

# Kalyani Patrikar

✉ kr.patrikar@gmail.com

🌐 kalyanipatrikar.github.io

## EDUCATION

Ph.D	Indian Institute of Technology Bombay <b>Electrical Engineering</b>	Jan. 2015 - Jun. 2021
M.Tech	Indian Institute of Technology Bombay <b>Materials Science</b>	Jul. 2011 - Jun. 2013
B.Tech	Visvesvaraya National Institute of Technology <b>Metallurgical and Materials Engineering</b>	Jul. 2007 - May. 2011

## Summary

Having extensive experience of fabrication and characterization of thinfilms and devices, along with analytical device modelling, numerical simulations, and ab-initio computations of molecular and film stack systems, I am keen to apply my skills to developing novel devices and processes.

## Ph.D. THESIS

### Bulk and Interfacial Charge Transport in Organic Field Effect Transistors

*Advisors: Prof. Dinesh Kabra (Physics), Prof. V. Ramgopal Rao (Electrical Engineering)*

- Reduced **contact resistance** for Cu electrodes in OFET by four orders by functionalizing contact interface with self assembled monolayer
- Demonstrated **novel mechanism** of SAM in OFETs based on experimental studies and **ab-initio** calculations
- Developed **physics based models** to predict interface properties and characteristics of functionalized OFETs
- Achieved **highest mobility** reported for OFET of common donor polymers PTB7 and PTB7-Th, by device stack engineering
- Analysed **polaron** transport in polymers by **density functional theory** calculations, to identify molecular structure substitutions increasing in mobility of organic semiconductor by an order of magnitude
- Developed multiscale **Monte Carlo** based algorithm based on intermolecular charge transfer one-electron Hamiltonian in disordered media to simulate **measured** temperature dependent mobility of OFET

## M.TECH THESIS

### Mechanical Properties of Hot Wire CVD a-SiC:H Thinfilms

*Advisors: Prof. Rajiv Dusane (Materials Science), Prof. Prita Pant (Materials Science)*

- Synthesised Silicon-Carbon alloy thinfilms with different combination of phases by hot wire **CVD**
- Measured thinfilm mechanical properties by **nanoindentation**, **modelled** data to obtain Young's modulus independent of nanoindenter displacement and substrate, correlated with film microstructure
- **Fabricated** and characterized a-Si:C **microbridges** for MEMS

## WORK EXPERIENCE

- **Senior Research Assistant**, *Center for Excellence in Nanoelectronics* Jul. 2013 - Dec. 2014
  - **Optimized** dielectric interface to improve thermal stability of OFET
  - Designed and **fabricated** metal oxide nanoparticles embedded OFETs for H<sub>2</sub>S **sensors**
- **Intern**, *Indian Nanoelectronics User Program* May - Jun. 2010
  - Studied **self assembly** and interface properties of Si quantum dot on SiO<sub>2</sub> and HfO<sub>2</sub> dielectric films by **density functional theory** calculations, for scaling memory devices
  - Fabricated 100 nm Si **nanocrystal** array on HfO<sub>2</sub> film, optimized process for self assembly from Si film

## PUBLICATIONS

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### Journal

1. **Kalyani Patrikar**, Valipe Ramgopal Rao, and Dinesh Kabra, "Role of Charge Transfer Integral in Evolution of Charge Transport Properties of Polymer Semiconductors", Under Review at *Physical Review Applied*.
2. **Kalyani Patrikar**, Urvashi Bothra, Valipe Ramgopal Rao, and Dinesh Kabra, "Charge Carrier Doping As Mechanism of Self-Assembled Monolayers Functionalized Electrodes in Organic Field Effect Transistors", *Adv. Mater. Interfaces* 2021, 2101377. <https://doi.org/10.1002/admi.202101377>
3. **Kalyani Patrikar**, Nakul Jain, Dwaipayan Chakraborty, Priya Johari, Valipe Ramgopal Rao, and Dinesh Kabra "Influence of Pendant Group on Mobility of Organic Thin Film Transistor in Correlation with Reorganization Energy of Molecules." *Advanced Functional Materials*, 29.8 (2019): 1805878. <https://doi.org/10.1002/adfm.201805878>
4. Nakul Jain, Rishabh Saxena, Sumukh Vaidhya, **Kalyani Patrikar**, V. Ramgopal Rao, Christopher R. McNeill and Dinesh Kabra, Quasi Fermi Level Splitting in Organic Bulk Hetero-Junction Solar Cell, submitted to *Physical Review Letters*

### Conference

1. "Role of Pendant Group in Organic Semiconductor Charge Transport Rate and Energetics", Oral presentation at MRS Fall Symposium 2020
2. "Interfacial Doping in Organic Semiconductors with Self Assembled Monolayers at Electrodes", Oral presentation at MRS Fall Symposium 2020
3. "Mechanical Properties of a-SiC:H Thinfilms" Oral presentation at 13<sup>th</sup> European Vacuum Conference and 7<sup>th</sup> European Topical Conference on Hard Coatings 2014
4. "Growth of Si Quantum dot/Nanocrystal on Hafnium Oxide films" Oral presentation at International Conference on Nanotechnology- Materials and Composites Frontier Applications 2011

## COURSES & ACADEMIC PROJECTS

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- **Simulated** MOSFET characteristics and electrostatics on Sentaurus TCAD
- Performed **Molecular Dynamics** simulation of temperature dependent structure of Aluminium crystal
- Fabricated and characterized **OLED** array, and bulk heterojunction **photodetector** array
- Defined input features from sensor data; optimized a **neural network** motion classifier in NumPy
- **Teaching Assistant**: Physics of Transistors, VLSI Technology, EE 101, Thermodynamics of Materials
- **Other Courses**: Solid State Devices, Nanoelectronics, MEMS, Microelectronics Simulations, Microelectronics Lab, Characterization of Materials, Machine Learning, Quantum Transport, Atoms to Materials

## TECHNICAL SKILLS

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<b>Thinfilm Technologies:</b>	PVD, CVD, Spin-coating, Lithography, Oxidation, Sputtering
<b>Electrical Characterization:</b>	I-V, C-V, Cryogenic I-V, TLM, Four probe
<b>Material Characterization:</b>	Nanoindentation, AFM, XPS, SEM, EDS, XRD, XRR, Raman, FTIR
<b>Lab Training:</b>	Class 100 and Class 1000 Clean Room, Glove Box, Chemistry Lab
<b>Software:</b>	Gaussian09, Quantum Espresso, TCAD, COMSOL
<b>Computation:</b>	Python, Matlab, GNU Octave

## EXTRACURRICULAR ACHIEVEMENTS

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- **Institute Executive Member**, part of IIT Bombay Post Graduate Academic Council (2012-2013)
- Silver in **Tennis** Inter-IIT Tournament 2016
- **Blog** at "medium.com/@k.r.patrikar"
- **High Altitude Treks** completed in Uttarakhand, India