

VIDUR RAJ

118 Garran Road, Graduate House,
Acton, ACT-2601, Canberra
Australia

Telephone No: +61 405854295

Email: vidurrs@gmail.com ; vidur.raj@anu.edu.au

Date of birth: 23rd Dec. 1992

Citizenship: Indian

EDUCATION & QUALIFICATIONS

Sept 2015 – Ongoing

Doctoral Fellow, The Australian National University
Acton, ACT-2601, Australia
(Expected Submission Date: 31/08/2019 (Chapters Decided))

- Thesis Title: Highly efficient III-V solar cells based on carrier selective contacts.
- Supervisors: Prof. Hoe Tan (Primary Supervisor)
Prof. Chennupati Jagadish
Prof. Lan Fu
Dr. Fiacre Rougieux

July 2009 – July 2014

B.Tech + M.Tech - Dual Degree (Nanotechnology)
Amity Institute of Nanotechnology, Amity University
Sector-125, Noida (U.P.), India

- 4-time merit scholarship holder.
- This program was supported by three short term research training and one 6-months full-time research training for master's thesis.
- CGPA 7.37/10 (Among top 10% of class)
- Major Credit Courses In Business Communication Skills (9 Credits) And French (18 Credits)

April 2007 – March 2009

Higher Secondary Certificate (12th Std)
Patna Central School, Sudarshan Vihar
Patna (Bihar), India - 800027

- Percentage – 88.6 %

April 2007 – March 2009

Higher Secondary Certificate (12th Std)
Patna Central School, Sudarshan Vihar
Patna (Bihar), India - 800027

- Percentage – 86.6 %

CERTIFICATES AND AWARDS

- Four-time merit scholarship (50% scholarship on academic fee) holder at Amity University. This is awarded For Outstanding Overall Academic Excellence.
- Scored third rank at Amity Techfest in best technical presentation. Topic of presentation was “Quantum mechanics and Quantum computation”.
- Selected among top 20 teams (selections were made from all over India irrespective of age) for presenting my work on renewable energy in ENERGIZE competition at IIT, Bombay.
- Certificate of completion of online course offered by EDX|BerkeleyX in “Quantum Mechanics and Quantum Computation”.
- Certificate of completion of online course offered by OpenEDX(Stanford Online Course) in “Quantum Mechanics For Scientists And Engineers”.

RESEARCH EXPERIENCE

Sept. 2015 – Ongoing

**PhD Candidate, The Australian National University
Acton, ACT-2601, Australia**

- My project was on optoelectronic simulation and fabrication of thin film and nanowire solar cells using charge selective contact. During the project, I successfully optimized three different kinds of thin film/nanowire solar cell both theoretically and experimentally. Some of the achievements during this project are:
 - Fabrication of 18.3 % efficient thin film InP solar cell using ZnO as an selective contact. The V_{oc} obtained for this device was one of the highest reported V_{oc} for heterojunction solar cell based on InP.
 - For the first time we have shown use of 2-D h-BN monolayers as a passivation layer to improve InP solar cells V_{oc} to 840 ± 20 mV.
 - Fabricated highly transparent p-type conductive CuI-TiO₂ composite thin films for devices applications.
 - Using the novel concept of radial junction, I fabricated 16.2 % efficient solar cell using a substrate for which planar efficiency is almost zero.
 - Several other materials such as SnO_x, MgF₂ and CaF₂ are being tested for application as electron selective contacts.

Aug. 2014 – July 2015

**Senior Research Fellow (SRF)
Centre for Nano Science and Engineering (CeNSE),
Indian Institute of Science, Bangalore
India - 560012**

- I worked on “Cu₂O based p-channel TFTs”. During this project I was responsible for Microwave assisted synthesis of high quality Cu₂O film mainly over flexible substrates. I got an experience on working in a class 100/1000 clean room to fabricate the devices. This project resulted in a working p-type TFT based on Cu₂O.

Jan 2014 – July 2014

**M.Tech Trainee
CSIR-National Physical Laboratory (NPL), New Delhi
India - 110012**

- During my M.Tech thesis, I investigated the controlled growth of indium over high indexed silicon to study the kinetics of adsorption/desorption of indium over silicon surface in the monolayer regime. As part of project:
 - I brought back a non-working UHV based Auger Electron Spectroscopy (AES) system into working condition and studied the growth kinetics of Indium over silicon substrate.

May 2013 – Dec. 2013

**Undergraduate Research Trainee
Amity Institute of Nanotechnology, Amity University
Sector-125, Noida (U.P.), India - 201313**

- I worked on a DST sponsored project “Modification of ZnO nanorods for various electronic applications”. I successfully fabricated ZnO nanorods and nanoplates and functionalized it with metal nanoparticles for different applications. The nanorods and nanoplates synthesized by me were later used for sensing and photocatalytic applications.

Sept. 2012 – May 2013

**Undergraduate Research Trainee
Amity Institute of Nanotechnology, Amity University
Sector-125, Noida (U.P.), India - 201313**

- I worked on a project related to fabrication of CNT based gas sensors. During the project, I fabricated ammonia (NH₃) and Nitrogen Dioxide (NO₂) sensors using Fe₂O₃-CNT and PVA-CNT composites. These

sensors were based on change in electronic conductivity of composite thin films on exposure to reducing or oxidizing gases.

May 2012 – June 2012

**Summer Trainee
CCNSB, IIT
Hyderabad, Telangana, India - 500 032**

- I had worked on the project titled “Computational study of gold nanoclusters for FRET application”. The main aim of the project was computational study of gold nanoclusters, their stability and structure. We wanted to study the properties of various quantum dots that can serve as potential candidate for acceptor and donor in FRET based devices. In the project I was responsible for computational study of 1-12 atoms gold nanoclusters using GAMESS. I used ab-initio calculations using ECP as basis set. The output was visualized using Molden and MacMolPlt.

May 2011 – June 2011

**Summer Trainee
Allele Lifesciences Pvt. Ltd.
C-59, Sector 10, Noida, Uttar Pradesh
India - 201301**

- I got basis training in genetic engineering. As part of training, I learned how to modify DNA, SDS-PAGE technique for protein mass detection, Bacterial culture etc.

Sept. 2011 – Dec. 2013

**Part-time Home Tutor
Scholar's world
Block H, Sector 39, Noida
Uttar Pradesh, India - 201304**

- I was responsible for teaching High School math and physics to 11th and 12th grade students. Also, I took Quantum Mechanics classes for 1st and 2nd year B.Tech Students.

KEY PERSONAL SKILLS

Relevant Experimental Techniques (All with Hands-On)

E-Beam Lithography (Single layer – Large area Fabrication Expertize)
Photolithography (Expertise with positive/negative resist for high resolution microns thick metal lift-off)
Sputter (Expertise with high quality metal oxide deposition)
E-Beam Evaporation (Metal Deposition)
Thermal/Plasma ALD (Oxide Deposition)
Reactive Ion Etching (Chlorine and Fluorine Based)
Cleanroom (Class 100/1000)
Wet Bench

Other Instruments:

Surface Profiler
Ellipsometer
Hall Probe
AFM
Four Probe
Microwave assisted thin film growth

Relevant Characterization Technique

FESEM
Cathodoluminescence (Defect analysis)
TRPL (Room temperature lifetime and PL measurement and analysis)
XPS and UPS (Surface/Interface chemistry and elemental analysis; Electronic analysis)

Solar simulator
EQE measurement system
UV-Vis spectroscopy
Four-Probe and Hall effect
EBIC (Nanowire p-n junction analysis)

Relevant Software Skills

Expertise:

Lumerical FDTD for Solar Cell
Lumerical Device for Solar Cells (Other devices which follow drift-diffusion transport model)
SCAPS-1D for Solar Cells (Thin film based devices)

Others:

MATLAB (Image Processing and Computational Physics)(Basic)
GAMESS (Ab initio calculations)
Simulink (Basic)
Origin
Molden
CasaXPS

Team Work

I have collaborated on several levels within and outside the group to achieve the desired results.

PUBLICATIONS

PATENT

Vidur Raj, "Harnessing electrical energy from the tribomagnetization in railways" - Application no - 597/DEL/2011

BOOK CHAPTERS

Monika Joshi, **Vidur Raj**, Paranu Balaji & Ayushi Kaushik (2014) "Ag-ZnO nanocomposite for multi gas sensing application" Physics of Semiconductor Devices, Springer International Publishing, Part V, 453-456

DOI : 10.1007/978-3-319-03002-9_113

http://link.springer.com/chapter/10.1007%2F978-3-319-03002-9_113

PEER-REVIEWED JOURNAL RESEARCH PAPERS

(* - Corresponding Author)

Vidur Raj, Monika Joshi & Pranauv Balaji (2014) "Ag grafted ZnO nanoplates for Photocatalytic applications" Mater. Focus 3 385-391(7) <http://dx.doi.org/10.1166/mat.2014.1192>

Contribution: I was responsible for fabrication of ZnO nanoplates and its functionalization with silver nanoparticles. Also, the paper was drafted by me.

Vidur Raj, Amit Kumar Singh Chauhan and Govind Gupta (2015) "Growth kinetics of indium metal atoms on Si(1 1 2) surface" MATER RES BULL 72 286-290
<http://dx.doi.org/10.1016/j.materresbull.2015.07.045>

Contribution: I was responsible to study the growth mechanism of In on silicon using AES (Auger electron spectroscopy) measurements. Also, the paper was drafted by me.

Vidur Raj *, Tãmara Sibeles dos Santos, Fiacre Rougieux, Kaushal Vora, Mykhaylo Lysevych, Lan Fu, Sudha Mokkaapati, Hark Hoe Tan, and Chennupati Jagadish. (2018) "Indium Phosphide Based Solar Cell Using Ultra-Thin ZnO as an Electron Selective Layer." Journal of Physics D: Applied Physics 51 (39): 395301.
<https://doi.org/10.1088/1361-6463/aad7e3>.

Contribution: The project was executed and managed by me under the guidance of my supervisor. Also, the paper was drafted by me.

Ghediya Prashant R., Tapas K. Chaudhuri, **Vidur Raj**, Dipankar Chugh, Kaushal Vora, Li Li, Hark Hoe Tan, and Chennupati Jagadish. (2018) "Direct-Coated Cu₂SnS₃ Films from Molecular Solution Inks for Solar Photovoltaics." Materials Science in Semiconductor Processing 88 (December): 120–26.
<https://doi.org/10.1016/J.MSSP.2018.07.041>.

Contribution: I assisted in thin film deposition and characterization.

Vidur Raj*, Lan Fu, Hark Hoe Tan, and Chennupati Jagadish. "Optoelectronic Simulation on Use of ZnO as an Electron Selective Contact for Nanowire Core-Shell Solar Cell Structure Based on InP", **Completed**

Contribution: The project was initiated, designed, executed and managed by me under the guidance of my supervisor. Also, the paper was drafted by me.

Vidur Raj*, Teng Lu, Mark Lockrey, Rong Liu, Yun Liu, Hark Hoe Tan, and Chennupati Jagadish, "CuI-TiO₂ Composite Thin Film for Flexible Electronics", **Completed**

Contribution: The project was initiated, designed, executed and managed by me under the guidance of my supervisor. Also, the paper was drafted by me.

Vidur Raj*, Lan Fu, Hark Hoe Tan, and Chennupati Jagadish, "16.2 % Efficient Nanowire Solar Cells Using Core-Shell AZO/ZnO/p-InP", **Under Preparation**

Contribution: The project was initiated, designed, executed and managed by me under the guidance of my supervisor. We have achieved ~16 % efficiency with a record J_{sc} of 31.6 mA/cm² and a quantum efficiency reaching as high as 95 % (at 600 nm). This work is ongoing.

Vidur Raj*, Dipankar Chugh, Hark Hoe Tan, and Chennupati Jagadish, "Passivation of InP using 2-D h-BN for solar cells application", **Under Preparation**

Contribution: The project was executed and managed by me with the help of Dipankar (equal contribution) under the guidance of my supervisor. We have achieved 17.6 % efficiency with a record V_{oc} of 840±20 mV. This work is ongoing.

CONFERENCE PAPERS/POSTERS

Monika Joshi, Singh R.P. & **Vidur Raj** (2013) "Fe₂O₃ –CNT nanocomposite for binary gas detection". 13th International conference on magnetic fluids New Delhi India, January 7-11, 2013.

Monika Joshi, **Vidur Raj** & Singh R.P. (2013) "Multi gas detection using PVA-CNT nanocomposite". 17th National seminar on physics and technology of sensors, Jamia Millia Islamia, New Delhi, India, March 11 – 13, 2013.

Monika Joshi, **Vidur Raj**, Pranav Balaji (2013) "Synthesis and Characterization of ZnO Nanoflowers for Gas Sensing Application", Poster presentation at ICRTMD'13 Amity University, Noida.

Vidur Raj*, Tâmara Sibebe dos Santos, Kaushal Vora, Mykhaylo Lysevych, Lan Fu, Sudha Mokkaapati, Hark Hoe Tan, and Chennupati Jagadish. (2016) "ZnO-InP Solar Cells without p-n junction", COMMAD 12-14 December, Sydney, Australia

Vidur Raj*, Hark Hoe Tan, and Chennupati Jagadish. (2018) "Optoelectronic Simulation of ITO/Oxide/GaAs Nanowire for Application in Solar Cells", ICONN, 29 JAN - 2 FEB 2018, Sydney, Australia

Vidur Raj*, Mark Lockrey, Rong Liu, Hark Hoe Tan, and Chennupati Jagadish. (2018). "CuI-TiO₂ Composite Thin Film for Flexible Electronic Applications", COMMAD, AIP Congress, December 9 - December 13, Perth, Australia

REFERENCES:

1. Prof. Hoe Tan

Professor
John Carver 4 17
Department of Electronic Materials Engineering
Research School of Physics and Engineering (RSPE)
Australian National University (ANU), Acton
ACT-2601, Australia

Office Phone: +61 2 61250356

Email: Hoe.Tan@anu.edu.au

Relation: I was a PhD student under the primary supervision of Prof. Hoe Tan.

2. Prof. Chennupati Jagadish AC,

Distinguished Professor
John Carver 4 18
Department of Electronic Materials Engineering
Research School of Physics and Engineering (RSPE)
Australian National University (ANU), Acton
ACT-2601, Australia

Office Phone: +61 2 61250363

Email: Chennupati.Jagadish@anu.edu.au;

Relation: Prof. Jagadish co-supervised me during my whole PhD tenure and was well aware of my progress during the project.

3. Prof Lan Fu

John Carver 4 09
Department of Electronic Materials Engineering
Research School of Physics and Engineering (RSPE)
Australian National University (ANU), Acton
ACT-2601, Australia

Office Phone: +61 2 61254060

Email: lan.fu@anu.edu.au;

Relation: Prof. Fu co-supervised me during my whole PhD tenure and was well aware of my progress during the project, especially those related to solar cells.

4. Dr. Govind Gupta (Supervised me for 6 months during my M.Tech thesis)

Senior Scientist,
Surface Physics & Nanostructures
Room No. 7 & 16, TEC Building,
National Physical Laboratory,

Dr. K.S. Krishnan Road, New Delhi-110012

Mobile: +91 9810303946

Email: govind@nplindia.org

Relation: Dr. Gupta is a highly reputed scientist in the field of surface science in India. He was my primary supervisor during my master's project at National Physical Laboratory, New Delhi, India.