Syed Sadique Anwer Askari

Curriculum Vitae

Contact Information

Milkee Kachahari, Sahoori
Begusarai, Bihar 851112, India

Email-id: anwer.ism@gmail.com
anwer@iiitranchi.ac.in
Mobile No.: **+91-9798908669**

Current Position

April 2023 – Present **Faculty**
Dept. of Electronics and Communication Engineering,
Indian Institute of Information Technology, Ranchi, India

Research Expertise

- ***Semiconductor Process Engineering*:** Thermal oxidation, RF/DC Sputtering, electron beam evaporation, Spin coating, Chemical cleaning, Annealing through Rapid Thermal Processing, and Muffle Furnace (cum tube furnace) in different ambient (5 years of Hands-on experience).
- ***Semiconductor Material Characterization*:** Profilometry (4 years Hands-on experience), Hall measurement (4 years Hands-on experience).
- ***Device Characterization (I-V & C-V)*: R**oom temperature measurement using probe station and Agilent, B1500A (2-year Hands-on experience), and Keithley 2450 (4 years Hands-on experience). Solar simulator.
- ***Device simulation and modelling:*** APSYS & SILVACO TCAD (7 years Hands-on experience), MATLAB Design of Experiment (DOE) (10 years Hands-on experience).
- ***Circuit Simulation Tool***: Multisim, LTSpice,

Research Interests

- Cutting edge CMOS based semiconductor devices fabrication and testing.
- Simulation of Semiconductor devices by TCAD **(SILVACO & APSYS**)
- Simulation and Fabrication of Thin film devices like TFT (For Sensor application)

Research Experience

June 2021 – April 2023 **Research Associate**, ***Indian Institute of Technology (Indian School of Mines) Dhanbad, India***,
Under Dept. of Electronics Engineering, Indian Institute of Technology (ISM), Dhanbad,

- **Project title**: Accurate Correlation of Dot Size Distribution with the Spectral Response of As-grown and Interdiffused Stacked Quantum Dots embedded in *p-i-n* Solar Cells
- **Responsibility**: I am currently working as a part of the Research Group of Prof. Subindu Kumar, involved in the development of a detailed model for the spectral response (SR) of stacked as-grown III-V quantum dot (QD) ensemble, embedded in the intrinsic region of *p-i-n* QD solar cells (QDSCs) by correlating it with the effects of interdiffusion and dot size distribution. Validation of developed model through industrial Simulator.

Tool Used*: Crosslight APSYS, SILVACO, MATLAB*

July. 2014 – March 2021 **Junior Research Fellow**, ***Indian Institute of Technology (Indian School of Mines) Dhanbad, India***,
Senior Research Fellow, ***Indian Institute of Technology (Indian School of Mines) Dhanbad, India***,
Research Associate, ***Indian Institute of Technology (Indian School of Mines) Dhanbad, India***,
Under the Centre of Excellence in Renewable Energy, Indian Institute of Technology (ISM), Dhanbad,
Sponsored by Ministry of Education, Govt. of India

- **Responsibility**:
  - Simulation of heterojunction devices and thin film Transistor by **TCAD SILVACO & APSYS**.
  - Development of laboratory for thin film growth using Physical Vapour Deposition (**Thermal Evaporation, E-Beam and RF/DC Sputtering**), first ever in the Institute.
  - Development of laboratory for Lab-scale Fabrication and Characterization of oxide-based solar PV cell.

- Development of ZnO Nano dots, n-type ZnO thin films, Alumina doped ZnO by **RF Magnetron sputtering**.
- In-situ annealing of thin film in RF/DC Sputtering Vacuum Chamber.
- Development of Metal contact by **DC Magnetron sputtering**
- Development of p-type SnO thin films by **e-beam evaporation**,
- Development of ZnO-nanorods by the hydrothermal process through ZnO seed crystal developed by **RF Magnetron sputtering**,
- Development of n-ZnO/p-Si heterojunction solar cell,
- Annealing of thin films and dots by **rapid thermal annealing system**.
- Annealing of thin film by **muffle and tube furnace**.
- Electrical characterization of thin film by **Hall effect measurement**,
- Electrical characterization of semiconductor devices by **Source Measurement Unit (SMU)**,
- Thickness measurement and surface profiling of thin film by a **profilometer**.

Aug. 2013 – July 2014 **Junior Research Fellow,** ***Indian Institute of Technology Kharagpur India.***

Project title: "Development of MBE cluster tool based epitaxial Nano-semiconductor infrastructure and process integration facility for high-performance RF/microwave compound semiconductor hetero-structure Nano-devices on Silicon."

Sponsored by Department of Information Technology, Govt. of India

- Responsibility:
  - Simulation of HEMT by **TCAD SILVACO**
  - Development of GaN (AlGaN) and GaAs (AlGaAs) thin film by **MBE**.
  - Material characterization by **Hall Effect Measurement**.

Teaching Expertise

- ✓ Electrical Technology
- ✓ Electronic Devices & Circuits
- ✓ Microelectronics and circuits
- ✓ Semiconductor Fabrication Technology and Process Modelling Laboratory
- ✓ Semiconductor Devices Laboratory (Simulation and Basic fabrication)

Teaching Experience

Aug. 2011 – May 2012 **Teaching Assistant**, epartment of Electronics and Communication Engineering, ***Indian School of Mines Dhanbad, India***,

July 2014 – June 2019 **Teaching Assistant**,
Department of Electronics Engineering,
Indian Institute of Technology (Indian School of Mines) Dhanbad, India,

Academic Outreach Program (FDP)

- ***Co-ordinator*** in Faculty Development Programme (FDP) on ***Green Technology for Sustainable Development*** on 25th- 29th November, 2023 at Indian Institute of Information Technology Ranchi
- ***Co-ordinator*** in Faculty Development Programme (FDP) on ***Research Methodology and Intellectual Property Rights (IPR)*** on 9th -13th September 2023 at Indian Institute of Information Technology Ranchi

Administrative Responsibility

- **Hostel Warden** of Type-III Hostel JUT Campus, IIIT Ranchi from December 06, 2023.
- **Member** of **Hindi Pakwara-2023** Committee at IIIT Ranchi
- **Faculty advisor** of 1st year students (session 2022-2023) of Section-C at IIIT Ranchi.

Education

July 2014 – Sept 2021 **Doctor of Philosophy**, *Indian Institute of Technology (Indian School of Mines) Dhanbad, India*.
Department of Electronics Engineering

- Thesis Title: ***Simulation and Experimental Study on Metal-Oxide-Semiconductor/Silicon Heterojunction Solar Cell***
- Advisor: **Prof. Mukul Kumar Das**,

July 2010 – May 2012 **Master of Technology**, *Indian School of Mines Dhanbad, India*.
Department of Electronics & Communication Engineering

- Thesis Title: **Effect of Four Wave Mixing in Distributed Fiber Raman Amplifier**
- Advisor: **Prof. Mukul Kumar Das**
- CGPA – *(8.52/10)*

✆ *+(91) 9798908669* • ✉ anwer.ism@gmail.com; anwer@iiitranchi.ac.in

2006–2010 **Bachelor of Technology**, *MCKV Institute of Engineering, West Bengal University of Technology*, India
- Specialization: **Electronics & Communication Engineering**
- CGPA – *(7.96/10)*

Awards and training

- Qualified in **Graduate Aptitude Test in Engineering (GATE)-2010** exam with **98 percentile** (GATE Registration Number: EC 6070614).
- INUP Hands-on Training Workshop (Clean room experience) at IIT Bombay, during April 24-28, 2017
- INUP Familiarization workshop on "Nanofabrication Technology" at IISc Bengaluru during 28-30 Jan 2015,
- Received **MHRD Fellowship** for Masters and Ph.D.
- Received SPIE Photonics West 2018 Travel grant, San Francisco, USA
- Received IONS Travel Grants, Nanjing China
- Received JSAP-OSA Travel grant, Fukuoka, Japan

Computer Skills

C/C++, Familiar with HDL, Multi2Sim, LATEX, Linux, Microsoft Office

Publications

Journal

1. Muzaffar Imam, **Syed Sadique Anwer Askari**, and Mukul Kumar Das*, "Development of Theoretical Model for Effective Carrier Lifetime in Polycrystalline Semiconductors" ***IEEE Transactions on Electron Devices,*** *(2023)* DOI: https://doi.org/10.1109/TED.2023.3300654
2. Muzaffar Imam, Tauseef Ahmed, **Syed Sadique Anwer Askari***, "Investigation of Interface and Grain Boundary Recombination in mc/pc-Si Solar Cells for Flexible Substrate" ***Arabian Journal for Science and Engineering,*** *(2023)* DOI: https://doi.org/10.1007/s13369-023-07932-4
3. Sudipta Banerjee, **Syed Sadique Anwer Askari**, and Mukul Kumar Das* "Effect of Rear Contact Coverage and Improvement of Efficiency of Crystalline p-Si Solar Cell Compared to State of Art PERC Cell," ***IEEE Access,*** *(2023)* DOI: 10.1109/ACCESS.2023.3264900
4. Tauseef Ahmed; **Syed Sadique Anwer Askari**, and Mukul Kumar Das* "An Efficient Light Trapping Method to Enhance the Efficiency of Thin Film Solar Cell," ***IEEE Transactions on Nanotechnology,*** *Vol. 22, 2023,* DOI: 10.1109/TNANO.2023.3262367
5. Pankaj Kumar, Kalyan Koley*, **Syed Sadique Anwer Askari**, Ashish Maurya, and Subindu Kumar "Assessment of Negative Bias Temperature Instability due to Interface and Oxide Trapped Charges in Gate-all-around TFET Devices," ***IEEE Transactions on Nanotechnology,*** *Vol. 22, 2023,* DOI: 10.1109/TNANO.2023.3255012
6. Manoj Kumar, **Syed Sadique Anwer Askari**, Purnendu Shekhar Pandey, Yadvendra Singh, Rajesh Singh, Sanjeev Kumar Raghuwanshi, Gyanendra Kumar Singh*****, Santosh Kumar "Experimental investigation and DFT study of tin-oxide for its application as light absorber layer in optoelectronic devices," ***IEEE Access,*** *(2023)* DOI: 10.1109/ACCESS.2023.3252890
7. Pankaj Kumar, Kalyan Koley*, **Syed Sadique Anwer Askari**, Ashish Maurya, and Subindu Kumar "Assessment of interface trapped charge induced threshold voltage hysteresis effect in gate-all-around TFET," ***Micro and Nanostructures,*** *Vol. 172, (2023)* DOI: 10.1016/j.micrna.2022.207502
8. Anjali Rai, **Syed Sadique Anwer Askari***, Mukul Kumar Das, Subindu Kumar "Efficiency enhancement of solar cells using multi-layer interdiffused InGaAs/ GaAs quantum dots: A numerical approach," ***Micro and Nanostructures,*** *Vol. 172, (2022)* DOI: 10.1016/j.micrna.2022.207445
9. Muzaffar Imam, **Syed Sadique Anwer Askari**, Mukul Kumar Das*, "Effect of grain boundary orientation on the recombination in polycrystalline materials: a theoretical and simulation study" ***Applied Physics A,*** *Vol. 128(9), (2022)* DOI: 10.1007/s00339-022-06027-5
10. Manoj Kumar, **Syed Sadique Anwer Askari**, Sanjay K. Ram, Mukul Kumar Das*, "Investigation of all-oxide thin film solar cell with p-SnO_x as absorber layer," ***IEEE Transactions on Electron Devices*** *Vol. 69(3), pp. 1115-1122 (2022)* DOI: 10.1109/TED.2022.3143077
11. Shambhu Sharan Kumar Sinha, Anjali Rai, Subindu Kumar*, **Syed Sadique Anwer Askari**, "On the spectral response of interdiffused quantum dot ensembles embedded in the intrinsic region of InGaAs/GaAs quantum dot solar cells*"* ***Physica E: Low Dimensional Systems and Nanostructures****, Vol. 134, pp. 114810 (2021)* DOI: 10.1016/j.physe.2021.114810
12. Lipika Mondal, **Syed Sadique Anwer Askari**, Manoj Kumar, Mukul Kumar Das*, "Band Offset Engineering for p-SnO/n-mc-Si Heterojunction Solar Cell" ***Applied Physics Letter****, Vol. 116, pp. 234106 (2020)* DOI:10.1063/1.5144767
13. Manoj Kumar, **Syed Sadique Anwer Askari**, M. K. Das*, Oxygen controlled E-beam evaporation deposited p-SnO_x thin film for photosensitive devices, ***Materials Letters****, Vol. 257, pp. 126684 (2019)* DOI: 10.1016/j.matlet.2019.126684
14. **Syed Sadique Anwer Askari***, Manoj Kumar &Mukul Kumar Das, "Numerical study on the interface property of ZnO/c-Si heterojunction solar cell," ***Semiconductor Science and Technology****, Vol. 33, pp. 115003 (2018),* DOI: 10.1088/1361-6641/aadf71

(* Corr. Author)

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Conference

- **Syed Sadique Anwer Askari***, M. Kumar, and M. K. Das, “Effect of Antireflection and Transmission of ZnO on the Performance of ZnO/p-Si Heterojunction Solar Cell”, *IONS Nanjing 2019, Nanjing University Gulou Campus, **Nanjing, China**. (**IONS Travel Grants**)*
- **Syed Sadique Anwer Askari***, Manoj Kumar, Muzaffar Imam &Mukul Kumar Das, “Performance analysis of Plasmonic based ZnO/Silicon Thin-Film Heterojunction Solar cell”, *The 79th JSAP Autumn Meeting JSAP-OSA Joint Symposia 2018, 18th to 21st September 2018, Nagoya Congress Center, **Nagoya, Japan**, paper 19a_211B_8.*
- **Syed Sadique Anwer Askari***, Manoj Kumar &Mukul Kumar Das, “Effects of interfacial SiO2 on the performance of ZnO/p-Si heterojunction solar cell”, *SPIE Photonics West 2018, The Moscone Center San Francisco, **California, United States** (**SPIE Photonics West 2018 Travel grant**)*
- **Syed Sadique Anwer Askari***, M. Kumar, and M. K. Das, "Effects of Interface defect on the performance of ZnO/p-Si heterojunction solar cell," in *JSAP-OSA Joint Symposia 2017, (Optical Society of America, 2017), Fukuoka, **Japan**, paper 6p_A410_12. (**JSAP-OSA Travel grant**)*
- Manoj Kumar, **Syed Sadique Anwer Askari**, Mukul Kumar Das, "Some studies on surface morphological properties of SnOx thin film layer grown by e-beam technique under controlled oxygen pressure", Materials Today : Proceedings, 2020, DoI: https://doi.org/10.1016/j.matpr.2020.09.839.
- Muzaffar Imam, **Syed Sadique Anwer Askari** and Mukul Kumar Das,“Enhanced Photovoltaic Performance in Pyramid-Textured Silicon Substrate based n-i-p-p+ Solar Cell”, Proc., 3rdInternational Conference on Solar Energy Photovoltaic (ICSEP-2019), 17th-19th December 2019, organized by KIIT University Bhubaneswar, India
- **Syed Sadique Anwer Askari**, Manoj Kumar & Mukul Kumar Das, “Performance Analysis of Perovskite on Si Tandem Solar Cell”, Proc. of 2nd Int. Conf. on Solar Energy Photovolraic (ICSEP-2016), KIIT University Bhubanesware, India, 17th -19th December 2016
- **Syed Sadique Anwer Askari** & Mukul Kumar Das, “Performance Analysis of ZnO/c-Si heterojunction Solar Cell, Proc. of the 1st Int. Conf. on Advancement of Computer Communication & Electrical Technology (ACCET 2016), Murshidabad College of Engineering & Technology, Berhampore, Murshidabad, West Bengal, India, 21-22 October, 2016, DoI: 10.1201/9781315400624-37

List of tools used

Semiconductor Process Engineering

Name of the Equipment	Make	Using since	Proficiency Level
RF & Magnetron Sputtering Materials: ZnO, ITO, AZO, SnO_2, GaO, MgO	Hind High Vacuum	April 2017	Expert
Thermal Evaporation Materials: Al,	Hind High Vacuum	April 2017	Expert
E-beam evaporator Materials: p-SnO, TiO_2, Al, Ni,	Hind High Vacuum	April 2017	Expert
Spin-coating, Materials: ZnO	Customised	July 2016	Skilled
Chemical Cleaning	Customised	April 2017	Skilled
Annealing through Muffle Cum Tube Furnace	Ants Ceramics	August 2017	Highly Skilled
Annealing through Rapid Thermal Processing	ECOPIA RTP-1300	December 2020	Skilled
Reactive Ion Etching (RIE)	Hind High Vacuum	August 2021	Skilled

Semiconductor Material Characterization

Hall measurement (Magnetic field ~ 1.5T)	Customised	August 2017	Highly Skilled
STYLUS profilometer	DektakXT BRUKER	August 2018	Highly Skilled

Device Characterization Equipment

Semiconductor Parameter Analyzer	KEYSIGHT B1500A	December 2020	Highly Skilled
Source Measure Unit (SMU)	Keithley 2450	December 2017	Expert

Device simulation and modelling

Name of the Equipment	Using since	Proficiency Level
SILVACO TCAD (ATLAS, ATHENA, DEVEDIT)	August 2013	Expert
Crosslight APSYS TCAD	July 2016	Highly Skilled
MATLAB	August 2011	Expert

Circuit Simulation Tool

Multisim	August 2011	Highly Skilled
LTSpice	August 2011	Highly Skilled

Reference

Prof. Mukul Kumar Das,
Associate Professor, Department of Electronics Engineering &
Head, Centre of Excellence in Renewable Energy, IIT(ISM) Dhanbad, India
Mobile: +91 9470194846
e-mail: mukulkdas@iitism.ac.in,

Prof. Jitendra Kumar
Professor, Department of Electronics Engineering, IIT(ISM) Dhanbad, India
Mobile: +91-9430132055
e-mail: jitendra@iitism.ac.in,

Prof. Vishnu Priye
Director, Indian Institute of Information Technology, Ranchi, India
Mobile: +91-9431125155
e-mail: director@iiitranchi.ac.in,

Prof. Ejaz Ahmad
Assistant Professor, Department of Chemical Engineering, IIT(ISM) Dhanbad, India
Mobile: +91 9891566334
e-mail: ejaz@iitism.ac.in

Prof. Subhananda Chakrabarti
Professor, Department of Electrical Engineering, IIT Bombay, India
Mobile: +91 9619685279
e-mail: subho@ee.iitb.ac.in

Declaration: I here declare that the information mentioned above is correct up to my knowledge and belief. I bear the responsibility for the correctness of those mentioned above.

Date: August, 2023

Place: Ranchi, Jharkhand, India (Syed Sadique Anwer Askari)