Curriculum Vitae

1. Personal Information

Name: Shivam Tiwari

E-mail: shivamtiwari.rs.mst17@itbhu.ac.in; myselfshivamtiwari@gmail.com

Current Position: Research Scholar at School of Materials Science and Technology, Indian Institute of Technology (Banaras Hindu University) Varanasi, Uttar Pradesh, India.

Research expertise and achievements:

I have a research background in chemistry, materials science and technology and polymers focusing on the utilization of the fundamentals to develop something which can be sustainable for society and environment. I work in the field of polymer based hybrids for energy applications, where I develop polymeric scaffolds through electrospinning or solution casting or molding process. The developed polymer based hybrids is characterized and designed to an efficient device form which can generate sustainable and environmentally sound output. Through the work I have gained expertise in the development of polymer based hybrids using different combination of reinforcements and characterizing them to understand the changes and use them to practical applications.

Research has been my interest right from the beginning of my academic career where at different levels of my academic pursuance different projects has been taken up by me and successfully led to a constructive result. The background of chemistry, material science and polymer has led me to gather different expertise in different fields of research which developed a better understanding and confidence for my future endeavors.

2. Education:

- **07/2017-Present: Ph.D.**

School of Materials Science and Technology, Indian Institute of Technology (Banaras Hindu University) Varanasi.

Supervisor: Prof. Pralay Maiti

Thesis Title (Proposed): "***Polymer based hybrids for energy harvesting applications"***

CGPA(Course work) – 9.60

- **07/2015-06/2017:Master of Technology (M. Tech)**

School of Materials Science and Technology, Indian Institute of Technology (Banaras Hindu University) Varanasi.

CGPA- 9.54 **(Gold Medalist)**

Project title: ***"Electrospun PVDF-nanoclay nanohybrid for piezoelectric device application"***

- **07/2013-06/2015: Master of Science (M.Sc.)**.

Department of Applied Chemistry. Ramakrishna Mission Vidyamandira, University of Calcutta, India

Percentage Secured- 76.58%

- **07/2010-06/2013: Bachelor of Science (B.Sc**. (Hons.))

Department of Industrial Chemistry, Ramakrishna Mission Vidyamandira, University of Calcutta, India
Percentage Secured- 87.875% **(2nd Rank)**

2010: Passed AISSCE (Class- **XIIth)** from Caesar School, CBSE board in Science stream**.**

Percentage Secured- 77 %

2008: Passed SSE (Class- **Xth)** from Caesar School, CBSE board in Science stream**.**

Percentage Secured- 82.4 %

3. Research and project experience:

❖ **Ph.D.:**

Proposed Title: "***Electrospun polymer based nanohybrid for energy harvesting applications.***"

Under the supervision of Prof. Pralay Maiti, Professor, School of Materials Science and Technology, IIT(BHU)Varanasi.

Objective:

- Prepare polymer based nanofibers using different fillers like carbon based fillers (graphene, carbon nanofibers, CNT and others), nanoclay, ionic liquids, ceramics, bio-fillers from optimized electrospinning process.
- Analyse the prepared scaffold using different characterizations to study its change in structure and properties.
- Fabricate the electrospun scaffolds into a flexible device for different applications like energy harvesting, fuel cell, capacitors.
- Development of bio-based adhesives from natural precursor for different substrate based application.

Other Works apart from entitled PhD work:

- Developed polymer – herbicide formulations for agricultural applications.
- Prepared polymer based composites using different polymers and fillers for reflective coating and water cooler applications.
- Computational study of the polymers for energy harvesting application using different softwares.
- Analysed different elastomers and materials for medical and dental applications.
- Polymeric membranes irradiated with high energy beam grafted with anions and cations for membrane technology applications.
- Different combinations of biomaterials for biological and drug delivery applications.

❖ **M. Tech Thesis:**

Title: ***"Electrospun PVDF-nanoclay nanohybrid for piezoelectric device application"***
Under the supervision of Prof. Pralay Maiti, School of Materials Science and Technology, IIT (BHU) Varanasi.

Objective:

- The objective of the project was to prepare PVDF-nanoclay nanohybrid from electrospinning process.
- Study the role of nanoparticle in the prepared nanohybrid using different characterization techniques.
- Design and develop a device for the electromechanical response for piezoelectric energy harvesting applications.

❖ **M.Sc. Project:**

Performed the M.Sc. project at the Ramakrishna Mission Vidyamandira, BelurMath titled -**"*Investigation on synthesis, structural and optical properties of Nitrogen doped Carbon Quantum Dots".***
Objective:

- To prepare Nitrogen doped Carbon quantum dots from Citric Acid, Ammonia.
- Prepared the quantum dot using hydrothermal synthesis.
- Optical investigation of the quantum dots at various wavelengths.
- Carried out a detailed photoluminescence study by Spectroflourophotometer.

❖ **B.Sc. Project:**

Underwent industrial training at the production unit and IPNR at H. & R. Johnsons (India), Pen, Mumbai and also performed a development project on***"Synthesis of Magnesium – Aluminate spinel by Sol-gel method"*** **in R&D unit under the supervision of Mr. D. Doshi, GM, R&D, H. & R.Johnsons (India), Pen, Maharashtra.**
Objective:

- Overviewed the different section of Ceramics (tiles) Plant from harnessing of raw materials to packaging of different types of tiles.
- Prepared Magnesium – Aluminate spinel by Sol-gel method.
- Carried out quantitative and qualitative analysis of raw materials factory output.
- The spinel produced was used for enhancement of properties of the products for the industry.

4. Experimental Skills:

Operational and basic understanding of instrumentslike SEM, DMA and Rheometer, DSC, TGA, Temperature based UTM, XRD, FTIR, Electrochemical Analyser (AUTOLAB), Electrospinning, UV Spectrophotometer, POM, Raman Spectroscopy, Compression moulding,Extruder and Injection moulding, DSO and DMM, d_{33} analyser, Dielectric measurement unit, Spin coater, Probe sonnication, Temperature based Centrifuge, Hardness Analyser, Wear Analyser, Fluorescence microscopy, CVD,Bomb Calorimeter,Ball Mill, Refractometer.

5. Research Contribution and Output

➢ Patents

❖ 'PVDF-Nanoclay based electrospun nanohybrid for efficient energy harvesting application.', Application No.- 201811018838 (Accepted)
❖ 'A bio-waste polymer hybrid with high energy harvesting efficiency', Application No.- 201811016816 (Accepted)

- ‘A metal ceramic joint adhesive;’ Application No. 201911002765 (Accepted) **(Technology Transferred to Industry)**
- **“**A bio-piezoelectric device and a method of preparation thereof”Application No. 201911013972 (Accepted)

Publications

- *“Ionic Liquid-Based Electrospun Polymer Nanohybrid for Energy Harvesting”* **Shivam Tiwari**, Anupama Gaur, Chandan Kumar, Pralay Maiti, ***ACS Applied Electronic Materials,*** 2021, 3, 6, 2738–2747.
- “*Dehydrohalogenated poly(vinylidene fluoride)-based anion exchange membranes for fuel cell applications*” Om Prakash, Shyam Bihari, Keshav, **Shivam Tiwari**, Ravi Prakash, Pralay Maiti, ***Materials Today Chemistry***, 2022
- *“Enhanced piezoelectric response in nanoclay induced electrospun PVDF nanofibers for energy harvesting”,* **Shivam Tiwari,** Anupama Gaur, Chandan Kumar, Pralay Maiti, ***Energy*** 171 , 485-492 (2019)
- *“Polymer Biowaste Hybrid for Enhanced Piezoelectric Energy Harvesting”*Anupama Gaur, **Shivam Tiwari**, Chandan Kumar, Pralay Maiti (2020). ***ACS Applied Electronic Materials,***2, 1426−1432.
- “Flexible, Lead-Free Nanogenerators Using Poly(vinylidene fluoride) Nanocomposites”, Anupama Gaur, **Shivam Tiwari**, Chandan Kumar, Pralay Maiti (2020), ***Energy & Fuels***,34, 6239−6244
- *“PVDF–PZT nanohybrid based nanogenerator for energy harvesting applications.” Shivaji. H. Wankhade*, **Shivam Tiwari**., Anupama Gaur., &Pralay Maiti *(2020).* ***Energy Reports****, 6, 358-364.*
- *“Bio-waste orange peel and polymer hybrid for efficient energy harvesting.”* Anupama Gaur, **Shivam Tiwari**, Chandan Kumar, Pralay Maiti (2020), ***Energy Reports***, *6, 490-496.*
- *“Bio-waste polymer hybrid as induced piezoelectric material with high energy harvesting efficiency”,*Chandan Kumar, Anupama Gaur, **Shivam Tiwari**, Arpan Biswas, Sanjay Kumar Rai, Pralay Maiti, ***Composites Communications*** *(2019)11, 56-61.*
- *"Efficient energy harvesting using processed poly (vinylidene fluoride) nanogenerator*", Anupama Gaur, Chandan Kumar, **Shivam Tiwari**, Pralay Maiti, ***ACS Applied Energy Materials*** (2018)*1*(7), 3019-3024.
- “*Emerging tunable fluorescence in nitrogen doped carbon quantum dot" by***ShivamTiwari,** Asish Ghosh, Angshuman Santra, Tuhin Das and Sabyasachi Ghosh.***Journal Materials Science and Mechanical Engineering***, **2015**, 2(10), 58-60 [Print ISSN: 2393-9095;Online ISSN: 2393-9109].
- "*Photoluminescence study in solution driven carbon quantum dot* " Angshuman Santra, Manish Kayal, **Shivam Tiwari,** Bikshan Ghosh, Deblin Jana, ***Journal of Basic andApplied Engineering Research***, **2015**, 2(15), 1309-1311 [Print ISSN: 2350-0077; Online ISSN:2350-0255]
- “Effect of functionalization on electrospun PVDF nanohybrid for piezoelectric energy harvesting applications” **Shivam Tiwari,** Dipesh Dubey, Om Prakash, Santanu Das Pralay Maiti **(Under Review)**
- “Experimentally optimized facile particle-polymer composite structure for efficient daytime radiative cooling,” Jay Prakash Bijarniya, **Shivam Tiwari,** Pralay Maiti, Jahar Sarkar (**Under Review)**
- "Efficient and Controlled Herbicide Delivery Through Conjugate Gel Formulation on Broad Leaf Weeds Mortality" Reshu Bhardwaj, Om Prakash, **Shivam Tiwari**, Preeti Maiti, Sandipta Ghosh, Ram Singh, Pralay Maiti. (**Under Review)**

- **Book Chapter**

"2D materials - polymer composites for developing piezoelectric energy harvesting devices."
Shivam Tiwari, Pralay Maiti
Publisher: Elsevier

6. Teaching and Mentoring Activities:

"*It is the supreme art of the teacher to awaken joy in creative expression and knowledge*." – **Albert Einstein**

- **Ph.D IIT (BHU) Varanasi: July 2017-June 2019**
  Department: School of Materials Science and Technology
  Position: Teaching Assistantship (TA)
  Role: Served as teaching assistant in the Industrial Polymer, Polymer processing courses and the laboratory courses for the undergraduate students.
- **Supervision / Mentoring of Junior Researchers:** During the course of my research, several students were helped / mentored in their project / thesis works.
  Number of Undergraduate Students: 04
  Number of Postgraduate Students: 05

7. Achievements & Awards:

- **Entrepreneurship / Startup:**

Startup Company Name: Natuos Agrilite LLP

Position: Director

Funding: Sanction of funds under Ankuran pre-seed stage Grant-in-Aid funding under Innovation and Agri-preneurship Program, RKVY – RAFTAAR scheme, DAC & FW at R-ABI, IIT (BHU), Varanasi after successful presentation and acceptance of the proposal titled **"Bio adhesive for ceramic tiles"** to the Centre of Excellence Incubation Committee (CIC) of ZTM & BPD unit, ICAR-IARI, New Delhi.

- Received "**Gold Medal**" for securing First Rank in M.Tech in Materials Science and Technology, Indian Institute of Technology (Banaras Hindu University) Varanasi.
- Awarded the "**Best All-rounder Student**" among the M.Sc. students in Ramakrishna Mission Vidyamandira, Belur Math, Howrah, West Bengal.
- Secured **2nd** rank in B.Sc. (Hons.) Ramakrishna Mission Vidyamandira, Belur Math, Howrah, West Bengal.
- Awarded **3rd** prize in short invited lecture at the International Online Conference on Macromolecules: Synthesis, Morphology, Processing, Structure, Properties and Applications (ICM 2021)10th-12th September 2021, Kottayam, Kerala, India.
- Awarded **3rd** prize in short invited lecture entitled at the International Online Conference on Energy Science (ICES 2021)10th-12thDecember 2021, Kottayam, Kerala, India.
- Awarded **1st** place in Oral Presentation: Scientifique under the Department of School of Energy Science and Engineering, IIT Guwahati during Research and Industrial Conclave 2022 (20-23 Jan 2022).
- Awarded the **Best Poster** award at the APA NANOFORUM-2022 | International e-Conference on Nanomaterials & Nanoengineering, NPL & IIT Delhi, Delhi India (24-26 Feb 2022).
- Received **Best Paper** award at National Conference on Biological Diversity and Environmental Sustainability organised by K.N.P.G. College, Gyanpur, Bhadohi (U.P)-25-26th March 2022.

Extra-curricular activities:

- Participated in Annual Cricket Tournament organized by Belur Ramakrishna Mission Vidyamandira, Howrah, West Bengal.
- Participated at school level Debate and Extempore competition and won prizes.
- An active member of college NSS unit and conducted various camps.
- Represented the college at inter- college cricket championship organized by ISI-Kolkata and won the championship.
- Participated at intra- college Volleyball championship.
- Participated at District Student-Youth Science Fair (2012) organized by Government of West Bengal.

OTHER SKILLS

- MS-Office
- Basic knowledge of C^{++}/C
- AUTO-CAD
- Basic Software and Instrument skills related to Research field
- Basic computational related knowledge required for Research.