

# Dipankar Chugh

Electronic Materials Engineering  
Research School of Physics  
The Australian National University  
Canberra, ACT, Australia

Email: Dipankar.Chugh@anu.edu.au  
Telephone: +61 (0) 406 319 610  
Citizenship: Australian  
Country of Birth: India

## EDUCATION

- July'15 – Jan'20 **AUSTRALIAN NATIONAL UNIVERSITY** **Canberra, Australia**  
Doctor of Philosophy – Physics  
Thesis: *(MOVPE) Growth and applications of wafer-scale hexagonal boron nitride*
- Developed expertise in the operation of MOVPE/MOCVD reactors and develop process recipes.
  - Optimized epitaxial growth of hexagonal boron nitride (hBN) and aluminum nitride (AlN).
  - Developed proficiency in the use and application of metrology/characterization methods, including XRD, AFM, SEM, photoluminescence and Raman spectroscopy
- 2006 – 2008 **UNIVERSITY OF CALGARY** **Calgary, Canada**  
Master of Science – Electrical Engineering  
Thesis: *Dielectric actuation of liquid and droplets for Lab on a Chip applications*
- Developed a novel technology for manipulating micro/nano-liter sized droplets on planar substrates using electric fields.
- 2002 – 2006 **INDIAN INSTITUTE OF TECHNOLOGY** **Guwahati, India**  
Bachelor of Technology – Biotechnology

## EMPLOYMENT HISTORY

- Feb'20-ongoing **Post-doctoral Research Fellow – Australian National University** **Canberra, Australia**  
Design and fabricate multi-quantum well, edge-emitting, diode lasers on GaAs substrates. I undertake the following activities: -
- Simulation and design of edge emitting, multi-quantum well laser structures.
  - Epitaxial growth optimization of III-Vs (InGaP, InGaAsP, GaAsP and AlGaAs) and (stack) growth of laser structures.
  - Material characterization of epitaxially grown III-V layers.
  - Laser device fabrication (including, photomask design, photo-lithography, chemical/plasma etching, wafer thinning and mechanical polishing, metal contact deposition and cleaving laser-diode bars).
  - Electrical characterization of diode lasers (threshold current, internal/external quantum efficiency: IQE/EQE).
- Aug'10 – June'15 **Microfluidic Technologist – University of South Australia** **Adelaide, Australia**
- Developed/optimized semiconductor fabrication processes, including deep reactive ion etching of quartz and silicon, UV photolithography, wet chemical etching, physical vapor deposition (metals and dielectrics), plasma/thermal bonding, electroplating.
  - Maintained ultra-high vacuum and other fabrication/characterization equipment including plasma etching, physical vapor deposition and UV photolithography tools.
  - Support research and development initiatives at UniSA's Future Industries Institute. Provide training to research students and staff on semiconductor fabrication processes.

Jan – Dec' 09

**Research Assistant – University of Calgary**

**Calgary, Canada**

- Developed proof-of-concept prototypes of microfluidic devices using semiconductor fabrication processes for clinical diagnostic applications.
- The microfluidic devices utilized high frequency electric fields for manipulating sessile micro-droplets containing biomolecules (e.g. fluorophore tagged mRNA molecules) for biochemical analysis.
- Communicate research findings in peer-reviewed journals.

#### **RESEARCH AND ANALYTICAL SKILLS**

- Over 10 years of extensive hands-on experience in semiconductor fabrication processes at cleanroom facilities (ISO class 5 and 6) at Australian National Fabrication Facility (ANU and Univ. South Australia); NanoFab (University of Alberta, Canada) and at Advanced Micro/Nanofabrication Integration Facility (University of Calgary, Canada).
- Experience in the growth of compound semiconductor materials (III-Vs) using metal organic vapor phase epitaxy.
- Experience in the design and fabrication of diode laser devices.
- Microfabrication Skills: UV photolithography, physical vapor deposition, plasma enhanced chemical vapor deposition, wet-chemical and plasma etching (III-Vs, silicon, metals and oxides), soft-lithography, hot embossing, wafer bonding, wafer dicing, electroplating.
- Characterization: X-ray diffraction, photoluminescence spectroscopy (steady-state, time-resolved and anti-bunching), atomic force microscopy, scanning electron microscopy (including cathodo luminescence spectroscopy), Raman spectroscopy, interferometry.
- Software: MATLAB, LabVIEW, L-Edit, AutoCAD, Origin, Microsoft Office.

#### **AWARDS AND SCHOLARSHIPS**

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|-------------|--|
| 2015 - 2019 | • Australia Postgraduate Award Scholarship (to pursue PhD at ANU)                |
| 2019        | • Mark Ridgway Travel Scholarship (attend scientific conference in Japan, 2019)  |
| 2016        | • Winner, EME's Three-Minute Thesis competition                                  |
| 2012        | • Frater Award for Staff Development by Australian National Fabrication Facility |
| 2009        | • MNT Travel and Microfabrication Grants by CMC Microsystems, Canada             |

#### **ADDITIONAL**

- Proficient in design of experiments (DOE), data analysis with hands-on experience in several semiconductor fabrication and characterization techniques.
- Developed collaborations with researchers and scientists at leading Universities in Australia, India, UK and China, leading to joint research publications.
- Published over 15 articles in peer-reviewed journals.
- Presented research work at prominent international scientific conferences in Australia (ICONN-2016, 2020), US (ICNS-2019; ICMOVPE-2018) and Japan (CSW-2019), IEEE 8th International Conference on Photonics (ICP) (2020)
- Invited talks at Malaysia Nitride Research Group 2020 workshop; Nanjing University, China; Hefei University of Technology, China.
- Participated in 3-day workshop on Science Communication by ANU's Center for the Public Awareness of Science in 2018.
- Delivered Three-Minute-Thesis talks at ANU School of Physics' Alumni Meet (Canberra) and The Emerging and Disruptive Technology Assessment Symposium 2017 (Melbourne) organized by the Defense Science and Technology Group, Australia.

## LIST OF JOURNAL PUBLICATIONS

1. Stern H. et al., Room-temperature optically detected magnetic resonance of single defects in hexagonal boron nitride. <https://arxiv.org/abs/2103.16494>.
2. Mendelson N, **Chugh D** et al, Identifying carbon as the source of visible single-photon emission from hexagonal boron nitride. *Nature Materials*, 20, 321–328 (2021).
3. Raj V, **Chugh D**, et al, Passivation of InP Solar Cells Using Large Area hexagonal-BN Layers. *NPJ 2D Materials and Applications* 5, 12 (2021).
4. Bera K, Roy A, **Chugh D**, Wong-Leung J, Tan H and Jagadish C, Role of defects and grain boundaries in the thermal response of wafer-scale hBN films. *Nanotechnology* 32 075702.
5. **Chugh D**, Adhikari S et al, Improving the Morphology and Crystal Quality of AlN Grown on Two-Dimensional hBN. *Crystal Growth & Design* 20, 3(2020) 1811-1819.
6. Bera J, **Chugh D**, et al, Strain distribution in wrinkled hBN films. *Solid State Communications* 310 (2020).
7. **Chugh D**, Jagadish C, Tan H. Large-Area Hexagonal Boron Nitride for Surface Enhanced Raman Spectroscopy. *Advanced Materials Technologies* 4, 1-7 (2019).
8. **Chugh D**, Wong-Leung J, Li L, Lysevych M, Tan H, Jagadish C Flow modulation epitaxy of hexagonal boron nitride. *2D Materials* 5, 4(2018) 1-10.
9. Ghediya P, Chaudhuri T, Raj V, **Chugh D**, Vora K, Li L, Tan H, Jagadish C. Direct-coated Cu<sub>2</sub>SnS<sub>3</sub> films from molecular solution inks for solar photovoltaics. *Materials Science in Semiconductor Processing* 88(2018) 120-126.
10. Duong T, Peng J, Walter D, Xiang J, Shen H, **Chugh D**, Lockrey M, Zhong D, Li J, Weber K, White T, Catchpole K. Perovskite Solar Cells Employing Copper Phthalocyanine Hole-Transport Material with an Efficiency over 20% and Excellent Thermal Stability. *ACS Energy Letters* 3, 10(2018) 2441-2448.
11. Elmas S, Ambroz F, **Chugh D**, Nann Thomas, Microfluidic Chip for the Photocatalytic Production of Active Chlorine, *Langmuir*, 32 (19), pp 4952–4958
12. Kaler K., Prakash R. and **Chugh D**. Liquid dielectrophoresis and surface microfluidics. *Biomicrofluidics* 4, 022805 (2010).
13. **Chugh D** and Kaler, K (2009). Integrated Liquid and Droplet Dielectrophoresis for Biochemical Assays. *Journal of Microfluidics and Nanofluidics*, DOI. 10.1007/s10404-009-0469-7.
14. **Chugh D** and Kaler K, (2008). Leveraging Liquid Dielectrophoresis for Microfluidic Application. *Biomedical Materials* 3, pp. 034009.
15. Pakshirajan K, **Chugh D** and Saravanan P, (2008). Feasibility of m-cresol degradation using an indigenous mixed microbial culture with glucose as a co-substrate. *J. of Clean Tech. and Environ. Policy* 10, pp. 303-308.
16. Wijngaart W, **Chugh D**, Man E, Melin J and Stemme G, (2007). A Low-Temperature Thermopneumatic Actuation Principle for Gas Bubble Microvalves. *J. of MEMS* 16, pp. 765.
17. Halder K, Mathur V, **Chugh D**, Verma A and Chowdhury S, (2005). Quadruplex-Duplex competition in the Nuclease Hypersensitive Element of Human c-myc Promoter: C to T mutation in C-rich strand enhances Duplex Association. *BBRC* 327, page 49-56.

## PATENTS/TECHNOLOGY DISCLOSURE

1. Controlled Dispensing of Ultrafine, Variable Volume, Emulsion Droplets, Karan V.I.S. Kaler, Ravi Prakash and **Dipankar Chugh**, Pub. No.: US 2012/0006681 A1, Pub. Date: Jan. 12<sup>th</sup>, 2012.

## REFERENCES

Prof. Hoe Tan  
Director: Australian National Fabrication Facility, ACT Node  
Research School of Physics  
The Australian National University  
Email: Hoe.Tan@anu.edu.au; Tel: (+61) 02 6125 0356  
Relation: Current principal supervisor (and Ph.D. supervisor)

Prof. Chennupati Jagadish  
Research School of Physics  
The Australian National University  
Email: Chennupati.Jagadish@anu.edu.au ; Tel: (+61) 02 6125 0363  
Relation: Associate supervisor (Ph.D.)

A/Prof. Jennifer Wong-Leung  
Research School of Physics  
The Australian National University  
Email: jenny.wongleung@anu.edu.au; Tel: (+61) 02 6125 0360  
Relation: Associate supervisor (Ph.D.)

Mr. Simon Doe  
Facility Manager: Australian National Fabrication Facility, SA Node  
Future Industries Institute,  
University of South Australia  
Email: Simon.Doe@unisa.edu.au; Tel: (+61) 08 8302 5226  
Relation: (previous) Line Manager, ANFF-SA (between 2010-2015)