Kalyani Patrikar

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EDUCATION

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

EXPERIENCE

Early Career Fellow, *Chemistry, Indian Institute of Technology Gandhinagar* PRESENT

- Modelled and demonstrated **mechanism** of charge transfer at organic-inorganic interfaces in organic devices and in photocatalysts
- Developed **multiscale model** combining ab-initio and Monte Carlo based methods for replicating charge transport in bulk heterojunctions; predicted photovoltaic device parameters accurately
- Designing non-fullerene acceptors with a machine learning based computational approach

Senior Research Assistant, *Center for Excellence in Nanoelectronics* Jul. 2013 - Dec. 2014

- Designed and fabricated oxide nanoparticles embedded organic transistors for toxic gas **sensors**

Intern, *Indian Nanoelectronics User Program* May - Jun. 2010

- **Simulated** self assembly of Si **quantum dots** on SiO_2 and HfO_2 by ab-initio methods
- **Fabricated** and characterized Si quantum dot arrays from thermally stressed Si thinfilm on high-k dielectric HfO_2 for flash memory devices

PhD 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** in organic transistors by four orders with **self assembled monolayers**
- Demonstrated novel charge doping **mechanism** of self assembled monolayers at transistor contacts; developed **physics based model** for charge transfer at organic interfaces based on device characterization and ab-initio computations of interface
- Reported **highest mobility** for transistors of DA polymers PTB7 and PTB7Th, achieved by device engineering
- Established new **paradigm** for improving charge carrier transport by pendant group substitution based on device characterization, and analysis of polaron transport
- Developed **algorithm** for a multiscale model to simulate measured temperature dependent **mobility**; showed the increased intermolecular interactions in DA polymers enhance charge transport

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**

ACADEMIC ACTIVITIES

- **Teaching**: Flexible Electronics (SC 343), Organic Semiconductors & Devices (Guest lecture EE 221) at IIT Gandhinagar
- **Teaching Assistant:** Physics of Transistors, VLSI Technology, Thermodynamics, Machine Learning, Microelectronics Lab, Communication Skills
- **Reviewer:** *IEEE Journal on Flexible Electronics, Materials Chemistry Frontiers* etc.

TECHNICAL SKILLS

Thinfilm Technologies	PVD (System In-charge), CVD, Solution Processing, Lithograhy
Optoelectronic Characterization	I-V, C-V, Cryogenic I-V, TLM, EQE, Photocurrent
Material Characterization	Nanoindentation, AFM, XPS, XRD, Raman, XRR, FTIR
Lab Training	Class 100 and Class 1000 Clean Room, Glove Box, Chemistry Lab
Software	CP2K, Gaussian09, Quantum Espresso, VMD, LabView
Programming	Python, Linux Shell, C, Matlab

EXTRACURRICULAR ACHIEVEMENTS

- Institute Executive Member, part of IIT Bombay Post Graduate Academic Council (2012-2013)
- High Altitude Treks completed in Uttarakhand, India (2014, 2016)

PUBLICATIONS

(Complete list at https://kalyanipatrikar.github.io/publications)

Journal

1. Kalyani Patrikar, Anirban Mondal, "Deciphering the Microscopic Phenomenon Behind Contact Resistances in Interlayer Functionalized Electrodes and Organic Semiconductors", *Phys. Rev. Materials 8, 054606, 2024*. 10.1103/PhysRevMaterials.8.054606
2. Kalyani Patrikar, Valipe Ramgopal Rao, Dinesh Kabra, Anirban Mondal, "Understanding the Microscopic Origin of the Contact Resistance at the Polymer–Electrode Interface", *ACS Applied Materials & Interfaces, 15 (42), 49427, 2023*. 10.1021/acsami.3c10260
3. Gayatri Joshi*, R. Kashyap*, Kalyani Patrikar* Anirban Mondal, and Saumyakanti Khatua, "Ligand-Mediated Electron Transport Channels Enhance Photocatalytic Activity of Plasmonic Nanoparticles" *Nanoscale, 2023,15, 16552* (* Equal Contribution). 10.1039/D3NR02829A
4. Kalyani Patrikar, Anirban Mondal, "Polarity and Orbital Driven Modulation of Contact Resistance of Organic-SAM Functionalized Electrode", *Journal of Chemical Physics, 159, 121102, 2023*. 10.1063/5.0170627
5. 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", *Advanced Material Interfaces, 9, 1, 2101377, 2021*. 10.1002/admi.202101377
6. 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, 1805878, 2019*. 10.1002/adfm.201805878

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 Monolayer at Electodes", Oral presentation at MRS Fall Symposium 2020
3. "Mechanical Properties of a-SiC:H Thinfilms" Oral presentation at 13th European Vacuum Conference and 7th European Topical Conference on Hard Coatings 2014. (Selected for **Student Award**)