemistry, Electrochemical Energy storage, Electrodeposition, Electrochemical mineralization, Electrochemical carbon sequestration

My overall interest is investigating the electrochemical phenomena associated with various electrochemical processes. My previous research work was focused on understanding the physical chemistry behind the development of multifunctional smart materials for various applications in the field of material science and energy storage such as:

- Carbon-negative material synthesis for the construction industry via electrochemical means and renewable energy
- Carbon sequestration in ocean mineral deposits
- Synthesis of polymer nanocomposites for EMI shielding applications
- Design, synthesis, and then the characterization of materials for electrochemical energy storage devices i.e. fuel cells, supercapacitors, and battery
- Synthesis of nanomaterials for electrochemical biosensors applications
- Development of catalysts for sweetening of kerosene and fixed bed reactor
- Design, synthesis, and then the characterization of catalysts for trans-esterification and hydrogenation reactions
- Development of material-based additives for lubrication applications

Research contributions

1. **Nishu Devi**, Xiaohui Gong, Daiki Shoji, Amy Wagner, Alexandre Guerini, Davide Zampini, and Alessandro F. Rotta Loria, "*Electrodeposition of Carbon-Trapping Minerals in Seawater for Variable Electrochemical Potentials and Carbon Dioxide Injections", **Adv. Sustainable Syst.***, 2025, 2400943.
2. **Nishu Devi**, Amy Wagner, Jeffrey Lopez, Alexandre Guerini, Davide Zampini, and Alessandro F. Rotta Loria "Mechanistic Insights into Electrodeposition in Seawater at Variable Electrochemical Potentials," ***Adv. Sustainable Syst.***, 2023,

2300446.

3. Kirti Mishra, **Nishu Devi**, Samarjeet Singh Siwal, and Vijay Kumar Thakur, "Dual role of 2-aminodiphenylamine with graphene oxide-palladium supported catalyst for direct methanol fuel cell application and removal of Otto fuel II component," **Surf. Interfaces**, 2024, 46, 104015.
4. Karamveer Sheoran, **Nishu Devi**, Walaa F. Alsanie, Samarjeet Singh Siwal, and Vijay Kumar Thakur, "An Aniline-Complexed Bismuth Tungstate Nanocomposite Anchored on Carbon Black as an Electrode Material for Supercapacitor Applications," ***ChemistrySelect*,** 2023, 8, e20230187.
5. Karamveer Sheoran, **Nishu Devi** and Samarjeet Singh Siwal, "Incorporation of sulfur with graphitic carbon nitride into copper nanoparticles toward supercapacitor application," ***Nanofabrication***, 2023, 8, 1-11.
6. Kirti Mishra, **Nishu Devi**, S. S. Siwal, V. K. Gupta, and V. K. Thakur, "Hybrid Semiconductor Photocatalyst Nanomaterials for Energy and Environmental Applications: Fundamentals, Designing, and Prospects," ***Adv. Sustain. Syst.***, 2023, 7, 230009.
7. Kirti Mishra, **Nishu Devi**, S. S. Siwal, and V. K. Thakur, "Insight perspective on the synthesis and morphological role of the noble and non-noble metal-based electrocatalyst in fuel cell application," ***Appl. Catal. B Environ.***, 2023, 334, 122820.
8. Harjot Kaur, **Nishu Devi**, S. S. Siwal, W. F. Alsanie, M. K. Thakur, and V. K. Thakur, "Metal–Organic Framework-Based Materials for Wastewater Treatment: Superior Adsorbent Materials for the Removal of Hazardous Pollutants," ***ACS Omega***, 2023, 8, 9004–9030.
9. **Nishu Devi**, Samarjeet Singh Siwal, "MXene-based nanomaterials for supercapacitor applications: New pathways for the future", ***Nanofabrication***, 2022, 7, 165-173.
10. Kirti Mishra, **Nishu Devi,** Samarjeet Singh Siwal, Qibo Zhang, Walaa F Alsanie, Fabrizio Scarpa, Vijay Kumar Thakur, "Ionic Liquid-Based Polymer Nanocomposites for Sensors, Energy, Biomedicine, and Environmental Applications: Roadmap to the Future", ***Advanced Science***, 2022, 9, 2202187.
11. **Nishu Devi**, Suprakas Sinha Ray, "Electromagnetic interference cognizance and potential of advanced polymer composites toward electromagnetic interference shielding: A review", ***Polym. Eng. Sci.***, 2022, 62, 1-31.
12. Samarjeet Singh Siwal, Qibo Zhang, **Nishu Devi**, Adesh Kumar Saini, Vipin Saini Bhawna Pareek, Sergejs Gaidukovsh, Vijay Kumar Thakur, "Recovery Processes of Sustainable Energy using Different Biomass and Wastes", ***Renewable and Sustainable Energy Reviews***, 2021, 150, 111483.
13. **Nishu Devi**, Suprakas Sinha Ray, "Performance of bismuth-based materials for supercapacitor applications: A review" ***Mater. Today Commun.***, 2020, 25, 101691.
14. **Nishu Devi**, Sarit K. Ghosh, Venkata K. Perla, and K. Mallick, "Organic–Inorganic

Complexation Chemistry-Mediated Synthesis of Bismuth–Manganese Bimetallic Oxide for Energy Storage Application" ***ACS Omega***, 2020, 30, 18693–18699.

15. Samarjeet Singh Siwal, Qibo Zhang, **Nishu Devi,** Vijay Kumar Thakur, "Carbon-Based Polymer Nanocomposite for High-Performance Energy Storage Applications" ***Polymers***, 2020, 12, 505.
16. **Nishu Devi**, S. Ghosh, V.K. Perla, T. Pal, and K. Mallick, "Laboratory-based synthesis of the pure form of gananite (BiF3) nanoparticles: a potential material for electrochemical supercapacitor application" ***New J. Chem.*** 2019, 43, 18369-18376.
17. **Nishu Devi**, S. Ghosh, and K. Mallick, "Supercapacitive performance of highly dispersed bismuth sulfide nanoparticles in organic matrix: The role of sulphur source" ***Inorg. Chem. Commun.,*** 2019, 103, 93-99.
18. R. Barik, **Nishu Devi,** V.K. Perla, S.K. Ghosh and K. Mallick, "Stannous sulfide nanoparticles for supercapacitor application", ***App. Surf. Sci.,*** 2019, 472, 112-117.
19. S. Siwal, **Nishu Devi,** V.K. Perla, S.K. Ghosh and K. Mallick, "Promotional role of gold in electrochemical methanol oxidation". ***Catalysis, Structure & Reactivity,*** 2019, 5, 1-9.
20. **Nishu Devi,** S. Ghosh, S.C. Ray and K. Mallick, "Organic Matrix Stabilized Ultra-Fine Bismuth Oxide Particles for Electrochemical Energy Storage Application" ***ChemistrySelect*****,** 2018, 3, 12057-12064.
21. S. Siwal, **Nishu Devi,** V. Perla, R. Barik, S. Ghosh and K. Mallick, "The influencing role of oxophilicity and surface area of the catalyst for electrochemical methanol oxidation reaction: a case study" ***Mater. Res. Innovations,*** 2018, 23, 440-447.
22. D. Nandi, R.U. Islam, **Nishu Devi,** S. Siwal and K. Mallick "Palladium nanoparticle-catalyzed aryl–amine coupling reaction: high performance of aryl and pyridyl chlorides as the coupling partner" ***New J. Chem.*****,** 2018, 42, 812-816.
23. R. Barik, **Nishu Devi,** D. Nandi, S. Siwal, S.K. Ghosh and K. Mallick, "Multifunctional performance of nanocrystalline tin oxide", ***J. alloys Compd*****.,** 2017, 723, 201-207.
24. S. Siwal, S. Ghosh, D. Nandi, **Nishu Devi,** V.K. Perla, R. Barik and K. Mallick, "Synergistic effect of graphene oxide on the methanol oxidation for fuel cell application", ***Mater. Res. Express*****,** 2017, 4, 095306.

Professional Training

- Six weeks B. Tech. training on "Study of Separation Processes of Acetic Acid and Water" at Terminal Ballistic Research Laboratory, DRDO, Chandigarh, India (11^{th} Jun 2012 to 20 July 2012).
- Six months M.Tech. training at CSIR-Indian Institute of Petroleum, Dehradun (Jan 2015-June 2015).
- One-day training at "Biologic Science Instruments" Johannesburg, South Africa (2017)

- One-day workshop at the University of the Witwatersrand, Johannesburg organized by Biologic Science Instruments (2017)
- One-day workshop based on SEM at the Northwestern University, Evanston, organized by Hitachi and Oxford Instruments in collaboration with NUANCE, Northwestern (2024)

Achievements, Awards, and Scholarships:

- Global Excellence and Stature Fellowship for 3 years (GES, March 2017 -December 2019) to pursue a Doctoral Degree at the University of Johannesburg.
- Received first position in graduate (M.Tech.) degree course (2015).
- Graduate Aptitude Test in Engineering (GATE), India qualified (2014).
- Received merit-cum-mean Indian Institute of Chemical Engineering (IIChE) Scholarship (2014).
- Coordinator of MANTHAN society in Techno-Rhythm (2012).
- Organizer of a seminar on "Clean Energy Sources" on National Science Day (2012).
- Participated and got first prize in "Chemical Quiz" organized by IIChE, (December 06, 2011).
- Rashtrapati Guide of Bharat Scouts and Guides at National level (2006).

Instrumental Skills

- Potentiostat
- X-Ray diffraction analysis
- Scanning electron microscopy
- Transmission electron microscopy
- Thermogravimetric analysis
- FTIR- spectroscopy
- UV-vis spectroscopy
- ICP-OES/MS
- High-pressure Parr reactor, batch reactor, continuous flow reactor, fixed bed reactor

Software/ IT skills

- MS Office: Word, PowerPoint, Excel
- Data analysis and graphics: Grapher, Origin, Chemcad, X'Pert High Score, GSAS-II, Adobe Illustrator
- Literature review and referencing: Mendeley, Endnote, Zotero

Declaration

I hereby declare that all the information furnished above is true to the best of my knowledge & belief; documentary evidence can be presented as and when required.

Date: July 04, 2025
Place: Oak Ridge, USA **(Nishu Devi)**