

## Career Summary

I am a graduate in Physics and Nanotechnology with a bachelor's in Maths, physics, and Chemistry. I was awarded my PhD in Material Science with a specialization in fabrication of optoelectronic devices, from the Queensland University of Technology in August 2021. My research experience spans over 6 years, including the PhD candidature. Before joining PhD, I was inspire fellow at the Indian Institute of Technology (Bombay) for 2 years. My PhD work was focused on the development of advanced materials for optoelectronic devices and energy storage. In my research, I successfully developed new materials and demonstrated their applications in sensors, organic flexible light-emitting diodes, solar cells, and lithium-ion batteries. After the award of my PhD to date, I worked as a postdoctoral researcher at 0.5 FTE in Griffith and 0.5 FTE at Queensland University of Technology (QUT) for 2 years. Currently, I am working as a visiting fellow at QUT and a Research Fellow at CSU.

## Expertise:

Material Synthesis: Nanoparticles, Quantum dots, core-shell nanoparticles from waste, self-assembly of nanoparticles, high-pressure synthesis of Intercalated Superconductors. Joule heating technique for high-temperature synthesis.

Fabrication techniques: Thin film device fabrication, Light emitting diodes, transistors, solar cells, and Battery cell manufacturing.

Instruments (advanced user): High-resolution Transmission Electron microscope (TEM) with Energy dispersive X-ray analysis mapping, X-ray photoelectron spectroscopy (XPS) with analysis of HOMO-LUMO level using Ultraviolet photoelectron spectroscopy (UPS), UV-visible spectrophotometer, Florescence spectrophotometer, and Quantum Yield analysis, FTIR spectroscopy, thin film deposition unit, micro-controllers, glove box operation., Scanning electron microscope (SEM), etc.

Soft skills and prototyping: Blender to develop 3d models. Blender model optimization with Python, Python, R programming, Machine Learning with Python, Origin, and Image analysis in Python Tools (LATEX, Marplot), Micro Python coding of microcontroller, and device software interface development.

## ACADEMIC DETAILS

Degree	University	Year
Doctorate	Queensland University of Technology, Australia	2017-2021
MTech in Nanotechnology	Sri Guru Granth Sahib World University, India	2013
Masters in Science (Physics)	Panjab University, India	2008
Bachelor of Science	Panjab University, India	2006

## Projects Undertaken:

- December 2021 - Feb 2023: Assembly of the instrument to synthesize gram-scale graphene from waste and incorporation into opto-electronic devices and batteries (Centre for waste-free world, **Queensland University of Technology**)
- June 2021 - Feb 2023: Complete design of Portable instrument and its control software incorporating sensors and heater for developing sensor platform. (**Queensland Micro & Nano Fabrication Centre, Griffith University**)
- August 2020 - Feb 2022: Synthesis of 2D hetero-nanostructures and incorporation of the material into next-generation electronic devices (LEDs, solar cells, and transistors). (**Centre for Material Science, Queensland University of Technology**)

- April 2017 - July 2020: Synthesis of the 2D self-assembled array of nanomaterial and their application in optoelectronic devices. (PhD Project, **Queensland University of Technology**)
- July 2015 - March 2017: Sensing and detection of Arsenic in Drinking Water with Nanomaterials. (**Indian institute of technology, Bombay -IIT-B**)
- March 2013 – June 2013: Synthesis of Core-shell Quantum dots and their application in Bio-sensing and solid-state lightning. (Visiting Research Scholar) (Guide: Prof. Sean Wei, School of Mechanical Engineering, Xi'an Jiaotong University, Xi'an (CHINA))

## EXPERIENCE

Employer	Position	Start date	End date	FTE*
QUT (School of Chemistry & Physics)	Visiting Research fellow	1-03-2023	Till date	NA
CSU	Research Fellow (Level B)	1-07-23	1-07-2028	100
QUT (School of Chemistry & Physics)	Postdoctoral Fellow	01-09-2020	28-02-23	50%
Queensland Micro Nanotechnology Centre (Griffith University)	Postdoctoral Fellow	14-06-2021	30-06-23	50%
QUT (School of Earth & Atmospheric Sciences)	Research Fellow	13-02-2021	27-03-2021	50%
Indian Institute of Technology (Bombay)	Junior research fellow	01-06-2015	01-04-2017	100%
SGGSW University, Fatehgarh Sahib	Assistant Professor	19-03-2013	27-05-2015	100%

\* Full-time equivalent (FTE)

## Role duties as research fellow/postdoctoral fellow at CSU and QUT:

1. **Research:** Conducting comprehensive research in the field of new materials production. This involves staying updated with the latest advancements, understanding the properties of different materials, and exploring their potential applications. Key knowledge of the physics of material and derivation of meaning conclusion using mathematics is required here.
2. **Development:** Working on the development of new materials. This includes designing and conducting experiments, analysing results, and making necessary adjustments to improve the materials' properties and performance.
3. **Device Manufacturing:** Overseeing the manufacturing process of devices that use newly developed materials. This involves ensuring the devices are built correctly and function as intended.
4. **Data Analysis:** Analysing data from experiments and device outputs. This includes interpreting complex data sets, identifying patterns, and drawing meaningful conclusions that can guide future research and development.
5. **Supervision:** Supervising PhD and MPhil students. This involves providing guidance and support in their research projects, overseeing their progress, and helping them overcome any challenges they may encounter.
6. **Teaching:** In addition to research duties, a significant part of the role is dedicated to delivering lectures, leading seminars, assessing student research work, and providing academic guidance to students.
7. **Collaboration and Communication:** Collaborating with other researchers and professionals in the field. This includes sharing findings, discussing ideas, and contributing to the overall knowledge in the field. Also, communicating the research findings through reports, academic papers, and presentations.
8. **Continuous Learning:** Keeping up to date with the latest research.

## CAREER HIGHLIGHTS

- Nominated for Outstanding Thesis Award (2020), Queensland University of Technology.
- QUT Postgraduate Research Award for PhD, and tuition fees award. (2017)
- Seed research grant for developing a sensor to detect Arsenic in water by Tata Centre for Technology and Design, IIT Bombay.
- Awarded Inspire Fellowship (one of the prestigious scholarships in India) by the Department of Science And Technology, Ministry of Science (India).
- Awarded Gold Medal in MTech Nanotechnology for outstanding performance.
- First rank holder in college during M.Sc. Physics
- Best poster award at an international conference in Nanoscience and Nanotechnology (ICONN-2020, Brisbane)
- Best poster award at Australian Community for Advanced Organic Semiconductors (AUCAOS), December 2017
- Runner up for best poster presentation at a Joint workshop on clean water technology by IIT Bombay and the University of Alberta under IC-IMPACTS.

### Professional workshops and meetings:

*International conferences:* Attended and presented my research at international conferences all over the world. International conference on nanomaterials, Brisbane, Inaugural session of the Australasian Community for Advanced Organic Semiconductors (4-6 December 2017, Kingscliff NSW), 5th International Symposium on Microchemistry and Microsystems 17-19th May 2013, Xiamen, China, National Symposium on Distributed and Embedded High-Performance computing (de-HPC.org) at Indian Institute of Bombay. A short-term course on Recent Advances in Microfluidics, Biochemical, and Saw Sensors for Human Healthcare by Global Initiative for Academic Networks (GIAN) under the Ministry of Human Resource Development (INDIA), at Mumbai University.

### Membership and patents:

- Associate Fellow of Higher Education Academy, UK Professional Standards Framework for teaching and learning support. (PR172020), Date of recognition: 22-08-2019.
- Indian Patent (201821030166), Published December 2023. Title: Methylcobalamin Functionalized Urea-Coated Gold Nanoparticles for Detection and Measurement of Arsenic Concentration in Water.

### TOP TEN RESEARCH OUTPUTS

1. Sustainable Manufacturing of Graphitic Carbon from Bio-Waste Using Flash Heating for Anode Material of Lithium-Ion Batteries with Optimal Performance. Adv. Sustainable Syst.2024, 2300610. *The first report to manufacture graphitic carbon from human hair.*
2. Biowaste-Derived, Self-Organized Arrays of High-Performance 2D Carbon Emitters for Organic Light-Emitting Diodes. A Singh et al. Adv. Mater. 2020, 1906176. **World's first demonstration** of the flexible light-emitting diode where an active layer was made from human hairs. *The research work was covered by 24 news outlets worldwide and helped me collaborate with Industry for future projects.*
3. Carbon Dots Derived from Human Hair for ppb Level Chloroform Sensing in Water. Amandeep Singh et al. Sustainable Materials and Technologies (<https://doi.org/10.1016/j.susmat.2020.e00159>). **The highest sensitivity** to detect chloroform in water was reported in this paper. *This demonstration helped the QUT research team (my supervisor and myself) to be part of the team that won the Defence grant DSI-DSTG Hazardous Agent Challenge (HAC) 2021.*
4. Self-assembled carbon Dot-Wrapped Perovskites Enable Light Trapping and Defect Passivation for Efficient and Stable Perovskite Solar Cells. A Singh et al. J. Mater. Chem. A, 2021. *The paper was a cover-page article.*

5. Band Alignment with Self-Assembled 2D Layer of Carbon Derived from Waste to Balance Charge Injection in Perovskite Crystals Based Rigid and Flexible Light Emitting Diodes. Amandeep Singh et al. Adv. Mater. Technol.2021, 2100583.
6. Potassium Doping to Enhance Green Photoemission of Light Emitting Diodes based on CsPbBr<sub>3</sub> Perovskite Nanocrystals. Amandeep Singh Pannu et al. Advanced Optical Materials 8 (18), 2000742.
7. Surface Treatment of Inorganic CsPbI<sub>3</sub> Nanocrystals with Guanidinium Iodide for Efficient Perovskite Light-Emitting Diodes with High Brightness. A. Singh et al. Nano-Micro Lett. (2022) 14:69.
8. Fluorination of pyrene-based organic semiconductors enhances the performance of light-emitting diodes and halide perovskite solar cells. A Singh et al. Organic Electronics 77 (2020) 105524.
9. Versatile aza-BODIPY-based low-bandgap conjugated small molecule for light harvesting and near-infrared photodetection. Bhat et al. InfoMat.2022; e12345. <https://doi.org/10.1002/inf2.12345>.
10. Electrode and dielectric layer interface device engineering study using furan flanked diketopyrrolopyrrole–dithienothiophene polymer based organic transistors. Sci Rep 10, 19989 (2020). <https://doi.org/10.1038>.

**Entrepreneurship and commercialization courses:** Undertaken various courses and activities that enhance my skills for translational research. In 2020 I have undertaken Research Commercialisation, and Entrepreneurship courses from an e-graduate school (QUT). As a result, I was successful in pitching Excolo 2022, which is an innovation pitching competition created by QUT to engage with industries to promote research commercialisation.

#### **MEDIA MENTIONS**

- <https://wiley.altmetric.com/details/75899210/news> My research is covered by more than 24 news outlets worldwide.
- <https://news.csu.edu.au/latest-news/breaking-research-human-hair-transformed-into-renewable-energy-storage>. The university spotlighted my research, which was also featured in numerous Australian news media.

#### **Google Scholar link for a complete list of publications:**

<https://scholar.google.com.au/citations?user=FqJAUuUAAAAJ&hl=en>