Sayan Ghosh

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HSB-224, Department of Physics, Indian Institute of Technology Madras, Chennai-600036

Summary

Highly motivated experimental researcher and material scientist working on development of all-solid-state lithium-ion batteries and structure-property correlations. Equipped with 4+ years of experimental research experience in different synthesis techniques, pouch cell and coin cell fabrication, spectroscopy and microscopy characterizations, atomic force microscopy.

Education

Indian Institute of Technology Madras — Chennai, India
Ph.D. in Experimental Physics; GPA: 8.73/10.00 — *Jan 2020 – present*
Supervisor: Prof. Sudakar Chandran
Topic: Structure-property correlations of solid-state electrolytes for all-solid-state battery.

- Synthesis of inorganic solid electrolytes and composite polymer electrolytes and its structure-property correlation (grain boundary conduction, effects of polarization in ion migration)
- Part of the research is being done in collaboration with Dr. Sahana MB from Centre for Automotive Energy Materials, ARCI Chennai, where I am involved in upscaling the preparation of solid electrolytes through CSTR method, pressure-dependent pouch cell fabrication and development of techniques to study in-situ characteristics of Li-ion batteries.

Visvabharati University — Santiniketan, India
B.Sc and M.Sc. in Physics; GPA: 8.48/10.00 — *July 2014 – July 2019*
Specialisation: Electronics

Research Output

Peer-reviewed Publications:

1. **Ghosh, Sayan**, Subhajit Nandy, Abhijitha Valalahally Gopala, Tarak K. Patra, Keun Hwa Chae, Birabar Ranjit Kumar Nanda, and Chandran Sudakar. "Defect-Induced Li-Ion Trapping and Hopping in a Grain Boundary-Engineered $Li_{1.3}Al_{0.3}Ti_{1.7}(PO_4)_3$ Solid-State Electrolyte." ACS Applied Materials Interfaces (2025), https://pubs.acs.org/doi/10.1021/acsami.4c21057.
2. **Sayan Ghosh**, C. Sudakar,"Isotropic Negative Thermal Expansion in $Li_{1.3}Al_{0.3}Ti_{1.7}(PO_4)_3$ Solid-State Electrolyte." **Journal of Materials Chemistry A** (2024) https://doi.org/10.1039/D4TA03772C
3. **Sayan Ghosh**, C. Sudarshan, C. Sudakar, "Influence of Lattice Vibrations and Phonon Interactions on the Ion Transport Properties of Grain Boundary Tailored $Li_{1.3}Al_{0.3}Ti_{1.7}(PO_4)_3$ Solid-state Electrolyte Ceramics." **J. Appl. Phys.** 133, 245106 (2023)
4. Vidyashree Hebbar, M. Viji, **Sayan Ghosh**, C. Sudakar, "Co-axially Electrospun Li-rich Layered Oxide@Spinel Core-Shell Heterostructure Nanofibers for Enhanced Stability and Electrochemical Performance." **Materials Research Bulletin**, Volume 180, 113057 (2024)
5. Pradeepkumar, Maurya Sandeep, Aruchamy Kathirvel, **Sayan Ghosh**, and C. Sudakar. "$Cs_2AgBiBr_6$ and related Halide double perovskite porous single crystals." Scientific Reports 15, no. 1 (2025): 843.

6. Subhajit Nandy, Mya Theingi, **Sayan Ghosh**, Keun Hwa Chae, C. Sudakar, "Influence of local structure and metal-oxygen hybridization on the electrical and magnetic properties of alkaline earth metal (Mg^{2+}, Ca^{2+}, Ca^{2+}) substituted $LaFeO_3$ ceramics." **J. Appl. Phys.** 136, 103901 (2024)

Submitted Manuscripts/ Manuscripts under Review

1. Athrey C D, **Sayan Ghosh**, C. Sudakar, "Vibrational Dynamics and Phonon Anharmonicity in $Cs_2B'B''X_6$ Halide Double Perovskites." [Equal Authorship]
2. Vikasmita Samanta, **Sayan Ghosh**, C. Sudakar, "Defect Induced Ferromagnetic Properties of Few Layered 2D MoS_2 Nanosheets Upon Oxidation."

Manuscripts Under Preparation

1. **Sayan Ghosh**, C. Sudakar, "Decoupling segmental dynamics and particle-polymer interactions in PVDF-HFP / $Li_{1.3}Al_{0.3}Ti_{1.7}(PO_4)_3$ composite solid electrolyte."

Poster/ Oral Presentations

1. (Oral) **Sayan Ghosh**, C. Sudakar, "Influence of phonon dynamics on the lithium-ion migration in NASICON-type $Li_{1.3}Al_{0.3}Ti_{1.7}(PO_4)_3$ solid electrolyte", International Conference on Materials for Humanity 2022 (MH22) 19-21 September 2022, Organised by Materials Research Society Singapore
2. (Poster) **Sayan Ghosh**, C. Sudakar, "Ionic conductivity and dielectric properties of $Li_{1.3}Al_{0.3}Ti_{1.7}(PO_4)_3$ solid electrolyte for all-solid-state-battery," FIMTA-2021, CSIR-IMMT, Bhubaneswar
3. (Poster) **Sayan Ghosh**, C. Sudarshan, C. Sudakar, "Interplay of Lattice Dynamics on the Ionic Conductivity of Grain Boundary Engineered $Li_{1.3}Al_{0.3}Ti_{1.7}(PO_4)_3$ Solid-state Electrolyte", IUMRS- International Conference in Asia 2022 (IUMRS-ICA 2022), Indian Institute of Technology Jodhpur, India

Skills

Battery Fabrication and Characterization: (i) Pouch cell and coin cell battery fabrication; (ii) Electrochemical Characterization [charge-discharge, cyclic voltametry, EIS, GITT]; (iii) Ionic Conductivity of inorganic and composite polymer electrolytes.

Material Synthesis: Sol-gel, Hydrothermal, Solid-state, Continuous stirred tank reactor (CSTR) synthesis techniques.

Characterization Techniques [Trained and Independent Operator]: (i) **Atomic Force Microscopy** - Parks NX10 sysmtem [Non-contact, tapping, Piezoelectric Force Microscopy, Magnetic Force Microscopy, Kelvin Probe Force Microscopy]; (ii) **Transmission Electron Microscopy** [Technai T20, JEOL F200 - Scanning Transmission Electron Microscopy, Energy Filtered Transmission Electron Microscopy (EFTEM), Electron Energy Loss Scpectroscopy (EELS)]; (iii) **Raman Spectroscopy** [Oxford Instruments - WITec alpha 300]; (iv) Dielectric Impedance Spectroscopy [Novocontrol Tech.].

Other Characterization Techniques [Analytical Skills]: (i) X-ray Diffraction; (ii) Differential Scanning Calorimetry; (iii) Scanning Electron Microscopy; (iv) Analysis of X-ray Absorption Spectroscopy

Softwares and Programming: (i) Python scripting (For TEM image analysis in Digital Micrograph software), (ii) LabVIEW, (iii) OriginLab, (iv) Adobe Photoshop, (v) Inkscape, (vi) Blender (beginner), (vii) Programming

(C, C++), (viii) Writing (Word & LATEX)

Soft skills: Oral and written communication of scientific results, collaboration and team work, project proposal writing, equipment procurement and documentation.

Professional Experience

Indian Institute of Science Bangalore, India
Project Assistant *July 2019 – Dec 2019*

- **Supervisor:** Prof. Akshay Naik
- Involved in fabrication of Graphene based FET devices on Si(++)/SiO_2 substrates.

Awards & Achievements

* Awarded INSPIRE Scholarship from Department of Science and Technology, Government of India (2014-2019)
* Qualified National level exam JEST-2019 (All India Rank: 588)
* Qualified National level exam GATE-2019 Physics (All India Rank: 1198)

Academic references

- **Prof. Sudakar Chandran**: Ph.D. Supervisor [email: csudakar@iitm.ac.in]
- **Dr. M. B. Sahana**: Collaborator [email: sahanamb@arci.res.in]