

CURRICULUM VITAE

Personal information

Dr. Bijoy Kumar Das

Scientist

International Advanced Research Centre for Powder Metallurgy & New Materials (ARCI),
India

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Educational background:

2006-2011 Ph.D. in Physics, Department of Physics, **National University of Singapore (NUS), Singapore. CAP: 4.3/5**

Thesis title: Studies on Metal Oxides and Cobalt Nitride as prospective anode materials for Lithium ion batteries.

Thesis supervisor: Prof. B.V.R. Chowdari

2004- 2006 Master of Technology in Materials Science and Engineering, **Indian Institute of Technology (IIT), Kharagpur, India. CGPA: 8.84/10**

2002- 2004 Master of Science in Physics, **Utkal University, Odisha, India. Percentage: 75.2/100 (First Class)**

1999-2002 Bachelor of Science (Physics Hons'), **Fakir Mohan University, Odisha, India. Percentage: 80.12/100 (in Hons') (First class with Distinction) 68.7/100 (Grand total).**

1997-1999 Intermediate of Science, **Council of Higher Secondary Education, Odisha, India. Percentage: 71/100**

1997 10th (High School), **Board of Secondary Education, Odisha, India Percentage: 82.1/100**

Research experience:

Jan 2021- till date Scientist, International Advanced Research Centre for Powder Metallurgy & New Materials (ARCI), India

Nov 2016-Dec 2020 Project Scientist, International Advanced Research Centre for Powder Metallurgy & New Materials (ARCI), India

Jan 2012- Oct 2016 Scientist, Helmholtz Institute Ulm (HIU), Institute of Nanotechnology (INT), **Karlsruhe Institute of Technology, Germany.**

Jan 2011-Dec 2011 Postdoctoral Researcher, **KTH (Royal Institute of Technology), Stockholm, Sweden.**

Ongoing project:

1. **Project title:** Low cost sodium ion battery for grid and off-grid storage applications

Role: Principal Investigator

Amount: 64.54 Lakhs

Duration: 3 years

Funding Agency: Department of Science and Technology (DST), India

2. **Project title:** Lithium ion batteries for Electric Vehicle application (TRC project)

Role: Scientist

Amount: 100.0 Cr

Duration: 5 years

Funding Agency: Department of Science and Technology (DST), India

Teaching experience:

01/2007-01/2010 Laboratory Assistant (Engineering Physics Laboratory), National University of Singapore, Singapore.

Responsibility: Teaching engineering physics experiments, designing experiments, conducting laboratory sessions, conducting viva and grading exam reports for undergraduate engineering students.

Research Interest:

(a) Lithium ion batteries for stationary and electric vehicle applications.

(b) Sodium ion batteries for grid/off-grid storage application.

(c) Supercapacitors

(d) Tunable magnetism

(e) Magnetocaloric materials

Thesis guided/guiding: **Post-doctorate:** 1

Ph.D./JRF: 2 (on going)

M.Sc./M.Tech.: 10 (completed)

B. Tech: 2 (Completed)

Honors and awards:

- Best Researcher Award in International Scientist Awards on Engineering, Science and Medicine, 04th -05th July 2020, Coimbatore, India given by VDGGOOD Technology.
- Nominated for Best Young Scientist Research award under IUMRS-MRS Singapore **2019**.
- Received 2nd Best Poster award in Industry-Academia Conclave on Energy Storage organized by DST, Govt of India held on 30th November 2019 at MNIT, Jaipur.
- Received Best Poster award in Second International Meeting on Clean Energy Materials Innovation Challenge IC6, Mission Innovation organized by DST, Govt. of India on 21-22nd February **2019** at IIT Delhi.
- Graduate Research Scholarship, National University of Singapore, Singapore, **2006-2010**.
- Postgraduate scholarship, Council for Scientific and Industrial Research (CSIR), Govt. of India, **2005-2006**.
- Postgraduate scholarship, Ministry of Human Resources and Development (MHRD), Govt. of India, **2004-2005**.
- National Scholarship from higher secondary to Master of Science (**1997-2004**), Govt. of India.
- Best graduate award being placed in first rank in Physics (Hon's), **2002**.
- Qualified the prestigious Graduate Aptitude Test in Engineering (GATE)-**2004**, with 97 percentile; All India rank-83.
- Qualified CSIR-UGC NET (JRF) in Physics-**2004**.
- Qualified Joint Entrance Screening Test (JEST) in Physics-**2004**.

Patents:

1. "Microwave assisted sol-gel process for preparing in-situ carbon coated electrode materials and the product thereof," **Bijoy Kumar Das**, P. Laxman Manikanta, N. Lakshmipriya, R. Gopalan, G. Sundararajan, **Indian Patent 201911008004**.
2. Microwave assisted sol-gel process for preparing in-situ carbon coated electrode materials and the product thereof", **Bijoy Kumar Das**, P. Laxman Manikanta, N. Lakshmipriya, R. Gopalan, G. Sundararajan, **European Patent: 20763813.1**.

3. Microwave assisted sol-gel process for preparing in-situ carbon coated electrode materials and the product thereof”, **Bijoy Kumar Das**, P. Laxman Manikanta, N. Lakshmipriya, R. Gopalan, G. Sundararajan, **Japanese Patent: 2020-550159**.
4. Microwave assisted sol-gel process for preparing in-situ carbon coated electrode materials and the product thereof”, **Bijoy Kumar Das**, P. Laxman Manikanta, N. Lakshmipriya, R. Gopalan, G. Sundararajan, **Korean Patent: 10-2020-7025994**.
5. Reversible alteration of a magnetic state of a material” **Bijoy Kumar Das**, Subho Dasgupta, Horst Hahn, Robert Kruk, **European Patent 13172431.2**.

Book Chapter:

1. Intercalation-based Layered Materials for Rechargeable Sodium-ion Batteries, **Bijoy Kumar Das**, R. Gopalan, Published in **Layered Materials for Energy Storage and Conversion**, RSC Publisher (2019), <http://dx.doi.org/10.1039/9781788016193>.

List of publications (*h-index*: 16) (*i10 index*- 18) (Total citation-779):

Total publications (Published/under consideration) >35; (Selected publications are listed)

1. “Electric-Potential-Induced Complete Control of Magnetization in MnZnSb Metallic Ferromagnets” Martin Møller Greve, **Bijoy Das**, Ibrahim Issac, Ralf Witte, Di Wang, Robert Kruk, Horst Hahn, Subho Dasgupta (2020) (In Press).
2. “Scalable synthesis and kinetic studies of carbon coated sodium titanate: A promising ultra-low intercalation voltage anode for sodium ion battery”, P. Laxman Mani Kanta, M. Venkatesh, Satyesh Kumar Yadav, B. Das*, R. Gopalan, **Trans. Ind. Nation. Acad. Eng. 5 (2020) 475-483**.
3. “Magnetocaloric properties and critical exponents in anti-PbFCl type ZnMnSb room temperature ferromagnet”, D.K. Dinkar, M. Palit, R. Gopalan, **B. Das***, **J. Magn. Mater. 489 (2019) 165437**.
4. “Investigation on polyvinyl alcohol and sodium alginate as aqueous binders for lithium titanium oxide anode in lithium ion batteries”, V.V.N. Phanikumar, V. Rao Rikka, **B. Das**, R. Gopalan, B.V. A. Rao, R. Prakash. **Ionics 25 (2019) 2549-2561**.

5. “Effects of surfactant on the structural and magnetic properties of hydrothermally synthesized NiFe₂O₄ nanoparticles” D. K. Dinkar, **B. Das***, R. Gopalan, B S. Dehiya, **Materials Chemistry and Physics 218 (2018) 70-76.**
6. “Tamarind seed skin derived fiber like carbon nanostructures as novel anode material for lithium-ion battery” S. R. Sahu, D. Parimala Devi, V. V. N. Phanikumar, T. Ramesh, N. Rajalakshmi, G. Praveena, R. Prakash, **B. Das***, R. Gopalan, **Ionics 24 (2018) 3413-3421.**
7. “Towards on-and-off magnetism: reversible electrochemistry to control magnetic phase transitions in spinel ferrites” S. Dasgupta, **B. Das**, Q. Li, T. Baby, S. Indris, M. Knapp, H. Ehrenberg, K. Fink, R. Kruk, H. Hahn, **Adv. Funct. Mater. 26 (2016) 7507-7515.**
8. “Improved Li- storage performance of heat-treated InFeCoO₄ spinel prepared by glycine assisted chemical route” **B. Das***, M.V. Reddy, BVR Chowdari, **Ionics 22 (2016) 1585-1591.**
9. Enhancement of electrochemical performance by simultaneous substitution of Ni and Mn with Fe in Ni-Mn spinel cathodes for Li-ion batteries, N. Kiziltas-Yavuz, M. Yavuz, S. Indris, N. N. Bramnik, M. Knapp, O. Dolotko, **B. Das**, H. Ehrenberg, A. Bhasker, **J. Power Sources 327 (2016) 507-518.**
10. “SnO and SnO.CoO nanocomposite as high capacity anode materials for lithium ion batteries” **B. Das***, M. V. Reddy, B.V.R. Chowdari, **Materials Research Bulletin 74 (2016) 291–298.**
11. Vanadium and Chromium Molecular Cluster Batteries (MCB): Li-Storage in Transition Metal Complexes J Rinck, **B. Das**, M Fichtner, **ECS Meeting Abstracts, (2016) 246-246.**
12. High performance metal nitrides, MN (M = Cr, Co) nanoparticles for non-aqueous hybrid supercapacitors. **B. Das***, M. Behm, G. Lindbergh, M. V. Reddy, B.V.R. Chowdari, **Advanced Powder Technology 26 (2015) 783.**
13. Intercalation-Driven Reversible Control of Magnetism in Bulk Ferromagnets. S. Dasgupta, **B. Das**, M. Knapp, R.A. Brand, H. Ehrenberg, R. Kruk and H. Hahn, **Adv. Mater. 26 (2014) 4639-4644. (Cover page).**

14. LiF/Fe/V₂O₅ nanocomposite as high capacity cathode for Lithium ion batteries, **B. Das***, A.Pohl, VSK Chakravadhanula, C. Kübel, M. Fichtner, **J. Power Sources** **267** (2014) 203-211.
15. Ferromagnets: Intercalation- Driven Reversible Control of Magnetism in Bulk Ferromagnets, Dasgupta, **B. Das**, M Knapp, RA Brand, H Ehrenberg, R Kruk, H Hahn, **Advanced Materials** **26** (2014) 4751-4751 (Cover Page).
16. A disc- like Mo- metal cluster compound, Co₂Mo₃O₈ as high capacity anode for Lithium ion batteries, **B. Das***, M. V. Reddy, S. Tripathy, BVR Chowdari, **RSC Advances** **4** (2014) 33883.
17. Oxidation state and local structure of a high-capacity LiF/Fe(V₂O₅) conversion cathode for Li-ion batteries, A.H. Pohl, A.A. Guda, V.V. Shapovalov, R. Witte, **B. Das**, F. Scheiba, J. Rothe, A.V. Soldatov, M. Fichtner, **Acta Mater.** **68** (2014) 179.
18. A Disc-Like Mo-Metal Cluster Compound, Co₂Mo₃O₈, as a High Capacity Anode for Lithium Ion Batteries. **B. Das***, M. V. Reddy, S. Tripathy, B. V. R. Chowdari , **ChemInform** **49** (2014); DOI: 10.1002/chin.201449010.
19. Li- storage of Fe₃O₄/C composite prepared by one- step carbothermal reduction method, **B. Das**, M. V. Reddy, B.V.R. Chowdari, **J. Alloys Compd.** **565** (2013) 90.
20. X-ray absorption spectroscopy and energy storage of Ni- doped Cobalt Nitride; (Ni_{0.33}Co_{0.67}N) prepared by a simple synthesis route, **B. Das**, M. V. Reddy, B.V.R. Chowdari, **Nanoscale**, **5** (2013) 1961.
21. Synthesis of porous-CoN nanoparticles and their application as a high capacity anode for lithium-ion batteries, **B. Das**, M. V. Reddy, G.V. Subba Rao, B.V.R. Chowdari, **J. Mater. Chem.**, **22** (2012) 17505.
22. Synthesis and Li-storage behavior of CrN nanoparticles, **B. Das**, M. V. Reddy, G.V. Subba Rao, B.V.R. Chowdari, **RSC Adv.**, **2** (2012) 9022.
23. “Nano- phase tin hollandites, K₂(M₂Sn₆)O₁₆ (M = Co, In) as anodes for lithium ion batteries” **B. Das**, M. V. Reddy, G.V. Subba Rao, B.V.R. Chowdari, **J. Mater. Chem.**, **21** (2011) 1171.
24. “Nano- composites, SnO(VO)_x as anodes for lithium ion batteries” **B. Das**, M.V. Reddy, G.V. Subba Rao, B.V. R. Chowdari, **J. Solid State Electrochem.** **15** (2011) 259.

25. "Li-cycling behavior of Mo-cluster compounds, $A_2Mo_3O_8$ ($A = Zn, Co$)" **B. Das**, M. V. Reddy, G. V. Subba Rao, B. V. R. Chowdari, 12th Asian Conference on **Solid State Ionics (2010)**, China.
26. "Nanoflake CoN as a high capacity anode for Li- ion batteries" **B. Das**, M. V. Reddy, P. Malar, Osipowicz Thomas, G.V. Subba Rao, B.V.R. Chowdari, **Solid State Ionics**, **180 (2009) 1061**.
27. "Carbothermal synthesis, spectral and magnetic characterization and Li- cyclability of the Mo- cluster compounds, $LiYMo_3O_8$ and $Mn_2Mo_3O_8$ " **B. Das**, M.V. Reddy, C. Krishnamoorthy, S. Tripathy, R. Mahendiran, G.V. Subba Rao, B.V. R. Chowdari, **Electrochim. Acta**, **54 (2009) 3360**.
28. "Hollandite-type compounds, $K_2(In_2Sn_6)O_{16}$ and $K_2(Co_2Sn_6)O_{16}$ as anodes for lithium batteries" **B. Das**, M. V. Reddy, G.V. Subba Rao, B.V.R. Chowdari. Proceedings of the 11th Asian conference on **Solid State Ionics**, (2008) 69-77.
29. "Synthesis of Mo- cluster compound, $LiHoMo_3O_8$ by Carbothermal reduction method and it's reactivity towards Li" **B. Das**, M. V. Reddy, G.V. Subba Rao, B.V.R. Chowdari, **J. Solid State Electrochem.**, **12 (2008) 953-959**.

Invited/contributed oral presentation in international/national conferences:

1. "Batteries for Electric Vehicles", **Bijoy Kumar Das**, AICTE sponsored Online Short Term training Programme (STTP) on "Recent Advances on Hybrid and Electric Vehicle Technologies" during 16th -21st of November 2020. (**Invited**)
2. "Low-cost and high specific energy Li-S batteries: Challenges towards it's practical applications" **Bijoy Kumar Das**, Workshop on Advance Battery Technology: Beyond Lithium-ion, ARAI-IESA Jt. online Proficiency Improvement Programme (oPIP), 06th - 08th October 2020 (**Invited**).
3. "Low-cost sodium ion battery for grid and off-grid applications" P. Laxman Mani Kanta, M. Venkatesh, N. Lakshmi Priya, **Bijoy Kumar Das**, Industry-Academia Conclave on Energy Storage held at MNIT Jaipur on 30th November 2019 organized by DST, Govt. of India (**Invited**).
4. "Carbon coated sodium titanates as ultra-low voltage anode for sodium ion battery" **Bijoy Kumar Das**, P. Laxman Manikanta, R. Gopalan, International Conference on

Advanced Materials and Processes (ADMAT), Hyderabad, India, 23-25 September 2019.

5. “Towards Rechargeable Sodium-ion Battery- Material’s challenges and Developments of their developments” **Bijoy Kumar Das**, R. Gopalan, 3rd International Conference on Advanced Materials (ICAM), Kottayam, India, 9-11 August 2019 (**Invited**).
6. Improved Electrochemical Performance of Iron and Cobalt Co-substituted Layered P2-Na_{0.67}MnO₂ Cathode Material for Sodium-Ion Battery Application, **Bijoy Kumar Das**, Venkatesh Manchala, R. Gopalan, 10th International Conference on Materials for Advanced Technologies (ICMAT), 13-28 June 2019, Singapore.
7. Invited Lecture on “Electrochemical Energy Storage Systems- Materials challenges and developments”, **Bijoy Kumar Das**, VIT Vellore, 8th March 2019. (**Invited Lecture**)
8. “Development of low-cost sodium ion batteries for grid and off-grid storage applications”, **Bijoy Kumar Das**, 2nd International Meeting on Clean Energy Materials Innovation Challenge, 21-22 February 2019 (**Invited**).
9. Electrochemical impedance spectroscopy (EIS) analysis for lithium ion battery”, **Bijoy Kumar Das***, R. Prakash and R. Gopalan, Indian Analytical Science Congress (IASC) 2018, Kerala Chapter.
10. FeF₂/graphite nanocomposite: Its Li- storage and kinetic studies by electrochemical techniques, **Bijoy Kumar Das**, M. Fichtner, International conference on Energy Science and Technology, Karlsruhe, Germany, 2015.
11. Vanadium and Chromium Molecular Cluster Batteries (MCB): Li- storage and kinetic studies by electrochemical analysis, J. Rinck, **Bijoy Kumar Das**, M. Fichtner, International conference on Energy Science and Technology, Karlsruhe, Germany, 2015.
12. New battery systems based on conversion materials: M. Fichtner, **Bijoy Kumar Das**, M. Helen, A. Pohl, M. Anji Reddy, Zh. Zhao-Karger; Batterieforum Berlin, Germany, 2015.
13. FeF₂/Fe₃O₄ core-shell nanocomposite as high capacity cathode for Lithium ion batteries, **Bijoy Kumar Das**, CVS Kiran, M. Fichtner, 14th UECT Ulm Electrochemical Talks, 2014.
14. Oxidation State and Local Structure of a High-Capacity LiF/Fe(V₂O₅) Conversion Cathode for Li-Ion Batteries, A.H. Pohl, A.A. Guda, V.V. Shapovalov, R. Witte, **Bijoy**

- Kumar Das**, F. Scheiba, J. Rothe, A.V. Soldatov, M. Fichtner, ECS meeting abstract:37215 (2014).
15. Oxidation state and local structure of a high-capacity LiF/Fe/V₂O₅ conversion cathode for Li-ion batteries, A. Pohl, **Bijoy Kumar Das**, CVS Kiran, M. Fichtner, 14th UECT Ulm Electro Chemical Talks, 2014.
 16. LiF/Fe/V₂O₅ as high capacity anode for Lithium ion batteries, **Bijoy Kumar Das**, A. Pohl, M. Fichtner, 2nd International Conference on Materials for Energy Storage, May 12-16 (2013), Karlsruhe, Germany.
 17. "Li-cycling behavior of Mo-cluster compounds, A₂Mo₃O₈ (A = Zn, Co)" **Bijoy Kumar Das**, M. V. Reddy, G. V. Subba Rao, B. V. R. Chowdari, Proceedings of the 12th Asian conference on Solid state Ionics: Fundamental applications and Technological applications; 2-6 May 2010, China. Pages, 820-829.
 18. "Studies on CrN nanoparticles as anode material for lithium ion batteries" **Bijoy Kumar Das**, M. V. Reddy, G. V. Subba Rao, B.V.R. Chowdari. Abstract submitted to the 4th MRS-S Conference on Advanced Materials, 2010 IMRE, Singapore.
 19. "Nanocomposites, (SnO._{1/2} VO_x) as anodes for lithium ion batteries" **Bijoy Kumar Das**, M. V. Reddy, G. V. Subba Rao, B.V.R. Chowdari, presented at International conference on materials for advanced Technologies (ICMAT) -2009 held on 28 June - 3 July, 2009 Suntec city, Singapore.
 20. "Hollandite-type compounds, K₂(In₂Sn₆)O₁₆ and K₂(Co₂Sn₆)O₁₆ as anodes for lithium batteries" **Bijoy Kumar Das**, M. V. Reddy, G.V. Subba Rao, B.V.R. Chowdari. Proceedings of the 11th Asian conference on Solid state Ionics: New materials for pollution free Energy devices; 69-77 (2008), India.
 21. "Metal cluster compounds, of LiYMo₃O₈ and Mn₂Mo₃O₈ as anode for lithium ion Batteries" **Bijoy Kumar Das**, M. V. Reddy, G. V. Subba Rao, B.V.R. Chowdari. Abstract submitted to the 3rd MRS-S conference on Advanced Materials, 2008 IMRE, Singapore.
 22. "Synthesis of Mo- Cluster compound, LiHoMo₃O₈ by carbothermal reduction method and it's reactivity towards Li" **Bijoy Kumar Das**, M. V. Reddy G. V. Subba Rao, B.V.R. Chowdari, presented at International conference on materials for advanced Technologies (ICMAT) -2007 held on 1-5 July, 2007 Suntec city, Singapore.

Reviewer of Journals:

- 1) ACS Omega
- 2) Journal of Magnetism and Magnetic Materials
- 3) Chemical Communication
- 4) Materials Chemistry and Physics
- 5) Powder Technology
- 6) Nano-Micro Letters
- 7) New Journal of Chemistry
- 8) RSC Advances
- 9) ACS Sustainable Chemistry & Engineering
- 10) Journal of Alloys and Compounds
- 11) Electrochimica Acta
- 12) Materials Research Bulletin

Experimental experience:

(i) Research skills:

I am well experienced with many physical and chemical techniques for the synthesis of various nanostructured electrode materials for their energy storage applications (Both Lithium and sodium storage). I have experience on many physical characterization techniques such as X-ray diffraction, SEM, TEM, XAS, EDX, FT-IR, Raman spectroscopy, etc. During my Ph.D, I worked on various nanostructured metal oxides and chalcogenides for energy storage applications, such as Li ion batteries. Electrodes made of such structured materials can absorb much more lithium than conventional electrodes and store much more energy. They can also minimize the charging time owing to their reduced dimension. I have developed various nanostructured electrode materials, which showed high and stable specific capacity ($700-900 \text{ mA h g}^{-1}$), as well as high rate performance ($\sim 600 \text{ mA h g}^{-1}$ at 5000 mA g^{-1}). I have also studied the underneath reaction mechanism and the Li- ion transport kinetics associated with these electrode materials by using various analytical techniques. During my postdoctoral research, I have extended the work mainly to develop new electrode materials of high specific energy for automobile industry. Currently, I am working on addressing the Li-ion reaction mechanism, nature of electrode- electrolyte interface and battery degradation

through in-situ and ex-situ characterization techniques. I am also working on high specific energy cathode materials based on conversion reaction and optimizing their performance by preparing suitable nanostructures and various nanocomposites. I have developed nanocomposite cathode materials based on conversion reaction, which showed very high reversible capacity ($\sim 350 \text{ mA h g}^{-1}$ w.r.t. total weight of electrode materials). Apart from material's development for energy storage and evaluating these materials in Coin cell/Swagelok cell level, I have extended my expertise to develop and demonstrate proto-type Lithium ion battery of 3.0V; 2-10 Ah for electric vehicle applications. I have more than 3 years of experience of working in fabrication of lithium ion cells in pilot-scale. I have also extended my expertise of electrochemistry for tuning the magnetic properties of bulk materials for magnetic switching devices. In this respect, I have demonstrated spectacular change in magnetic properties of bulk materials by lithium intercalation.

(ii) Experience in lithium ion cell fabrication in pilot-plant scale:

- Slurry preparation (Optimization of Rheology and viscosity), Electrode fabrication
- Electrode calendaring, slitting, winding/stacking and Electrolyte filling
- Development of indigenous Lithium ion cell of 1-10 Ah
- Cell formation cycle, cell testing and safety evaluation

(iii) Hands on experience in:

- Powder and thin film X-ray diffraction (XRD)
- Scanning Electron Microscopy (SEM)
- Transmission Electron Microscopy (TEM)
- Fourier-transform Infra-red Spectroscopy (FT-IR)
- Raman Spectroscopy
- Pulsed Laser Deposition
- RF- magnetron sputtering
- UV/Visible spectroscopy
- Electrochemical instruments for characterization (Bitrode, Arbin, Biologic, Zahner, Solatron Impedance analyzer, Autolab etc..)
- Physical Property Measurement System (PPMS)
- Thermal analysis Instrument (TGA/DSC)
- BET surface area Analyzer
- Density measurement for powder sample (Pycnometer)
- Basic experience in Atomic Force Microscopy, Transmission Electron Microscopy.

(iv) **Materials preparation skills:**

- Synthesis of micron- and nano- materials using different methods, like Ceramic routes, Carbo-thermal reduction, thermal nitridation, Solution methods: Urea combustion, Oxalate decomposition, Borohydride reduction, Sol-gel, Hydrothermal/Solvothermal synthesis, Microwave assisted Sol-gel, Co-precipitation methods etc.
- Experience in growth metal oxides/nitride thin films by RF magnetron sputtering and pulsed laser deposition techniques.
- Experience in preparation of nanomaterials/ nanocomposites using high energy ball milling (Spex).

(v) **Software skills:**

- Rietveld refinement (TOPAS software) to refine the X- ray data and obtain the crystal parameters.
- Material Data Studio, Diamond to draw the crystal structure from the crystallographic information file.
- WinXAS and Athena for X-ray absorption spectroscopy data.
- GATAN software for TEM data.
- Z-View and Z- plot for Impedance data.
- Regular use of computer for data analysis and data output with Widows and many other software, such as Origin, Excel and word etc.

Place: Chennai

Date: 10/01/2021

Bijoy Kumar Das
(Signature)

My photo for website

