Dr. Nabadyuti Barman

Designation **Assistant Professor** (since September 2020)

Department **Department of Chemistry,**
Srikrishna College, University of Kalyani

Contact Information
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Academic Qualifications

- **Research Associate (Post-doctoral Fellow)**

Institute : New Chemistry Unit (NCU), Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Bangalore , India
Duration: August 2017 - July 2019

- **Doctorate of Philosophy (Ph.D) in Chemical Science**
- **Senior Research Fellow (SRF)**

Institute : Materials Research Centre, Indian Institute of Science, Bangalore , India
Duration: July 2013 - July 2017

- **Junior Research Fellow (JRF)**

Institute : Materials Research Centre, Indian Institute of Science, Bangalore 560012, India
Duration: January 2012 - July 2013

- **M.Sc. in Chemistry**

Institute : Indian Institute of Technology Madras, Chennai, India
Completed: July 2011

- **B.Sc.(Chemistry (Honours), Mathematics, Physics)**

College : Lady Brabourne College, Kolkata
University : University of Calcutta
Completed: July 2009

- **XIIth Standard**

Board : West Bengal Council of Higher Secondary Education, West Bengal
Completed: June 2006

- **Xth Standard**

Board : West Bengal Board of Secondary Education, West Bengal
Completed: June 2004

Ph.D. Thesis **Investigations into the Structure and Multifunctional Properties of Tellurium doped Calcium Copper Titanate ($CaCu_3Ti_{4-x}Te_xO_{12}$; $0 \leq x \leq 0.2$).**

Ph.D. Thesis Supervisor Prof. K. B. R. Varma

Research Interests

- Structure determination of crystalline and non-crystalline compounds (Specifically, perovskites, double perovskites, weberites and NASICON type compounds) through *in-situ* or *ex-situ* X-Ray Diffraction, X-ray Absorption Fine Spectroscopy (XAFS), Transmission Electron Microscopy (TEM), Nuclear Magnetic Resonance (NMR) and Raman Spectroscopy.
- Crystal growth or thin-flim deposition to design new energy storage materials through cost effective new synthesis methodologies.
- Solid state cathode, anodes and electrolytes (specially, inorganic materials applied in alkali ion batteries).
- Ion transport modeling through Impedance spectroscopy, Linear and nonlinear optics for various (organic and inorganic) materials.
- Nonlinear high-K Dielectric (capacitor), Incipient Ferroelectric, varistor and semiconductor ceramic materials.

Experimental Skills

- **Synthesis of single-crystalline materials**: Isothermal and slow cooling method (saturated solution), flux method (melt solutions), Czochralski method and Verneuil method.
- **Synthesis of poly-crystalline materials**: Solid state route, chemical vapor deposition (CVD) method, sol-gel and co-precipitation process(example: solid state synthesis, glass, sol-gel, co-precipitation, solvo-thermal synthesis).
- **Fabrication**: Electrodes, Polishing ceramics, Poly-crystalline ceramics capacitor and varistor, single crystal resonator, Batteries (swagelok, Pouch and coin cell).
- **Structural Characterization**: X-ray diffraction (XRD), Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Atomic Force Microscopy (AFM), X-ray Photoelectron Spectroscopy (XPS), Fourier transform Infrared spectroscopy (FTIR), Raman Spectroscopy, X-ray Absorption Fine structure spectroscopy (XAFS).
- **Transport property characterization**: Impedance spectroscopy, Piezoelectric and Ferroelectric loop measurements, Second Harmonic generation (SHG) with Nd:YAG laser, I-V measurements, Hall Measurement, Cyclic-Voltametry and Battery cycling.

Technical and Computational Skills

- **Crystallographic Programs**: PAN Analytical X'pert High Score, GSAS-EXPGUI, Full-Prof Suit, SPuDS, JANA-2006, WiRE, VESTA, GAUSSIAN-03, Crystal Maker.
- **Software Packages**: LabVIEW, Origin, Adobe Photoshop, Microsoft Office, Z-View, Texmaker, CASA XPS, GATAN Microscopic suite, Wi-Tech, Athena, Artimis, BT-Lab suite and Chem draw.

Research Experience

- **M.Sc project**: "Fluorinated thio-ethers: Do they substitute HFEs?".
  Advisor: Prof. B. Rajakumar, IIT Madras, Chennai, August 2010 - April 2011.
- **Project during Ph.D.**: "Second harmonic generation in Sulphate based ionic salts for Piezo-resonator application".
  Advisor: Prof. K. B. R. Varma, IISc, Bangalore, June 2012 - June 2013.
- **Postdoctoral Projects**:
- "High performance of Iso- and aleo-valent transition metal doped NASICON cathodes in Na-ion Batteries"
- "Topotactic Solvothermal synthesis methods for Weberite Mterials for Na-ion Batteris"
- "Intermetallic pervoskite carbides anodes in Na and Li-ion Batteries"
  Advisor : Dr. Premkumar Senguttuvan, JNCASR, Bangalore, November 2017 onwards.

Teaching Experience

- Teaching assistant for the Under-graduate course **"Instrumental Methods of Chemical Analysis"** offered by Prof. S. Vasudevan in IISc in August-December semester 2013.

Publications (in peer-reviewed journals)

- **Nabadyuti Barman**, Shalini Tripathi, N. Ravishankar and K. B. R. Varma, Centrosymmetric Tetragonal Tellurium Doped Calcium Copper Titanate and its Dielectric Tunability, *Solid State Comm.* **241**, 7 (2016) [ISSN : 0038-1098].
- **Nabadyuti Barman**, Priyank Singh, N. Chandrabhas and K. B. R Varma, Incipient ferroelectric to a possible ferroelectric transition in Te^{4+} doped calcium copper titanate ($CaCu_3Ti_4O_{12}$) ceramics at low temperature as evidenced by Raman and dielectric spectroscopy, *AIP adv.* **7**, 035105 (2017) [ISSN : 2158-3226].
- **Nabadyuti Barman** and K. B. R. Varma, Enhanced non-linear current-voltage response of Te-doped calcium copper titanate ceramics, *Ceram. Int.* **43**, 6363 (2017) [ISSN : 0272-8842].
- **Nabadyuti Barman**, Utsav Dey, Subham Ghosh, Shreya Sarkar, Sebastian C. Peter and Premkumar Senguttuvan, Topochemical Bottom-up Synthesis of 2D and 3D Sodium Iron Fluoride Frameworks, *Chem. Mat.* **31**, 295 (2019) [ISSN : 1520-5002].
- Subham Ghosh, **Nabadyuti Barman**, Madhulika Mazumder, Swapan K. Pati, Gwenaëlle Rousse and Premkumar Senguttuvan, High Capacity and High Rate NASICON-$Na_{3.75}$ $V_{1.25}$ $Mn_{0.75}(PO_4)_3$ Cathode for Na-ion Batteries via Modulating Electronic and Crystal Structures, *Adv. Energy Mater.* **9**, 1902918 (2019) [ISSN : 1614-6840].
- **Nabadyuti Barman**, Subham Ghosh and Premkumar Senguttuvan, Impact of Mg^{2+} and Al^{3+} Substitutions on the Structural and Electrochemical Properties of NASICON-$Na_xVMn_{0.75}M_{0.25}(PO_4)_3$ (M = Mg and Al) Cathodes for Sodium ion Batteries, *Small* **16**, 2003973 (2020) [ISSN : 1613-6829].

Conference Participation

- International Union of Materials Research Society (IUMRS-ICA 2013), 2013, Bangalore, India.
- APS March Meeting, March 14- 18, 2016, Baltimore, Maryland , USA, **Poster** : "Triggering incipient ferroelectricity in Calcium Copper Titanate ($CaCu_3Ti_4O_{12}$) ceramics through partial B-site substitution by Te^{4+} ions".
- 9th international conference on Broadband Dielectric Spectroscopy and its application, September 11- 16, 2016, Pisa, Italy, **Poster**: "Centrosymmetric tetragonal B-site doped Calcium Copper Titanate".

Academic Visits

- **September** 2014 - **October** 2014: Microwave absorption of ferrite materials at $2 - 12$ GHz frequency range, Defence Research and Development Organization (DRDO), Jodhpur, India.
- **November** 2017: X-ray Absorption Spectroscopy studies of NASICON cathodes for Sodium-ion Batteries (Proposal : I-20170111), PETRA III, DESY, Hamburg, Germany.
- **October** 2018: Phase transitions and conduction pathways of NASICON cathodes for Sodium-ion Batteries through In-situ X-ray Absorption Spectroscopy studies (Proposal : I-20180308), PETRA III, DESY, Hamburg, Germany.