Azeem u shan Banday

Research/Teaching Positions

Since 2021 – Present **Lecturer in Physics**, Higher Education Department, Govt. of Jammu & Kashmir, India.

2015 – 2018 **Senior Research Fellow (SRF)**, University of Delhi, Delhi, India.
Supervisor: Prof. Sevi Murugavel

2013 – 2015 **Junior Research Fellow (JRF)**, University of Delhi, Delhi, India.
Supervisor: Prof. Sevi Murugavel

2012 – 2013 **Junior Research Fellow (JRF)**, Sikkim University, Sikkim, India.

2011 – 2012 **Project Fellow**, University of Kashmir, Srinagar, India.
Supervisor: Prof. Naseer Iqbal

Education

2014–2020 **Doctor of Philosophy (Ph. D.)**, Delhi University, India (defended in November, 2020)
Thesis title: "Investigations on local atomic structure and charge transport mechanism in olivine phosphate crystal and glass".
Supervisor: Prof. Sevi Murugavel

2010–2011 **Master of Science (M. Sc.) with Class Ist**, Kashmir University, India.
Specializations: Condensed Matter Physics, Nanoscience.

2007–2009 **Bachelor of Science (B. Sc.)**, Kashmir University, India.
Major's: Physics, Maths., Information Technology.

Professional Qualifications

2011–2012 **Bachelor of Education (B. Ed.)**, Kashmir University
B. Ed., a professional degree required to prepare/qualify individuals fully for teaching.

Computational proficiency

Hands-on training of MS-Office, Origin software, Proficient in using Microsoft word, excel, power-point and associated programmes

Familiarity with Material Characterization Techniques

- X-ray Diffraction studies with Rietvield refinement analysis
- Differential Scanning Calorimetry/Thermal gravimetric Analysis
- Diffuse reflectance measurement using UV-visible Spectrophotometer
- Fourier Transform-Infra Red (FTIR) spectroscopy and Raman Spectroscopy
- X-ray Absorption Spectroscopy (XAS) and Mössbauer Spectroscopy
- Impedance Analysis/Dielectric Studies

Publications (Peer-reviewed)

2023 **Tunable Electronic Structure of heterosite $FePO_4$: An In-depth Structural Study and Polaron Transport**,
A. Banday, R. Shahid, M. Gupta and S. Murugavel, RSC Adv., 13, 18332,(2023).
doi:10.1039/D3RA01366A

2021 **Synthesis, crystal structures, dielectric and magnetic properties of manganese sulfonyldibenzoates**,
Balendra, B. Singh, **A. Banday**, S. Tewari, V. Kumar, S. Murugavel, P.A. Joy and A. Ramanan, CrystEngComm, 23, 6703,(2021).
doi:10.1039/D1CE00810B

2020 **Effect of crystallite size on the phase transition behavior of heterosite $FePO_4$**,
A. Banday, R. Shahid, S.S. Meena, S.M. Yusuf and S. Murugavel, Phys.Chem.Chem.Phys., 22, 15478,(2020).
doi:10.1039/D0CP02387F

2019 **Alkaline-earth metal based coordination polymers assembled from two different V-shaped ligands: Synthesis, structure, and dielectric properties**,
Balendra, **A. Banday**, S. Tewari, B. Singh, S. Murugavel and A. Ramanan, Inorganica Chimica Acta, 495, 118940, (2019).
doi:10.1016/j.ica.2019.05.039

2019 **Strontium-Carboxylate-Based Coordination Polymers: Synthesis, Structure and Dielectric Properties**,
Balendra, **A. Banday**, V. Kumar, S. Murugavel and A. Ramanan,ChemistrySelect, 4, 4756 , (2019).
doi:10.1002/slct.201900096

2019 **Direct evidence for the influence of lithium ion vacancies on polaron transport in nanoscale $FePO_4$**,
A. Banday, M. Ali, R. Pandey and S. Murugavel, Phys.Chem.Chem.Phys., 21, 9858 (2019).
doi:10.1039/C9CP00408D

2017 **Calcium and Strontium Coordination Polymers Based on Rigid and Flexible Aromatic Dicarboxylates: Synthesis, Structure, Photoluminescence and Dielectric Properties**,
Balendra, **A. Banday**, S. Murugavel, P.K. Kanaujia, G.V. Prakash and A. Ramanan, ChemistrySelect, 2, 8567, (2017).
doi:10.1002/slct.201701232

2017 **Small polaron hopping conduction mechanism in $FePO_4$ glass and crystal**,
A. Banday and S. Murugavel, Journal of Applied Physics 121, 045111 (2017).
doi:10.1063/1.4974948

Conference Proceedings

2018 **Polaronic conductivity and scaling behavior of lithium iron phosphate glass**,
A. Banday and S. Murugavel, AIP Conference Proceedings 1953, 090077 (2018).
doi: 10.1063/1.5032924

2017 **Alkaline earth coordination polymers: photoluminescence and dielectric properties**,
B. Kumar, A. Ramanan, **A. Banday**, S. Murugavel, P. Kanaujia and G.V. Prakash, Acta Cryst. (2017). A73, C183.
doi: 10.1063/1.5032924

2016 **Size dependent polaronic conduction in hematite**,
M. Sharma; **A. Banday** and S. Murugavel, AIP Conference Proceedings 1731, 110049 (2016).
doi:10.1063/1.4948070

2016 **Structure and transport investigations on lithium-iron-phosphate glasses**,
A. Banday, M. Sharma and S. Murugavel, AIP Conference Proceedings 1731, 070042 (2016). doi:10.1063/1.4947874

Conference Presentations/talks

2018 **Correlation Between Structural and Electrical Properties in Lithium Iron Phosphate Cathode Material for Rechargeable Lithium Ion Batteries**,
A. Banday, M. Ali, R. Pandey and S. Murugavel, International School of Materials for sustainable Development and Energy, July 6–13, 2018.
European Materials Research Society held in Erice, Italy

2017 **A Comparative Study of $LiFePO_4$ Glass and Crystal as a Cathode Material for Rechargeable Lithium Ion Batteries**,
A. Banday and S. Murugavel, 12th National Conference on Solid State Ionics (NCSSI-12), December 21–23, 2017.
BITS Pilani, Pilani Campus, India

2017 **Polaronic Conductivity and Scaling Behavior of Lithium Iron Phosphate glass**,
A. Banday and S. Murugavel, 2nd International conference on Condensed Matter & Applied Physics, Nov. 24–25, 2017.
Engineering College, Bikaner India

2017 **Transport and dynamics of mobile ions in $LiFePO_4$ glass and crystal**,
A. Banday and S. Murugavel, International conference on Nano and Functional Materials-interface between Science & Engineering (NFM-2017), Nov. 16–18, 2017.
Organised jointly by BITS Pilani, Pilani Campus and Materials Research Society of India (MRSI)-Rajasthan Chapter

2017 **Role of lithium vacancies on polaronic transport in lithium iron phosphate**,
A. Banday, R. Pandey and S. Murugavel, Ist World Conference Solid Electrolytes for Advanced Applications: Garnets and Competitors, September 6–9, 2017.
Department of Physics, Pondicherry University, India

2017 **Lithium Ion Transport in Lithium-Iron-Phosphate Glasses**,
A. Banday and S. Murugavel, 15th Asian Conference on Solid State Ionics, Nov. 27–30, 2017.
Indian Institute of Technology Patna, India

2016 **Small polaron hopping conduction mechanism in $LiFePO_4$ glass and crystal**,
A. Banday, M. Ali, R. Pandey and S. Murugavel, International Conference on Technologically Advanced Materials & Asian Meeting on Ferroelectricity (ICTAM-AMF10), Nov. 7–11, 2016.
University of Delhi, India

2015 **Structure and transport investigations on lithium-iron-phosphate glasses**,
A. Banday, M. Ali, R. Pandey and S. Murugavel, 60th DAE Solid State Physics Symposium, Dec. 21–25, 2015.
Amity University, Utter Pradesh, India

2015 **Polaronic Conduction in Lithium Iron Phosphate Glasses**,
A. Banday, M. Ali, R. Pandey and S. Murugavel, National Conference on Functional Glasses/Glass-Ceramics and Ceramics (NCFGC-2015), Dec. 10–12, 2015.
VNIT, Nagpur, India

2014 **A Study of LiFePO4 as cathode material for rechargeable Lithium-Ion batteries**,
A. Banday, M. Ali, R. Pandey and S. Murugavel, International Conference on Electron Microscopy & XXXV Annual Meeting of Electron Microscope Society of India (EMSI), July 9-11 July, 2014.
University of Delhi, India

Symposia/Workshops/Scientific Activities/Memberships

2017 **National Workshop on Nanotechnology: Emerging Frontiers & Applications**, January 30–31, 2017.
Shyam Lal College, University of Delhi

2015 **Workshop on Spectro-Electrochemistry**, June 17–18, 2015.
Organized by University of Delhi & Sinsil International Pvt. Ltd. Mumbai

2015 **IUCr Workshop on X-Ray Diffraction Systems and Related Applications**, Sep. 25–26, 2014.
University of Delhi

2014 **International Conference on Electron Microscopy & XXXV Annual Meeting of Electron Microscope Society of India (EMSI)**, July 9–11, 2014.
University of Delhi

2014 **Advanced Workshop on Broad Band Dielectric Spectroscopy**, January 17–18, 2014.
Organized by the University of Delhi and Novocontrol Technologies GmbH & Co.KG, Germany

Academic Achievements/Fellowships

2018 **Awarded International travel grant by DST-SERB**, India.
- For participating and presenting in the International School of Materials for Sustainable Development and Energy held in Erice (Italy).

2018 **Full scholarship award**, Italy.
- To attend the International School of Materials for Sustainable Development and Energy held in Erice (Italy) from July 6th-13th 2018 organized by the European Materials Research Society.

2015–2018 **Senior Research Fellowship (SRF)**, UGC, India.
- Awarded Senior Research Fellowship by University Grants Commission (UGC) to continue PhD work for three years.

2013–2015 **Junior Research Fellowship (JRF)**, UGC, India.
- Awarded Junior Research Fellowship by University Grants Commission (UGC) to continue PhD work for first two years.

2013 **Research Fellowship**, Hyderabad University, India.
- Awarded National Level PhD fellowships after qualifying entrance tests for University of Hyderabad and GGS Indraprasta University.

2013 **Awarded Fellowship**, University of Sikkim, India.
- Fellowship offered by Department of Physical Sciences, University of Sikkim to pursue M. Phil. course.

2013 **Qualified CSIR-UGC NET/JRF**, Ministry of Human Resource Development (MHRD), Government of India.
- Qualified National Eligibility Test (NET) with Junior Research Fellowship (JRF) in Physical Sciences, conducted by Ministry of Human Resource Development (MHRD) for Assistant professorship in Colleges and Universities across India.

Brief summary of my research work:

2014–2020 **Ph.D. work**, University of Delhi, Delhi, India.

- **Supervisor, Prof. Sevi Murugavel:** Lithium ion batteries (LIBs) are the most advanced rechargeable batteries available thus far because of their high power density, high energy density, light weight and highly safe. Within the family of olivine phosphates, $LiFePO_4$ is arguably one of the most potential candidates for cathode materials and has been under extensive study ever since its discovery. The main focus of my thesis work was to improve the electronic conductivity of $LiFePO_4$ which impacts the battery design to a great deal. I aimed at studying the underlying mechanism of charge transport in $LiFePO_4$ to improve its conductivity. In this regard I have prepared different nanosized $LiFePO_4$ samples by a modified single step solid state reaction method. Similarly different crystallite sized $FePO_4$ samples were also prepared by chemical delithiation method. The various analytical techniques have been employed to understand the structural, optical, morphological and electronic phenomena of different nanosized $LiFePO_4$ and $FePO_4$ samples. The polaronic conduction mechanism of $LiFePO_4$ and $FePO_4$ samples has been revealed by using Mott model of polaronic conduction and the influence of vacancies on the polaron transport has been established. Furthermore, a comparison between the olivine structured crystalline $LiFePO_4$ and its amorphous analog glassy $LiFePO_4$ has been drawn. The glassy $LiFePO_4$ has been prepared by the standard melt quenching technique. The phase purity and structural properties of as-prepared samples has been characterized by various analytical techniques which attested that the obtained samples were without any parasitic impurity. The intrinsic electrical conductivity measurements were done using broadband impedance spectroscopy over wide temperature ranges. The physical parameters extracted from the Mott model of polaronic conduction firmly support the evidence of enhancement in the polaronic conductivity in case of glassy $LiFePO_4$ samples. These revelations are believed to instigate further insightful improvements in the electrochemical performance of next generation LIB's.

H-index -7; Total citations -106,
Google Scholar link:https://scholar.google.com/citations?user=6HrqNZkAAAAJ&hl=en
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References

Please Note: References are available only on request.

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