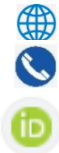
Gaurav Shukla



Professional Experience

Mar 2022- Present Institute Postdoctoral Fellow (IPDF)
Department of Physics, Indian Institute of Technology (IIT) Bombay, India (QS rank – 1st in India)
Advisor: Prof. Pramod Kumar
Main activities: Doing independent research, guiding PhD and Masters Students, and teaching assistant (TA) for B. Tech 1st year (General Physics lab) and 2nd year (Electronics lab)
Field of research: Organic electronics for synaptic applications

Dec 2021- Mar 2022 Research Associate (Provisional)
Centre for Nano and Soft Matter Sciences, Bangalore, India
(A National Research Lab under Gov. of India)
Advisor: Dr. S. Angappane
Main activities: Doing Independent research on self-cleaning surfaces and guiding Junior PhD students in the lab

Education

Aug 2016- Dec 2021 PhD in Physics
Centre for Nano and Soft Matter Sciences (CeNS), Bangalore, India
Degree awarded by Manipal Academy of Higher Education, Karnataka, India on 11.04.2022.
Thesis title – "Fabrication of oxide nanostructures using *GLAD* for device applications"
Advisor: Dr. S. Angappane

Jul 2013- Jun 2015 Master of Science (Physics)
Department of Physics, University of Allahabad, Prayagraj, Uttar Pradesh, India

Scholarships and Awards

1. 1st rank in M.Sc. Condensed Matter Physics, Jul 2015
2. UGC-CSIR - JRF in Physical Sciences, Dec 2016
3. UGC-CSIR-NET in Physical Sciences, Jun 2016
4. JEST in Physical sciences, 2016
5. DST- CeNS JRF (2016-2018) and SRF (2018-2021) Fellowships.

Research Work

- Design and fabrication of nanostructures using glancing angle deposition (GLAD) technique employing electron beam evaporation and sputtering for-
  - Fabrication of durable superhydrophilic surfaces both on hard (glass, Si, and FTO) and flexible (PET) substrates.
  - Generation of multifunctional structural colours (self-cleaning, tunable transparency, optical sensor, and information encryption).
  - Highly transparent, superhydrophilic and anatase phase TiO_2 stabilization up to 1000 °C, essential for industry applications,
  - Fabrication of ultrafast humidity sensor (145 ms and 210 ms, response and recovery times) and UV assisted room-temperature oxygen sensor (3 and 10 s, response and recovery times).
  - Fabrication of hydrophobic SERS substrates using Au/TiO_2 nanorod heterostructure (Enhancement Factor ~10^7),
  - Fabrication and prototyping of scalable and flexible superhydrophilic surfaces.
- Introducing defects in NiO by electron bombardment for enhanced hydrogen evolution through urea electrolysis.
- Predicting the miniaturization limit of vertical organic field effect transistor (VOFET) having perforated graphene as a source material.
- Developing vertical organic field effect transistors based synaptic devices for neuromorphic applications.

Expertise

● Maskless projection photolithography ● Photolithography using mask (mask is designed in CleWin software) ● DC/RF sputtering ● E-beam evaporation ● Thermal evaporation ● Glancing angle deposition (*GLAD*) ● CCR Low-temperature I-V measurements ● Semiconductor characterization system (SCS) Keithley-4200 with probe station ● FESEM and EDS (TESCAN MIRA 3) ● X-ray diffractometer (Rigaku Japan) ● UV-Vis spectrophotometer ● Contact angle meter (KYOWA) ● Optical microscope ● Tube and Muffle furnaces ● Keyence digital microscope ● FTIR

Data transfer and analysis

● Raman spectrometer ● TEM ● AFM

Analysis tools: ImageJ, Gwyddion, Origin, MS Excel

Simulations: *COMSOL Multiphysics*

Other skills: MS office, LaTeX, 3D Paints, Science communication, Prototyping, Science photography and videography.

Congress

1. **Gaurav Shukla,** Predicting the Miniaturization Limit of Vertical Organic Field Effect Transistor (VOFET) having Perforated Graphene as a Source Electrode, 11th ICMAT, 26-30 June 2023, Singapore. (**Oral talk and Session Chair**)

2**. Gaurav Shukla** and S Angappane, Self-cleaning structural colours, Photonics and Lasers Academia - Industry Meet (PLAIM), Dec 07-09, 2022 at Bombay exhibition centre, Mumbai, India. (**Invited talk)**
3. **Gaurav Shukla**, Structural colours and their origin, International workshop on advances in materials and future scenario, Dec 30, 2022 at G.P.R. Engineering College, AP, India. **(Invited talk)**
4. **Gaurav Shukla** and S Angappane, Self-cleaning structural colours by TiO2/Ti nanostructures, 9th National Conference on Condensed Matter Physics and Applications (CMPA 2021), Sep 16-17, 2021 organised by MIT, MAHE, India. **(Oral presentations)**
5. **Gaurav Shukla** and S Angappane, Self-cleaning structural colors by TiO2/Ti nanostructures, International Conference on Nano Science and Technology (ICONSAT), Mar 5-7, 2020 organized by SNBNCBS, Kolkata, India. **(Poster presentations)**
6. **Gaurav Shukla** and S Angappane, Self-cleaning structural colors by TiO2/Ti nanostructures Bangalore India Nano International Conference, Mar 2-3, 2020, organized by JNCASR and DST-Karnataka, India. **(Poster presentations)**
7. Gaurav Shukla and S Angappane, 'Tunable structural colour generation in metal/dielectric films', International Conference on "Chemistry and Physics of Materials: Glorious Past and Exciting Future", Feb 20-22, 2019 organized by JNCASR, Bangalore, India. **(Poster presentations)**
8. **Gaurav Shukla** and S Angappane, Structural colour tunability in Ti/TiO_2 thin films, Bangalore India Nano International Conference, Dec 5-7, 2018, organized by JNCASR and DST-Karnataka, India. **(Poster presentations)**
9. **Gaurav Shukla** and S Angappane, Relation between textured surface and diffuse reflectance of Cu films, 62nd DAE Solid State Physics Symposium (DAE SSPS), Dec 26-30, 2017 organized by BARC, Mumbai, India. **(Poster presentations)**
10. **Gaurav Shukla** and S Angappane, Study of diffuse reflectance of textured Cu films, Bangalore India Nano International Conference, Dec 7-8, 2017 organized by JNCASR, Bangalore, India. **(Poster presentations)**
11. **Gaurav Shukla**, Ravishankar Sugumar and S Angappane, Fabrication of copper nanostructures by glancing angle deposition (GLAD), Winter School, Dec 5-9, 2016 at JNCASR, Bangalore, India. **(Poster presentations)**
12. Attended SymPhy, Annual symposium of Physics department, IIT Bombay, Jan 28-29, 2023.
13. Attended 'Indian Physics Association (IPA) - Young Physicist Meet' on Dec 10, 2022 at Punjab University. (Online forum)
14. Attended 'Annual Leadership Meeting' organized by American Physical Society (Virtual Mode), Feb 4-6, 2021.
15. Attended Science Leadership Workshop organised by Indian Science Academies with Central University of Punjab, India, Jun 22-28, 2020.
16. Workshop on "International year of Periodic Table", May 29, 2019, organised by CeNS, IISc, and JNCASR, Bangalore, India. (**Volunteer**)
17. International Conference on Nano Science and Technology (ICONSAT), Mar 21-23, 2018 organised by DST-CeNS, Bangalore, India. (**Volunteer**)
18. DST GoI -Nanomission School on Nanoscience & Nanotechnology - Physical sciences, 'Emerging Methods and Materials in Nanoscience and Nanotechnology', 23 Oct – 3 Nov 2017 at CeNS, Bangalore, India. (**Demonstration** - Probe station for electrical measurements).

Services

1. V4 Scientific model ***demonstrator*** (10^{th} - 12^{th} students), outreach program at CeNS.
2. ***Exhibitor coordinator*** (under the flagship of *Bangalore India Nano* and *Karnataka Science and Technology Promotion Society*), 2020.
3. ***Mentoring*** for under privileged students at 'FEA India'- an NGO based in Delhi, *India*.
4. ***Demonstrator*** for Breakthrough Science Society, Allahabad Chapter, India (2013-2015).
5. ***Member*** of the Student Council (*Lead the council formation*) and ***Coordinator*** of Sports Club at CeNS (2021-Mar 2022).
6. **Reviewer** for *Nano Lett., J. Mater. Sci., Bull. Mater. Sci., J. Coat. Technol. Res.* etc.

Memberships

1. American Physical Society (APS)
2. OPTICA (Formerly OSA)
3. Materials Research Society of India (MRSI) (Life member)

Languages

English, Hindi, and Awadhi (mother tongue) = Full professional proficiency
Bhojpuri, Kannada and Sanskrit = Limited working proficiency

List of Publications

1. **Gaurav Shukla**, Ramesh Singh, and Pramod Kumar, Predicting the miniaturization limit of vertical organic field effect transistor (VOFET) having perforated graphene as a source material, *Nanotechnology, 35, 035201 (*2023).
2. **Gaurav Shukla*** and S. Angappane, Highly transparent, superhydrophilic and high-temperature stable anatase phase TiO_2 nanostructures, *Mater. Chem. Phys. 127589 (2023).*
3. **Gaurav Shukla** and S. Angappane, Dimensional constraints favour high temperature anatase phase stability in TiO_2 nanorods, *Appl. Surf. Sci.* 577, 151874 (2022).
4. Hiran Jyothilal, **Gaurav Shukla**, Sunil Walia, Bharath S P, and S Angappane, UV assisted room temperature oxygen sensors using titanium dioxide nanostructures, *Mater. Res. Bull.* 140, 111324 (2021). (In news: PIB India, Video)
5. Chandraraj Alex, **Gaurav Shukla**, and Neena S. John, Introduction of surface defects in NiO with effective removal of adsorbed catalyst poisons for improved electrochemical urea oxidation, *Electrochim. Acta* 385, 138425 (2021). (In news: The Hindu, India Times)
6. **Gaurav Shukla*** and S. Angappane, Self-cleaning structural colours by TiO_2/Ti nanostructures, *Appl. Opt.* 59, 10483-10492 (2020). (In news: DD news)
   (Featured on the **cover page** of the journal, Volume 59, issue 33)
7. Hiran Jyothilal, **Gaurav Shukla**, Sunil Walia, Suman Kundu and S. Angappane, Humidity sensing and breath analyzing applications of TiO_2 slanted nanorod arrays, *Sens. Actuators A* 301, 111758 (2020). (In news: Vigyan Samachar)
8. **Gaurav Shukla**, Chandan Kumar, and S. Angappane, Structural properties and wettability of TiO_2 nanorods, *Phys. Status Solidi B* 256, 1900032 (2019).
   (In news: Vigyan Samachar)
9. **Gaurav Shukla** and S. Angappane, Relation between textured surface and diffuse

reflectance of Cu films, *AIP Conf. Proc.* 1942, (2018).

10. Bharath S P, **Gaurav Shukla**, S Angappane, Discriminative analysis of volatile organic compounds using artificial neural network assisted Au loaded ZnO and TiO_2 based thin film sensors. (Under review)

11. **Gaurav Shukla**, Ramya Prabhu, Neena S. John, and S. Angappane, Fabrication of hydrophobic SERS substrates using Au/TiO_2 nanostructues. (Under preparation)

***represents corresponding author**

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