Curriculum Vitae

Dr. SREERAJ PURAVANKARA
Assistant Professor, School of Energy Science & Engineering
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Research interests

- Energy materials
- Rechargeable batteries
- Structural Chemistry
- Electrochemical energy storage
- Stationary Storage
- Electric Vehicles

Education

- Ph.D. (Electrochemistry/Material Science) Summa cum laude, (0,0)
  NRW Graduate School of Chemistry, WWU Muenster, Germany December 2005
- Master of Science (M.Sc.) (Physical Chemistry) First class with 2nd Rank (72%)
  School of Chemical Sciences, Mahatma Gandhi University, Kerala, India. April 2001

Professional Experience

- Indian Institute of Technology Kharagpur, India July 2015 - present
  Assistant Professor, School of Energy Science & Engineering
- Technical University Munich, Germany March 2013 to May 2015
  Research Associate, Dept. of Inorganic chemistry/Electrochemistry
- University of Muenster, Germany July 2008 to Feb. 2013
  Research Associate, Dept. of Inorganic/Physical Chemistry
- Max-Planck Institute, Stuttgart, Germany April 2006 to June 2008

Member/Awards

- **Faculty Excellence Award** (Asst. Professor) at IIT KGP (August 2022).
- **Visiting Faculty & External examiner** at ARAI Academy, Pune, India (since December 2020)
- **STFC Futures Early Career Award** (2019), Type: International, Awarded by Science & Technology Facilities Council, United Kingdom, Discipline: Batteries for energy storage.
- **Science & Engineering Research Board (SERB)** India, Early Career Research Award (2016)
- Member of **Chemical Research Society of India** (CRSI)
- Member of **Material Research Society of India** (MRSI)
- Member of **Electrochemical Society of India** (ESI)
- **Initiated** "URJA" - A student body of Energy Science & Engineering at IIT Kharagpur
- **Max-Planck Fellowship** for Post-doctoral research (2006).
- Achieved the highest academic recognition **[Summa cum Laude (0,0)]** for Ph.D. in Germany.
- **NRW Graduate School Fellowship** for doctoral research.
- **Rajiv Gandhi Summer Research Fellowship** by JNCASR, Bangalore, for the year 2000.

Publications in peer-reviewed journals

1. P. Verma, M. N. Nandanwar, J. Chakraborty, **S. Puravankara**, Insights into the Morphological Evolution of Mossy Dendrites in Lithium Metal Symmetric and Full Cell: A Modelling Study, J. Electrochem. Soc., 170(3), 0529, (2023) (IF: 4.4)
2. D. Pahari, A. Chowdhury, D. Das, T. Paul, **S. Puravankara,** The evolution of structure–property relationship of P2-type Na0. 67Ni0. 33Mn0. 67O2 by vanadium substitution and organic electrolyte combinations for sodium-ion batteries, *J Solid State Electrochem.*, doi.org/10.1007/s10008-023-05466-1, (2023) (IF: 2.75)
3. D. Das, S. Manna, **S. Puravankara**, Electrolytes, Additives and Binders for NMC Cathodes in Li-Ion Batteries—A Review, Batteries, 9(4), 193, (2023). (IF: 5.9)
4. Nagmani, P. Verma, **S. Puravankara** Jute-Fiber Precursor-Derived Low-Cost Sustainable Hard Carbon with Varying Micro/Mesoporosity and Distinct Storage Mechanisms for Sodium-Ion and Potassium-Ion Batteries, Langmuir, 38(50), 15703–15713, (2022) (IF: 4.3)
5. Nagmani, A. Kumar, **S. Puravankara**, Optimizing Ultra-Microporous Hard Carbon Spheres for Enhanced Sodium Storage in Half and Full Cells for Sodium-ion Batteries, Battery Energy, 1. 20220007 – 20220018, (2022) (IF: NA)
6. A. Kumar, Nagmani, **S. Puravankara**, Ti and V containing Symmetric Sodium-Ion Batteries – Progress and Prospects, Mat. Today Energy, 29, 101115-101141, (2022) (IF: 9.3)
7. D. Pahari, A. Kumar, D. Das, **S. Puravankara**, P2-type NaxTmO2 oxides as Cathodes for Non-Aqueous Sodium-ion Batteries – Structural evolution and Commercial Prospects, Int. J. Energy Res., 46, 21894-21927, (2022) (IF: 4.7)
8. Nagmani, D. Pahari, P. Verma, **S. Puravankara**, Are Na-ion batteries nearing the Energy Storage Tipping Point? – Current Status of Non-aqueous, Aqueous, and Solid-Sate Na-ion battery Technologies for Sustainable Energy Storage, J. Energy Storage, 56, 105961-105978, (2022) (IF: 8.9)
9. A. Mondal, A. Routray, **S. Puravankara**, Parameter identification and co-estimation of state-of-charge of Li-ion battery in real-time on Internet-of-Things platform, J. Energy Storage, 51, 104370-104381, (2022) (IF: 8.9)
10. Nagmani, A. Tyagi, D. Pahari, **S. Puravankara**, Lithium-ion battery technologies for electric mobility – State-of-the-art scenario, ARAI Journal of Mobility Technology, Volume 1, Issue 2 (April-June 2022). (IF: NA)
11. A. Tyagi, Nagmani, S., Puravankara, Opportunities in Na/K [hexacyanoferrate] frameworks for sustainable non-aqueous Na^+/K^+ batteries, Sustainable Energy & Fuels, 6, 550-595, (2022) (IF: 6.8)
12. Nagmani, A. Tyagi, **S. Puravankara**, Insights into the diverse precursor-based micro-spherical hard carbons as anode materials for sodium-ion and potassium–ion batteries, Material Advances, 3, 810-836, (2022) (IF: NA)
13. S. Misra, D. Pahari, S. Giri, F. Wang, P. P. Jana, **S. Puravankara**, The γ-brass type Cu–rich complex intermetallic phase $Cu_{41}Sn_{11}$: Structure and electrochemical study, Solid State Sciences 119, 106682, (2021) (IF:3.1)
14. D. Pahari, A. Chowdhury, **S. Puravankara**, Effect of Vanadium Substitution on the Ni-Site in P2-Type Na0. 67Ni0. 33Mn0. 67O2 in Optimized Carbonate Ester Electrolytes as Cathode for Sodium-Ion Batteries, (2021), DOI: 10.26434/chemrxiv-2021-wcbvm (under review in Solid State Sciences)
15. S. Misra, D. Pahari, S. Giri, P. P. Jana, **S. Puravankara**, Synthesis, Crystal Structures, Phase Width and Electrochemical Performances of γ-Brass Type Phases in Cu-Zn-Sn System. Journal of Alloys & Compounds. 855 (2), 157372 – 157384 (2021). (IF: 5.3)
16. Nagmani, **S. Puravankara**, Insights into the plateau capacity dependence on the rate performance and cycling stability of a Superior Hard Carbon Micro Sphere anode for Sodium-Ion Batteries, ACS Applied Energy Materials, 3 (10), 10045-10052, (2020). (IF: 6.1)
17. D. Pahari, **S. Puravankara**, Greener, Safer, and Sustainable Batteries: An Insight into Aqueous Electrolytes for Sodium-Ion Batteries, ACS Sustainable Chemistry & Engineering 8 10613-10625 (2020). (IF: 8.2)
18. D. Pahari, **S. Puravankara** , On controlling the P2-O2 phase transition by optimal Ti-substitution on Ni-site in P2-type Na0.67Ni0.33Mn0.67O2 (NNMO) cathode for Na-ion batteries, Journal of Power Sources 455 227957-227964 (2020). (IF: 9.1)

19. D. Pahari, S. Misra, S. Giri, P. P. Jana, **S. Puravankara**, Electrochemical Alloying/Dealloying Mechanism of Ternary Intermetallic $Cu_{6-\delta}Zn_{2+\delta}Sb2$ (δ= 0 and 1) as Anode for Li-Ion and Na-Ion Batteries. J. Solid State Chem*. 292*, 121660, (2020). (IF: 3.5)
20. P. Sharma, A. Kumar, S. Bankuru, J. Chakraborty, **S. Puravankara**, Large-Scale Surfactant-Free Synthesis of WS_2 Nanosheets: An Investigation into the Detailed Reaction Chemistry of Colloidal Precipitation and Their Application as an Anode Material for Lithium-Ion and Sodium-Ion Batteries. New J. Chem*. 44* (4), 1594–1608, (2020). (IF: 3.6)
21. D. Pahari, **S. Puravankara**, A Novel Ternary Ordered Intermetallics Cu3ZnSb As Anode for Alkali-Ion Storage, OSF preprints, 10 (2019) (IF: NA)
22. D. Pahari, **S. Puravankara**, On Improving the Cycling Stability of P2-Type Na0. 67Ni0. 33Mn0. 67O2 Cathode Material By Ti-Substitution for Na-Ion Batteries, OSF preprints, 10 (2019) (IF: NA)
23. K. Ghosh, S.K. Srivastava, **S. Puravankara**, Nanostructured ZrO_2 /MWCNT Hybrid Materials: Fabrication, Characterization and Applications in Shielding of Electromagnetic Pollution. J. Nanosci. Nanotechnol*., 19* (6), 3367– 3375, (2019). (IF: 1.4)
24. D. Nayak, **S. Puravankara**, S. Ghosh, V. Adyam, Asymmetric Reaction Pathway of Na^{+}-Ion during Fast Cycling in α- and γ-Fe_2O_3 Thin Film Anode for Sodium-Ion Batteries. Ionics*, 25* (12), 5857– 5868 (2019). (IF: 3.8)
25. Bhuyan, B., Srivastava, S. K., **S. Puravankara**, Mittal, V. Magnesium Aluminium Layered Double Hydroxide Assisted Dispersion of Multiwalled Carbon Nanotubes for Enhanced Reinforcement of Ethylene-Co-Vinyl Acetate Matrix. Macromol. Res. *26* (10), 868–871 (2018). (IF: 2.3)
26. Anodic Decomposition of Trimethylboroxine as Additive for High voltage Li-ion batteries, A. Freiberg, M. Metzger, D. Haering, S. Bretzke, **S. Puravankara**, T. Nilges, C. Stinner, C. Marino, H. A. Gasteiger, *J. Electrochem. Soc.,* **161(14)***, A2255-A2261 (2014).*
27. Insight into the Li ion dynamics in $Li_{12}Si_7$: Combining field gradient NMR, 1D/2D MAS NMR and relaxometry, A. Kuhn, S. Dupke, M. Kunze, K. Volgmann, **S. Puravankara**, T. Langer, R. Poettgen, M. Winter, H.-D. Wiemhöfer, H. Eckert, P. Heitjans, *J. Phys. Chem. C.* **118***, 28350-28360 (2014).*
28. NMR relaxometry as a versatile tool to study Li ion dynamics in potential battery materials, A. Kuhn, M. Kunze, **S. Puravankara**, H.-D. Wiemhöfer, V. Thangadurai, M. Wilkening, P. Heitjans, *Solid State Nucl. Magn. Reson.,* **42***, 2-8 (2012).*
29. Li ion diffusion in the anode material $Li_{12}Si_7$: Ultrafast Quasi-1D diffusion and two distinct fast 3D jump processes separately revealed by ^{7}Li NMR relaxometry, A. Kuhn, **S. Puravankara**, R. Pöttgen, H.-D. Wiemhöfer, M. Wilkening, P. Heitjans, *J. Am. Chem. Soc.,* **133***, 11018-11021 (2011).* ***Appeared as cover page of the journal.***
30. Li-NMR Spektroskopie an Kristallinem $Li_{12}Si_7$: zur Aromatizität planarer, Cyclopentadienyl-analoger Si_5^{6-}Ringe, A. Kuhn, **S. Puravankara**, R. Pöttgen, H.-D. Wiemhöfer, M. Wilkening, P. Heitjans*, Angew. Chem.,* **123(50)***, 12305- 12308 (2011).*
31. Li-NMR Spectroscopy on Crystalline $Li_{12}Si_7$: Experimental Evidence for the Aromaticity of the Planar Cyclopentadienyl-Analogous Si_5^{6-}Rings, A. Kuhn, **S. Puravankara**, R. Pöttgen, H.-D. Wiemhöfer, M. Wilkening, P. Heitjans*, Angew. Chem .Intl. Ed.,* **50***, 12099-12102 (2011).* ***Highlighted as Editor's choice in Science November 11 2011, Vol. 334 no. 6057 p. 739***
32. Electrochemical investigations of Li_2AuSn_2, **S. Puravankara**, N. A. Kaskhedikar, H.-D. Wiemhöfer, J. Maier, R. Pöttgen, *Solid State Ionics,* **181(1-2)***, 59-63 (2010).*
33. Lithium-Transition Metal-Tetrelides - Structure and Lithium Mobility, R. Pöttgen, T. Dinges, H. Eckert, **S. Puravankara**, H.-D. Wiemhöfer, *Z. Phys. Chem.,* **224(10-12)***, 1475-1504 (2010).*
34. Neutron diffraction and Electrochemical studies on $Li_{(1-x)}Ag_2Sn$, **S. Puravankara**, H.–D. Wiemhöfer, R.–D. Hoffmann, R. Skowronek, J. Walter, R. Pöttgen, *Solid State Sci.,* **8(7)***, 843-848 (2006).*
35. Neutron diffraction and Electrochemical studies on $LiIrSn_4$, **S. Puravankara**, H.–D. Wiemhöfer, R.–D. Hoffmann, R. Skowronek, A. Kirfel, R. Pöttgen, *J. Solid State Chem.,* **179(2)***, 355-361 (2006).*
36. Ternary Lithium Stannides $Li_xT_3Sn_{7-x}$ (T= Rh, Ir) **S. Puravankara**, D. Kurowski, R.–D. Hoffmann, Zh. Wu, R. Pöttgen, *J. Solid State Chem.,* **178(11)** *, 3420-3425 (2005).*
37. The Stannide $LiRh_3Sn_5$ – Synthesis, Structure, and Chemical Bonding, **S. Puravankara**, D. Johrendt, H. Müller, R.–D. Hoffmann, Zh. Wu, R. Pöttgen, *Z. Naturforsch.,* **60b***, , 933-939 (2005).*

38. Structure and bonding of $Li_{1.42(5)}Pd_2Sn_{5.58(5)}$: A Lithium Intercalated Palladium Stannide, **S. Puravankara**, Zh. Wu, R.–D. Hoffmann, U. Häussermann, R. Pöttgen, *Chem. Mater.,* **17 (4)***, 911-915 (2005).*
39. Effect of ruthenium doping on the properties of $Pr_{0.5}A_{0.5}MnO_3$ (A = Ca, Sr), K. V. Sarathy and **S. Puravankara**, *Solid State Commun.,* **122 (7-8)***, 385-387 (2002).*

Patent

1. Aluminum Substituted gamma–MnO_2 Electrode For Secondary Cells, D. Nayak, P.K. Jha, A. Agarwal, S. Janakiraman, N.V.P. Chaudhary, K. Biswas, S. Ghosh, V. Adyam, **S. Puravankara** (Filed, Indian Patent Application No.: 201931013311, dated April 2, 2019)

Conference papers

1. Mondal A., Pahari D., **S. Puravankara**., Routray A., On-line Capacity Estimation of Li-ion battery Using Semi-parametric Transfer Learning, IECON 2022–48th Annual Conference of the IEEE Industrial Electronics Society, 1-6, (2022)
2. Mondal A., Pahari D., **S. Puravankara**., Routray A., On-line Parameter Identification and State of Charge Estimation of Li-ion Batteries, IEEE 17th India Council International Conference (INDICON - 2020), New Delhi, India (2020)
3. Mondal A., Pahari D., Biswas R., **S. Puravankara**., Routray A, Frequency Selective Filters for Estimating the Equivalent Circuit Parameters of Li-ion Battery, 8th International Conference on Power Science and Engineering (ICPSE 2019)
4. On Improving the Cycling Stability of P2-Type $Na_{0.67}Ni_{0.33}Mn_{0.67}O_2$ Cathode Material by Ti-Substitution for Na-Ion Batteries, D. Pahari and **S. Puravankara**, ECS Meet. Abstr. MA2019-02 522, 236th ECS Fall Meeting, Atlanta, GA, USA, October 12-17, 2019.
5. A Novel Ternary Ordered Intermetallics Cu_3ZnSb As Anode for Sodium-Ion Storage, D. Pahari, **S. Puravankara** et al. ECS Meet. Abstr. MA2019-02 600, 236th ECS Fall Meeting, Atlanta, GA, USA, October 12-17, 2019.

Oral presentations

1. Electrode materials for commercial Na-ion batteries", **Invited Lecture** at THE INTERNATIONAL CONFERENCE ON BEYOND FOSSIL FUELS: The Future of Alternative Energy Technologies, [B:FAT 2020], IIT-BHU, (July 2022)
2. Are Na-ion batteries nearing the Energy Storage Tipping Point? Type: **Invited Lecture** at International Conference on Energy Materials, MGU, Kottayam, Kerala & Wroclaw University of Science & Technology, Poland, (December 2021)
3. Sodium-ion batteries for Energy Storage - A Materials perspective Online, India (04-09-2020 to 04-09-2020), Type: **Keynote Lecture**, Event Name: 2nd National Seminar on Frontiers in Material and Chemical Sciences (NSFMCS 2020)
4. Sodium-ion batteries for Energy Storage at Online, India (07-10-2020 to 07-10-2020), Type**: Invited Lecture**, Event Name: IESA-ARAI Academy, 'Advance Battery Technology: Beyond Li-ion batteries (06-08 October 2020).
5. Beyond Li-ion batteries? **Type: Invited Lecture**, Exploring Na-ion battery electrodes for energy storage, at Jain University (Deemed to be University), Bangalore, 2nd National Seminar on Frontiers in Material and Chemical Sciences (NSFMCS) (Sept 2020)
6. Electrochemical energy storage Technologies for e-mobility at Christ College, Irinjalakuda, Kerala, India, **Type: Invited Lecture**, Event Name: "Recent Trends and Challenges in developing Green chemical methods for industrial and medicinal applications" 2020. (February 2020)
7. Batteries for Stationary Storage - Current Status and Future Trends, **Type: Invited Lecture** at Department of Chemistry, Acharya Nagarjuna University, Guntur, Andhra Pradesh, India, Event Name: National Seminar on Emerging Trends in Chemistry & Materials 2020 (January 2020)

8. Alkali metal ion battery technologies at St. Joseph's College Devagiri, Calicut, India (December 2019), **Type: Invited Lecture** Event Name: National Conference on Materials Chemistry NCMC - 2019
9. Celebrating the 2019 Nobel Prize in Chemistry: Li-ion battery: Powering a wireless and fossil-fuel-free world at IIT Kanpur, **Type: Invited Lecture** (Event Name: Celebrating the 2019 Nobel Prize in Chemistry Department of Chemistry, IIT Kanpur, (November 2019),
10. Battery Technologies for Energy Storage at **Type: Invited Lecture**, Event: QIP Department of Chemistry, Christ (Deemed to be University), Bangalore, India, (May 2019)
11. "Battery materials for Energy Storage" - **Type: Invited Lecture,** Event: MRSI Materials Conclave & AGM 2019, February 14, 2019, Bangalore.
12. "P2-type oxide cathode materials for Na-ion batteries" - **Type: Invited Lecture**, UK-India workshop, ElChem Routes, 10-13 December 2018, JNCASR, Bangalore.
13. "Electrode materials, electrolytes & separators for Li-ion batteries, **Type: Workshop** at Li-ion battery workshop, IIT Kharagpur, India 2016.

Workshop/Conferences organized

- International Conference on Twenty-First Century Energy Needs – ICTFCEN 2016 (Nov. 2016), IIT Kharagpur – as **Technical Program Committee (Chair)**
- Workshop in Lithium-ion Battery Technology – May 2016, IIT Kharagpur – as **Co-convener**
- Introduction to Python workshop – August 2017
    - Initiated the formation of the student body 'URJA' for the school and organized the workshop as **faculty coordinator**.

Reviewer

I have been a reviewer for the following peer-reviewed journals:
Advanced Materials, ACS Applied Energy Materials, ACS Sustainable Chemistry & Engineering, ACS Inorganic Chemistry, ACS Chemistry of Materials, Journal of Physical Chemistry B, Journal of Material Chemistry A, Energy Advances, Journal of Power Sources, ChemElectroChem, Electrochimica Acta, International Journal of Hydrogen Energy, Journal of Chemical Sciences.