

Abhinanda Sengupta

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Ph.D. research scholar specializing in rechargeable batteries. Recognized for consistent excellence in research and substantial contributions to Na-ion and Li-ion battery development with expertise in advanced analytical tools like TEM, HAADF, FEG-SEM, XRD, along with pouch and cylindrical cell manufacturing. Seeking to advance pioneering research as an electrochemical energy storage device researcher.

WORK EXPERIENCE

Indian Institute of Technology Bombay

Ph.D. Research Scholar

Mumbai, IN

July 2018–Aug 2024

- Thesis title: Mechanistic Insights of Heteroatom-doped Layered Oxide Cathode Materials for Next-gen Sodium-ion Batteries
 - Synthesis, electrode engineering, cell assembly (Swagelok, Coin, Pouch and 18650 Cylindrical cells)
 - Hands on experience on characterization techniques like TEM, XRD (*in-situ* & *ex-situ*), SEM, XPS, EXAFS, Raman, and FTIR analysis
- Teaching Assistant for Post-graduate and Undergraduate level students for EN 658 Electrochemical Energy Storage, EN 656 Chemistry for Energy Science, EN323 Renewable Energy Generation & Storage, EN 309 Thermal and Fluid Engineering Lab
- Mentoring and training of Ph.D. research scholars and Masters' students
- Written and obtained 4 project proposals funded by Government of India
- Presented the research work at Indian Navy and Indian Airforce, Ministry of Defence, Government of India
- Technical Software Skills: FullProf Rietveld Refinement, High Score plus for X-Ray diffraction analysis, Crystal structure creation and analysis through VESTA and Crystal Maker, X-Ray Photo Electron Microscopy analysis through CASA XPS
- Organized workshops, seminars and conferences
- Maintained excellent attendance record, consistently arriving to work on time

Indian Institute of Technology Bombay

Operator, Transmission Electron Microscopy (TEM)

Mumbai, IN

Feb 2020–Present

- Experience of acquiring images in TEM, HR-TEM, SAED, Dark-field imaging, STEM, HAADF, EDS Mapping, EDS spectra
- Performed analysis and attained images of powder, nanoparticles, quantum dots, graphene, biologic, and bulk samples

Indian Institute of Technology Bombay

Operator, Field Emission Gun Electron Microscopy (FEG-SEM)

Mumbai, IN

Jan 2019–Mar 2020

- Acquired images in FEG-SEM and EDS mode of cathodes, anodes, solid-electrolytes, Na/Li-metals, dendrites

National Centre for Photovoltaics Research and Education (NCPRE), Ministry of New and Renewable Energy, Indian Institute of Technology Bombay

Senior Research Fellow

Mumbai, IN

Dec 2017–June 2018

- Student head of the Energy Storage group, quarterly report writing and compilation of the group's work
- Synthesis of electrode materials for Li-ion batteries; characterizations; cell fabrication (coin, pouch and 18650 cylindrical cells)
- Optimization of full-cell based on NMC//Graphite chemistry

EDUCATION

Indian Institute of Technology Bombay

Ph.D. on the thesis titles, “Mechanistic Insights of Heteroatom-doped Layered Oxide Cathode Materials for Next Generation Sodium-ion Batteries” (CGPA: 9/10.0)

Mumbai, IN

July 2018-Aug 2024

University of Calcutta

Master of Technology in Chemical Engineering (Gold Medalist) (CGPA: 8.77/10.0; Rank – 1st)

Kolkata, IN

July 2015-July 2017

West Bengal University of Technology

Bachelor of Engineering in Chemical Engineering (CGPA: 8.5/10.0)

Kolkata, IN

July 2011-July 2015

St. Thomas' Girls' School

Indian School Certificate (87%)

Kolkata, IN

April 2009-Mar 2011

SCHOLARSHIPS AND AWARDS

- Fellowship for doctoral research by the Ministry of New and Renewable Energy (MNRE) and Science & Engineering Research Board (SERB), Government of India
- Visiting researcher fellowship by Indo-Israel project, funded by the Department of Science & Technology (DST), India to visit Prof. Malachi Noked's Laboratory at Bar-Ilan University, Israel
- Best poster presentation award by the American Chemical Society (ACS) at ISMC-2022 (Bhabha Atomic Research Centre)
- International conference fellowship by DST-SERB, Government of India

PUBLICATIONS

1. **A. Sengupta**, A. Kumar, G. Barik, A. Ahuja, J. Ghosh, H. Lohani, P. Kumari, T. K. Bhandakkar, S. Mitra, Lower Diffusion-Induced Stress in Nano-Crystallites of P2-Na_{2/3}Ni_{1/3}Mn_{1/2}Ti_{1/6}O₂ Novel Cathode for High Energy Na-ion Batteries, *Small*, 2023, 19(12), 2206248
2. **A. Sengupta**, A. Kumar, A. Bano, A. Ahuja, H. Lohani, S. H. Akella, P. Kumar, M. Noked, D. T. Major, S. Mitra, Unleashing the Impact of Nb-doped, Single Crystal, Cobalt-free P2-type Na_{0.67}Ni_{0.33}Mn_{0.67}O₂ on Elevating the Cycle Life of Sodium-ion Batteries, *Energy Storage Materials*, 2024, 69, 103435
3. **A. Sengupta**, A. Kumar, A. Bano, A. Ahuja, K. Thapliyal, H. Lohani, P. Kumar, M. Noked, D. T. Major, S. Mitra, Deciphering the Role of Ligand-to-Metal Charge Transfer in Triggering Anionic Redox Activity of P2-Type Na_{0.67}Ni_{0.33}Mn_{0.67-x}Ru_xO₂ (0 ≤ x ≤ 0.16) (Submitted)
4. **A. Sengupta**, A. Kumar, A. Ahuja, S. H. Akella, A. Patil, H. Lohani, P. Kumar, M. Noked, D. T. Major, S. Mitra, Enhancing Sodium-ion Battery Efficiency via Interfacial Engineering in Layered Oxide Cathode Material (Manuscript)
5. J. Nongkynrih, **A. Sengupta**, B. Modak, S. Mitra, A. K. Tyagi, D. P. Dutta, Enhanced electrochemical properties of W-doped Na₃V₂(PO₄)₂F₃@C as cathode material in sodium ion batteries, *Electrochimica Acta*, 2022, 415, 140256
6. A. Ahuja, A. Kumar, **A. Sengupta**, M. Gautam, H. Lohani, P. Kumari, S. Mitra, Single-crystal spinel Li_{1.08}Mn_{1.92}O₄ octahedra cathode covered with Li-ion permeable robust NMC thin-layer protection for high voltage lithium-ion batteries, *Energy Storage Materials*, 2022, 52, 169-179
7. H. Lohani, A. Kumar, A. Bano, A. Ghosh, P. Kumari, A. Ahuja, **A. Sengupta**, D. Kumar, D. T. Major, S. Mitra, Inclusion of Anionic Additives in the Inner Solvation Shell to Regulate the Composition of Solid Electrolyte Interphase, *Advanced Energy Materials*, 2024, 2401268
8. A. Kumar, A. Ghosh, A. Ghosh, A. Ahuja, **A. Sengupta**, M. Forsyth, D. R. MacFarlane, S. Mitra, Sub-zero and room-temperature sodium-sulfur battery cell operations: A rational current collector, catalyst and sulphur-host design and study, *Energy Storage Materials*, 2021, 42, 608-617
9. H. Lohani, A. Kumar, P. Kumari, A. Ahuja, M. Gautam, **A. Sengupta**, S. Mitra, Artificial organo-fluoro-rich anode electrolyte interface and partially sodiated hard carbon anode for improved cycle life and practical sodium-ion batteries, *ACS App. Mat. & Int.*, 2022, 14(33), 37793-37803
10. H. Lohani, D. T. Duncan, X. Qin, P. Kumari, M. Kar, A. Sengupta, A. Ahuja, A. Bhowmik, S. Mitra, Fluorine Rich Borate Salt Anion Based Electrolyte for High Voltage Next Generation Sodium Metal Battery Development, *Small*, 2024, 2311157
11. P. Kumari, A. Kumar, H. Lohani, A. Ahuja, **A. Sengupta**, S. Mitra, Robust-dense composite cathode with improved three-dimensional ionic percolation network and electrode/electrolyte interface for the development of All-solid-state sodium batteries, *Small Methods*, 2024,
12. A. Ahuja, A. Kumar, K. Alam, H. Lohani, **A. Sengupta**, P. Kumari, K. Thapliyal, S. Mitra, Enhancing High-Voltage LNMO Cathode performance in Li-metal batteries via Anionic Electrolyte Additive-Integrated CEI Engineering (Submitted in *Advanced Functional Materials*)
13. A. Ahuja, A. Kumar, **A. Sengupta**, S. H. Akella, H. Lohani, P. Kumari, M. Noked, S. Mitra, Atomic Layer Deposition for Prolonged Li-ion Battery Life: Robust Coating on LNMO Cathodes (Submitted)
14. B. Kashyap, **A. Sengupta**, B. Modak, S. Mitra, A. K. Tyagi, D. P. Dutta, Co-doping in Na₃V₂(PO₄)₂F₃: An efficient manipulation to improve the electrochemical performance of cathodes in sodium ion batteries (Manuscript)
15. H. Lohani, A. Bano, **A. Sengupta**, A. Ghosh, P. Kumari, A. Ahuja, D. T. Major, S. Mitra, Fluorine and boron containing anions as additives for high ICE and long cycle sodium-ion batteries (Manuscript)
16. P. Kumari, A. Kumar, **A. Sengupta**, H. Lohani, A. Ahuja, S. Mitra, Enhanced All Solid-State Sodium Batteries via Advanced P2-type Layered Oxide Cathode Composites (Manuscript)

17. Sk A. Moyer, S. Maitra, K. Mukherjee, A. Sengupta, S. Roy, Structural Features and Optical Properties of $\text{CH}_3\text{NH}_3\text{Pb}_{(1-x)}\text{Sn}_x\text{Cl}_3$ Thin-Film Perovskites for Photovoltaic Applications, *Journal of Electronic Materials*, 2020, 49, 7133-7143
18. A. Dey, P. Karan, **A. Sengupta**, Sk A. Moyer, P. Sarkar, S. Basu Majumder, D. Pradhan, S. Roy, Enhanced charge carrier generation by dielectric nanomaterials for quantum dots solar cells based on CdS-TiO₂ photoanode, *Solar Energy*, 2017, 158, 83-88
19. Sk A. Moyer, **A. Sengupta**, A. B. Biswas, S. Roy, A. Dey, B. C. Das, Fabrication of environmentally friendly perovskite solar cell by partial replacement of lead with tin, *Invertis Journal of Renewable Energy*, 2017, 7(2), 59-63

PATENTS

1. **A. Sengupta**, A. Kumar, A. Ahuja, H. Lohani, P. Kumari, S. Mitra, Lower Diffusion-Induced Stress in Nano-crystallites of P2- $\text{Na}_{2/3}\text{Ni}_{1/3}\text{Mn}_{1/2}\text{Ti}_{1/6}\text{O}_2$ Novel Cathode for High Energy Na-ion Batteries, IN Patent App. 202221064263
2. **A. Sengupta**, A. Kumar, A. Ahuja, H. Lohani, P. Kumari, S. Mitra, Development of a Heteroatom-doped, Single Crystal, Cobalt-free P2-type Layered Oxide Cathode Material for Elevated Cycling Life of Sodium-ion Batteries, IN Patent App. 202421022102
3. P. Kumari, H. Lohani, **A. Sengupta**, A. Ahuja, S. Mitra, A. Kumar, Scalable, energy-efficient and low-cost synthesis of densified pure-phase NASICON solid electrolyte, IN Patent App. 202421007565
4. H. Lohani, A. Kumar, P. Kumari, A. Ahuja, M. Gautam, **A. Sengupta**, S. Mitra, Artificial Organo-Fluoro-Rich Anode Electrolyte Interface and Partially Sodiated Hard Carbon Anode for Improved Cycle Life and Practical Sodium-Ion Batteries, Granted, Indian Patent No: 546889.

CONFERENCE PROCEEDINGS

1. **A. Sengupta**, S. Mitra, Engineering diffusion-induced stress-resistant nano-crystalline P2-type layered oxide cathodes for high-energy sodium-ion batteries, SBS4- International Sodium-ion Battery Symposium, September, 2023 (Oral)
2. **A. Sengupta**, S. Mitra, P2-type Layered Transition Metal Oxide High Voltage Cathode for Na-ion Battery, B:FAT, Department of Ceramic Engineering, IIT (BHU) Varanasi, July, 2022 (Oral)
3. **A. Sengupta**, S. Mitra, Co-Free Heteroatom-Doped P2-Type Layered Oxide Cathodes: Advancing High Power Sodium-ion Battery Technology, 244th ECS Meeting, Gothenburg, Sweden, October, 2023 (Poster)
4. **A. Sengupta**, S. Mitra, Electrochemical Performance of $\text{Na}_3\text{V}_{1.96}\text{W}_{0.04}(\text{PO}_4)_2\text{F}_3@C$ as Cathode Material in Sodium-ion Batteries, 9th Interdisciplinary Symposium on Materials Chemistry, BARC, Mumbai, December, 2022 (Poster)
5. A. Sengupta, Development of Environmentally Stable and High Efficiency Cathodes for Sodium-ion Batteries, International Meeting on Energy Storage Devices, IIT Roorkee, Uttarakhand, December, 2018 (Poster)

BOOK CHAPTERS

1. P. K. Dutta, **A. Sengupta**, V. Goel, P. Preetham, A. Ahuja, S. Mitra, Nano-/Micro-engineering for Future Li-ion Batteries, Nano-Energetic Materials, Springer, 2019
2. S. Sau, G. K. Mishra, H. Lohani, **A. Sengupta**, M. Gautam, S. Mitra, Challenges and opportunities for energy storage technologies, Elsevier, 2022

REFERENCES

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