CURRICULUM VITAE

Dr. Avanish Shukla

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Department of Chemistry
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Academic Career

Post-Doctoral Fellow (PDF)

- Institute PDF at Indian Institute of Technology Bombay (**IITB**).

(August 2019- December 2020)

Project Research Scientist

- Project Research Scientist at **IIT Bombay**.

(July 2019- August 2019)

Ph.D. (Chemistry)

- Ph.D. in Chemical Sciences from Academy of Scientific and Innovative Research (AcSIR) at **CSIR-CECRI**, **Chennai** **(July 2013 – May 2019)**

  Title of the Thesis: Development of Nanocomposite Membranes for Polymer Electrolyte Fuel Cells

  (Supervisors: Dr. Vijayamohanan K. Pillai (Outstanding Scientist and Former-Director, CSIR-CECRI; Presently-Chair Professor at IISER Tirupati) and Dr. Santoshkumar D. Bhat (Principal Scientist, CSIR-CECRI)**)**

M.Sc. (Chemistry)

- M.Sc. (*Specialization-Physical Chemistry*), **University of Delhi**, New Delhi, with First division **(July 2010 - June 2012)**

B.Sc.

- B.Sc. (Chemistry, Physics, Mathematics) from Ewing Christian College, University of Allahabad, Prayagraj, with First division

(July 2006- July 2009)

10th & 12th

- Jawahar Navodaya Vidyalaya, Pipiganj, U.P.

RESEARCH EXPERIENCE
(Total- 7 Years, Including Ph.D.)

- Post-Doctoral Fellow at Indian Institute of Technology (IIT) Bombay, Mumbai
  (August 2019 to December 2020)

- Project Research Scientist at IIT Bombay, Mumbai
  (July 2019 to August 2019)
- Project Assistant-III at CSIR-CECRI Chennai, India. **(September 2018 to June 2019)**

  Project Title: Demonstration and Validation of a 5 kW HT PEMFC based Combined Cooling and Power System, Sponsor: NMITLI-IOP-Thermax
  (A National Mission Programmed for Technology Initiative)

  Role: Fabrication of catalyst coated membrane by using Decal transfer, MEA making and their performance and stability investigation.

AREAS OF EXPERTISE

Fuel Cells

- Development of nanocomposite membranes (NCMs) using an additives (sGNR, sGNR-sGQD, PSSA-GONP, PABS-SWCNT etc.) with sulfonated poly ether ether ketone (sPEEK)
- Physico-chemical property investigation of NCMs viz. proton conductivity, ion exchange capacity, water uptake, fuel permeability, tensile strength etc.
- Fabrication and performance investigation of membrane electrode assembly (MEA) by using Bitrode and Bio-Logic test-station

Electrochemistry

- Experience in handling various electrochemical techniques viz. Impedance Spectroscopy, Cyclic Voltammetry, Linear Sweep Voltammetry

Material/Nanomaterials Sciences

- Synthesis and chemical functionalization of nanostructured carbon materials (GNRs, GNR-GQDs hybrid, PSSA-GONP, PABS-SWCNT etc.)

RESEARCH PUBLICATIONS
(International Journals)

1. Simultaneous unzipping and sulfonation of multi-walled carbon nanotubes to sulfonated graphene nanoribbons for nanocomposite membranes in polymer electrolyte fuel cells
Avanish Shukla, S. D. Bhat, Vijayamohanan K. Pillai
J. Memb. Sci., **2016**, 520, 657-670

2. A facile synthesis of graphene nanoribbon-quantum dot hybrids and their application for composite electrolyte membrane in direct methanol fuel cells
Avanish Shukla, P Dhanasekaran, N. Nagaraju, S. D. Bhat, Vijayamohanan K. Pillai
Electrochimica Acta, **2019**, 297, 267-280;

3. Covalent grafting of polystyrene sulfonic acid on graphene oxide nanoplatelets to form a composite membrane electrolyte with sulfonated poly(ether ether ketone) for direct methanol fuel cells,
Avanish Shukla, P. Dhanasekaran, S. Sasikala, N. Nagaraju, S. D. Bhat, V. K. Pillai
J. Memb. Sci. 2019, 595, 117484

4. Nanocomposite membrane electrolyte of polyaminobenzene sulfonic acid grafted single walled carbon nanotubes with sulfonated polyether ether ketone for direct methanol fuel cell,
Avanish Shukla, P. Dhanasekaran, S. Sasikala, N. Nagaraju, S. D. Bhat, V. K. Pillai,
Int. J. Hydrog. Energy, 2019, 44, 27564

5. A copper-trimesic acid metal–organic framework incorporated sulfonated poly (ether ether ketone) based polymer electrolyte membrane for direct methanol fuel cells
N. Nagaraju, K Pichaimuthu, S Sarmah, P Dhanasekaran, **Avanish Shukla**, S. M. Unni, S. D. Bhat
New J. Chem., **2018**, 42, 16758-16765

6. Boosting Pt oxygen reduction reaction activity and durability by carbon semi-coated titania nanorods for proton exchange membrane fuel cells
P. Dhanasekaran, S. Vinod Selvaganesh, **Avanish Shukla**, N. Nagaraju, S.D. Bhat
Electrochimica Acta, **2018**, 263, 596-609;

7. Revealing hexadecyltrimethylammonium chloride (HDTA) intercalated bentonite in sulfonated poly(ether ether ketone) as nanocomposite membrane electrolyte for direct methanol fuel cells
S. Sasikala, G. Rambabu, **Avanish Shukla,** N. Nagaraju,

and S. D. Bhat
J. Electrochem. Soc. **2018**, 165, F1358-F1368,

8. Enhancing stability and efficiency of oxygen reduction reaction in polymer electrolyte fuel cells with high surface area mesoporous carbon synthesized from spent mushroom compost
P. Dhanasekaran, **Avanish Shukla**, K. Navaneetha Krishna, I. Rongrin, S. V. Selvaganesh, D. Kalpana, and S. D. Bhat
Sustainable Energy and Fuels, 2019, 10.1039/C8SE00520F

9. Non-Invasive Macroscopic and Molecular Quantification of Water in Nafion® and SPEEK Proton Exchange Membranes using Terahertz Spectroscopy.
Nirmala Devi, Shaumik Ray, **Avanish Shukla**, S. D. Bhat, Bala Pesala,
J. Memb. Sci. 2019, 588, 117183

10. Silica-decorated carbon-Pt electrocatalyst synthesis via single step polyol method for superior polymer electrolyte fuel cell performance, durability and stack operation under low relative humidity,
P. Dhanasekaran, **Avanish Shukla,** V. Selvaganesh, S. Mohan, and S. D. Bhat,
J. Power Sources, 2019, 438, 226999

11. Investigation of the versatility of SPES membranes customized with sulfonated molybdenum disulfide nanosheets for DMFC applications. K Divya, D Rana, MSSA Saraswathi, SD Bhat, **Avanish Shukla**, A Nagendran,
Int. J. Hydrog. Energy, 2020, 45, 15507-15520

12. Synergistic interaction of graphene-amorphous carbon nanohybrid with thin metal loading for enhanced polymer electrolyte fuel cell performance and durability, P Dhanasekaran, SV Selvaganesh, **Avanish Shukla**, SD Bhat
Materials Letters 282, 128837,2021

13. Pyridine-Bridged Polybenzimidazole for Use in High-Temperature PEM Fuel Cells, Harilal, **Avanish Shukla**, PC Ghosh, T Jana
ACS Applied Energy Materials 4 (2), 1644-1656, 2021

14. Sulfonated poly (ether ether ketone) reinforced with polystyrene sulfonic acid functionalized micelle templated mesoporous MCM-41 for direct methanol fuel cells, N Niluroutu, **Avanish Shukla**, VM Dhavale, SM Unni, SD Bhat

International Journal of Hydrogen Energy, 46 (39), 20640-20649, 2021

15. Tracking the hydration dynamics of Nafion fuel cell membranes using terahertz spectroscopy.
Nirmala Devi, Shaumik Ray, **Avanish Shukla**, S. D. Bhat, and Bala Pesala,
Proc. SPIE 10917, Terahertz, RF, Millimeter, and Submillimeter-Wave Technology and Applications XII, 109171R (*conference paper*)

BOOK CHAPTER
(International)

- Advanced carbon nanocomposite membrane electrolytes for direct methanol fuel-cell applications. **Avanish Shukla,** SD Bhat.
  Direct Methanol Fuel Cell Technology, 2020, 107-134. ***(Elsevier*)**

CONFERENCES
(International-6)
(National-1)

Papers presented in conferences-

- **ICONEST 2017** at IISc Bangalore, August 2017
- **iSAEST-11** at Chennai during December 2016
- **MACRO** at IACS Kolkata during January 2015
- **13th Eurasia** at IISc Bangalore during December 2014
- **ICAER** 2013 at IIT Bombay during December 2013
- **NCE-20** at VIT Vellore during June 2018
- **iSAEST-12** at Chennai during January 2019

AWARDS

- **Best Poster Award** in **ICONEST 2017** at IISc Bangalore, August 2017
- **Best Researcher Award** in **"**Nanocomposite Membrane for Polymer Electrolyte Fuel Cell" awarded by Research Under Literal Access (RULA) Awards on 26 Feb 2019
- **Junior Research Fellowship (JRF)** in chemical sciences awarded by CSIR-UGC in December 2012
- **Graduate Aptitude Test in Engineering (GATE)** in Chemistry, March 2013
- Participated in two year **National Service Scheme (NSS)** program organized by University of Allahabad, Uttar Pradesh, INDIA