

Umesh Mogera, Ph.D.
Postdoctoral Research Scholar
University of California, Los Angeles
Email: umeshm@ucla.edu,
Phone: +1-4245359130



Research Areas

1. Flexible bioelectronics

- Conducting hydrogel composite as electrodes for MRI-compatible soft electronics
- Biofluid barrier for long-lived electronic soft implants
- Wearable microfluidic sweat sensor for point-of-care diagnostics

2. Organic supramolecular electronics

- Supramolecular field effect transistor
- Ultrafast supramolecular humidity sensor
- Continuous and simultaneous monitoring of breath humidity and flow
- Humidity based memory device
- Self-assembly of conducting 1D nanostructures
- LB monolayer of charge-transfer assembly and its study

3. Graphene and twisted graphene

- Rapid synthesis of large area defect-free graphene
- Twisted multilayer graphene and its unique properties
- Synergy between graphene and Ni(111)
- Landscape of turbostraticity in multilayer graphene
- Polymer-free direct transfer of single layer graphene and its FET
- Ultra-sensitive strain sensor from graphene wrinkles

4. 1D and 2D Nanomaterials for energy storage

- Supramolecular nanofibre and metal electrodes for supercapacitors
- Supramolecular nanofibre as an electrolyte for supercapacitors
- Decoupled graphene stacks as electrodes for supercapacitors

5. Heterogeneous Integration for electronic packaging

- Silicon Interconnect Fabric – a next generation packaging platform for Si
- Superconducting Interconnects
- Power delivery and thermal management for the high power (1 W/mm²) heterogenous integration platforms

Publications and Patents

Publications:

1. N Gupta,* S Walia,* **U Mogera*** and G U Kulkarni, Twist Dependent Raman and Electron Diffraction Correlations in Twisted Multilayer Graphene, *J. Phys. Chem. Lett.* 2020, 11, 8, 2797 (*equal)
2. **U. Mogera** and G. U. Kulkarni, A new twist in graphene research: Twisted graphene, *Carbon* 156, 2020, 470.
3. S Kundu,* **U Mogera***, S J George and G U Kulkarni, A planar supercapacitor made of supramolecular nanofibre based solid electrolyte exhibiting 8 V window, *Nano Energy*, 61, 2019, 259 (*equal contribution).
4. A Bhattacharyya, M. K. Sanyal, **U Mogera**, S. J. George, S. Dhiman, G. U. Kulkarni and P. Fontaine Formation of Two-Dimensional Network of Organic Charge-Transfer Complexes at the Air–Water Interface, *Langmuir*, 2019, 35, 39, 12630.
5. U. Shah, **U. Mogera**, P. Ambore, B. Vaisband, S. S. Iyer, and T. S. Fisher, Dynamic Thermal Management for Silicon Interconnect Fabric using Flash Cooling, *18th IEEE ITherm*, 1228, 2019.
6. P Ambhore, **U. Mogera**, B. Vaisband, , U. Shah, T. Fisher, M. Goorsky and S. S. Iyer, PowerTherm Attachment Process for Power Delivery and Heat Extraction in the Silicon-Interconnect Fabric, *69th IEEE ECTC*, 1605, 2019.
7. S. Jangam, A. Bajwa, **U. Mogera**, P. Ambhore, T. Colosimo, T. Palumbo, D. DeAngelis, B. Chylak and S. S. Iyer, Fine-Pitch ($\leq 10\ \mu\text{m}$) Direct Cu-Cu Interconnects using In-situ Formic Acid Vapor Treatment, *69th IEEE ECTC*, 620, 2019.
8. **U. Mogera** and G. U. Kulkarni, Twisted Multilayer Graphene Exhibiting van Hove Singularities Induced Strong Absorption Bands, *Bulletin of Materials Science*, 41, 2018, 130 (Invited article).
9. **U. Mogera**, A Sundaresan and G. U. Kulkarni, Graphene-Ni(111) Synergy Influencing Crystalline Orientation, Grain Morphology and Magnetic Properties of Poly-Ni, *J. Phys. Chem. C*, 122, , 25, 2018, 13962 (Invited Article).
10. **U. Mogera**, M. Gedda, S. J. George and G. U Kulkarni, Humidity Based Passive Memory Sensor based on Supramolecular Nanofibres, *ACS Appl. Mater. Interfaces*, 2017, 9, 32065.
11. **U. Mogera** and G. U. Kulkarni, Improving the Quality of Graphene/Cu by Joule Heating and Enabling Polymer-free Direct Transfer onto Arbitrary Substrates, *Carbon*, 2017, 124, 525.
12. **U. Mogera**, S. Walia, B. Bharath, M. Gedda and G. U. Kulkarni, Intrinsic Nature of Graphene Revealed in Temperature Dependent Transport of Twisted Multilayer Graphene, *J. Phys. Chem. C*, 2017, 121, 13938.
13. A. Bhattacharyya, M. K. Sanyal, **U. Mogera**, S. J. George, M. K. Mukhopadhyay, G.. U. Kulkarni and S. Maiti, Nanoscopic Understanding of Ultrafast Humidity Sensing in Supramolecular Nanofibres Through In-Situ GISAXS Measurements, *Scientific Reports*, 7, 246, 2017.
14. **U. Mogera**, M. Gedda, S. J George, G. U. Kulkarni, Supramolecular Nanofibres as Ambient Stable Wide-

Voltage Window Electrolyte for Micro-Supercapacitors, *ChemNanoMat*, 3, 1, 2017, 39.

15. **U. Mogera**, D Radhakrishnan, R, Pujar. C, Narayana, G. U. Kulkarni, Highly Decoupled Graphene Multilayers: Turbostraticity at Its Best, *J. Phys. Chem. Lett*, 2015, 6, 4437.
16. **U. Mogera**, N. Kurra, D. Radhakrishnan, C. Narayana, G. U Kulkarni, Low Cost, Rapid Synthesis of Graphene On Ni: An Efficient Barrier for Corrosion and Thermal Oxidation, *Carbon*, 2014, 78, 384.
17. **U. Mogera**, A. A Sagade, S. J George, G. U Kulkarni, Ultrafast Response Humidity Sensor Using Supramolecular Nanofibre and Its Application in Monitoring Breath Humidity and Flow, *Scientific Reports*, 2014, 4, 04103.
18. K. V. Rao, K. Jalani, K. Jayaramulu, **U. Mogera**, T. K. Maji, S. J. George, Charge-Transfer Nanostructures through Noncovalent Amphiphilic Self-Assembly: Extended Co-facial Donor-Acceptor Arrays, *Asian J. Org. Chem.* 02, 2014, 3, 2.
19. A. Sagade, K. V. Rao, **U. Mogera**, S. J. George, A. Datta, G. U. Kulkarni, High-Mobility Field Effect Transistors Based On Supramolecular Charge Transfer Nanofibres, *Adv. Mater.* 2012, 25, 559.
20. A. Jain, K. V. Rao, **U. Mogera**, A. A. Sagade and S. J. George, Dynamic Self-Assembly of Charge-Transfer Nanofibers of Tetrathiafulvalene Derivatives with F₄TCNQ, *Chem. Eur.* 10, 2011, 17, 12355.
21. N. Varghese, **U. Mogera**, A. Govindaraj, A. Das, P. K. Maiti, A. K. Sood, C. N. R. Rao, *Binding of DNA Nucleobases and Nucleosides with Graphene*, *ChemPhysChem* 1, 2009, 10, 1, 206.

Patents:

1. Supramolecular Nanofiber as Electrolyte by **U. Mogera**, M. Gedda, S. J George, G. U. Kulkarni Indian Complete Application, Date of filing: October 01, 2015
2. An Electrolyte with 8 V Voltage Window by G. U. Kulkarni, **U. Mogera** and S. Kundu, Provisional filed
3. A Process for Synthesis of Graphene and a Graphene Thereof by G. U Kulkarni, **U. Mogera**, and N. Kurra, Indian Patent, Application No. 2713/CHE/2014, Date of filing: July 03, 2014
4. Turbostratic Graphite and Process of Preparing the Same by **U. Mogera** and G. U Kulkarni Indian Patent, Application No.: 2967/CHE/2015, Date of filing: June 12, 2015
5. Turbostratic Graphence Dispersions, Coatings and Process Therefore by G. U. Kulkarni, N. Gupta and **U. Mogera**, Complete specification filed on Feb 07, 2018

Research Metrics

Google Scholar		Research Gate	
Citations	872	Total Research interest	385.5
h-index	9	Total Reads	2470

Work Experience (Expertise in experiments)

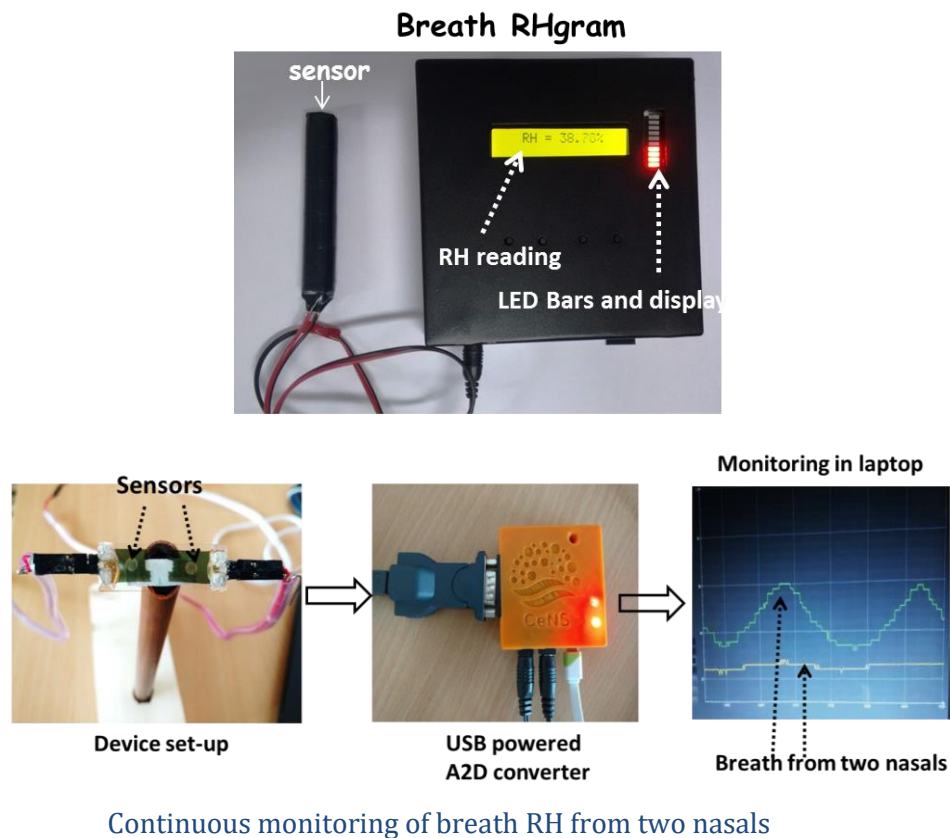
- Synthesis of nanomaterials (nanoparticle, graphene (CVD, chemical, exfoliation))
- Working experience with soft polymers (PDMS, PMMA), microfluidics, soft lithography
- Working experience with flexible and stretchable electronic devices
- Device fabrication (in clean room) and processing
- Microfabrication, lithography and materials characterisation
- Setting up of vacuum system for Joule-heating based CVD synthesis
- Setting up of controlled gas flow chamber for sensing studies
- Involved in the refurbishing of x-ray photoelectron spectrometer (1977 model) and bringing back it into the working condition
- Setting up of the electronics room in the lab for electrical measurements
- Familiar with the working atmosphere in the synchrotron centres (Photon factory, Japan and Soleil, France)

I am also conversant with the following characterisation and measurements techniques:

- Atomic Force Microscope (AFM, C-AFM, MFM and EFM)
- Atomic Force Microscope with environment control (Multimode, Veeco)
- Low-temperature Scanning Tunnelling Microscope (RHK)
- Scanning electron microscope (FESEM, FEI)
- X-ray Photoelectron Spectrometer (Omicron)
- Micro-Raman (Horiba and Thermo Scientific) and other spectrometers (UV-Vis, FTIR, Fluorescence and Photoluminescence)
- Surface characterization: powder-XRD, contact angle, optical and surface profiler
- Electrical characterization: SCS-4200, Probe station, nanomanipulator, mass flow controller, wire bonder, oscilloscope, pulse generator, temperature stage controller
- Electrochemical and EIS measurements (CHI and Gamry)
- Thin film deposition system (physical vapour deposition, electron beam deposition and sputtering)
- Langmuir-Blodgett setup
- Others: glove box operation, maskless photolithography, isothermal titration calorimetry, thermo-gravimetric and differential thermal analyser.

Industry interactions and global attentions

- Following our publication in Nature Scientific Reports, 2014 on supramolecular nanofibres, Ford Motors, Michigan, approached us to use the supramolecular nanofibres as negative swelling materials. After detailed technical discussions, we have supplied the material for testing.
- A sports medicine research group from University of Cincinnati have shown interest to use ultrafast humidity sensor to monitor humidity in the breath during various sports activities. As per the requirement, we have developed stand-alone humidity sensor, which is now calibrated before shipping.
- The portable humidity sensor was exhibited in Bangalore Nano 2016. Several companies have shown interest in it, particularly aiming clinical applications.



- Indian Giant Tata group have shown interest in our invention related to decoupled graphene multistacks that we published in JPCL, 2015. They have tied up collaboration with us to fund a project to up-scale the process (roll to roll) and market the product in various forms for different applications.

Brief Biodata

Contact details:

Full name: Umesh Moger
Permanent address: Omshree Nilaya, Alvegadde, Shiroor (P)
Udupi – Karnataka – India - 560064
Date of Birth: 1st December 1987
Nationality: Indian
Secondary Email: umesh2250@gmail.com

Educational background:

Graduation: B.Sc in Physical Sciences.
Subjects: Chemistry, Physics, Mathematics.
Year of passing and class obtained: 2008, Distinction
University: Mangalore University
Post-Graduation: MSc in Chemistry (Silver medal)
Year of passing and class obtained: 2010, Distinction
University: Mangalore University

Research background:

Jawaharlal Nehru Centre for Advanced Scientific Research,
Bangalore, India
(ranked #14 in Nature's quality index)

August 2010-July 2016

PhD

Thesis title:

*Functional Properties and Novel Applications of 1D Supramolecular
Nanofibres and Decoupled 2D Graphene Stacks*

*(Defended Thesis on 4th
Nov, 2016)*

Postdoc

Research Associate

Centre for Nano and Soft Matter Sciences, Bangalore

Dec 16 – Sep 18

Postdoc

Research Scholar

University of California, Los Angeles

From Sep 18 – Feb 20

Academic achievements

- Awarded 'ACS Best Poster Award' in ICONSAT, Bengaluru, 2018
- Awarded 'Nanoscale Best Poster Award' in 'NanoIndia', Tanjore, 2015.
- Secured silver medal in MSc. Chemistry, 2010, awarded by Mangalore University.
- Secured All India 42 rank in National Eligibility Test (NET), conducted jointly by the Council of Scientific and Industrial Research (CSIR) and University Grants Commission.
- Awarded JRF and SRF from CSIR during 2010-2015.
- Qualified GATE-2010, a national level exam organized by IIT-Guwahati, Ministry of Human Resources and Development (MHRD), India
- Selected (among 10 students from India) and successfully completed the Project Oriented Chemical Education, during 2006-2008, offered by JNCASR, Bangalore, as part of three consecutive summer programmes (alike Summer Internship)

Conference presentations

- UCLA CHIPS Workshop 2019, Los Angeles (Poster)
- SRC ASCENT Meeting 2019, Uni of Notre Dame, Chicago (Oral +Poster)
- MRS Spring Meeting, 2018, Phoenix (Oral)
- ICONSAT, 2018, Bengaluru (Poster)
- MRS Fall meeting, 2016, Boston, (Poster)
- Bangalore Nano Expo, 2016, Bangalore (Product display)
- International Conference on Advanced Materials organised by Indian Institute of Science, Bangalore (Poster)
- JNCASR-IISER joint conference on 'Chemistry of Materials', 2015 (Poster)
- NanoIndia, Tanjore, 2015 (Poster)
- In-house symposium, JNCASR, 2015 (Oral)
- Indo-Japan conference on graphene. 2014, Bangalore (Poster)
- In-house symposium, JNCASR, 2013 (Poster)
- Indo-Australian workshop on nanomaterials, 2013, Bangalore (Oral)
- Winter School on 'Chemistry of Materials', 2012, Bangalore (Poster)
- Exploring Materials using Spallation Neutron Source, Indo-US Workshop, Bangalore, (Poster)
- International Conference on Nanoscience and Technology, 2011, Hyderabad (Poster)
- Winter School on 'Chemistry of Materials', Dec-2011, Bangalore (Poster)

References:

The following are the distinguished scientists and my mentors who know me very well

- **Professor Subramanian S Iyer** (Postdoc Advisor)
Distinguished Professor
Charles P. Reames Endowed Chair
Electrical & Computer Engineering Department
Materials Science and Engineering Department
Henry Samueli School of Engineering and Applied Science
University of California, Los Angeles – 90024
- **Professor Giridhar U. Kulkarni** (PhD Advisor)
Director, Centre for Nano and Soft Matter Sciences
Bangalore
On Lien from: Chemistry & Physics of Materials Unit and DST Unit on Nanoscience
Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR)
Bangalore, India
- **Prof. Subi J. George** (Teacher and long-term collaborator)
Associate Professor, New Chemistry Unit,
JNCASR, Bangalore - 560064, India.
- **Prof. Chandrabhas Narayana** (Teacher and collaborator)
Chairman, Chemistry and Physics of Materials Unit
JNCASR, Jakkur P.O., Bangalore 560064 India
- **Prof. Milan K. Sanyal** (Collaborator)
Saha Institute of Nuclear Physics, Kolkata, India