

SURESH KUMAR GARLAPATI

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RESEARCH INTERESTS

- Printed and flexible electronics
Preparation of metal oxide, organic semiconductors and 2D materials based electronic devices using printing/solution processes.
- Nanostructured materials
Preparation of nanoparticles and thin films by solution based methods such as sol-gel, precipitation, hydrothermal methods and preparation of inks as well.
- Characterization of materials and thin films
Electrical and structural characterization of different materials and thin films to understand structure-property relations.
- Sensors
Organic field-effect transistor (OFET) based sensors to detect volatile organic compounds and different gases. Electronic nose using OFET based sensor arrays.
- Memristors
Preparation and characterization of metal oxide memristors and 1T1R devices for different applications (radiation detection, gas sensing and artificial synapses)

RESEARCH EXPERIENCE

13/10/2020-present *Assistant Professor*

Materials Science and Metallurgical Engineering, IIT Hyderabad, India

10/2019-09/10/2020 *Research Fellow*

Zepler Institute for Photonics and Nanoelectronics, University of Southampton, UK
Prof. Dr. T. Prodromakis's group

- Part of the FORTE (Functional Oxide Reconfigurable Technologies) project.
- Developing metal oxide memristors, 1T1R and ferroelectric devices for memory applications.

04/2017-09/2019 *Post-doctoral research associate*

Faculty of Science and Engineering, University of Manchester, UK
Prof. Dr. K. C. Persaud's group and Prof. Dr. M. L. Turner's group

- Part of the iPESS (integration of Printed Electronics with Silicon for Smart Sensors) and Innovate UK projects (PlasticArmpit) and working with multiple industries (Arm, Unilever, Pragmatic).
- Developed organic field-effect transistors to detect extremely low concentrations. (parts per million to parts per billion) of volatile organic compounds and gases.
- Developing flexible e-nose sensor array with high sensitivity and selectivity.
- Delivering project goals and managing the project effectively.

01/2017-03/2017 *Post-doctoral researcher*

Institute of Nanotechnology, Karlsruhe Institute of Technology, Germany
Prof. Dr. Horst Hahn's group

- Photonic curing techniques to cure printed oxide thin films to prepare high performance transistors at room temperature.
- Published two scientific papers in reputed journals (Advanced Electronic Materials and Nanotechnology).

12/2011-12/2016 *Research assistant*

Institute of Nanotechnology, Karlsruhe Institute of Technology, Germany
Prof. Dr. Horst Hahn's group

- Part of the Helmholtz virtual institute project (VI-530) and worked closely with other universities (Technical University of Darmstadt, University of Duisburg-Essen, Germany).
- Developed printable metallic and semiconducting nanoparticulate inks.
- Developed ink-jet printed high performance oxide transistors and logic circuits using electrolyte gating concept.
- First one to demonstrate ink-jet printed CMOS logics from oxide semiconductors.
- Developed novel curing methods (chemical and photonic curing) to prepare low or room temperature processed oxide transistors.
- Published scientific papers in reputed journals (ACS applied materials & interfaces, Small and ACS Nano).
- Successful collaboration resulted in several scientific papers.

08/2011-10/2011 *Project Associate*

Department of Metallurgical and Materials Engineering, Indian Institute of Technology Madras, India

Prof. Dr. S. S. Bhattacharya's group

- Spark plasma sintering and characterization of alumina nanoparticles.

EDUCATION

12/2011-12/2016 *PhD* in Materials Science

Joint Research Laboratory for Nanomaterials, Technische Universität Darmstadt and Karlsruhe Institute of Technology, Germany

Thesis title: "Low temperature processing of printed oxide transistors", supervised by Prof. Dr. Horst Hahn

Grade: Very good

08/2009-05/2011 *M. Tech* in Metallurgical and Materials Engineering

Indian Institute of Technology Madras, India

Thesis title: "Synthesis and characterization of hole conducting nanoparticles for printed oxide electronics", supervised by Prof. Dr. S. S. Bhattacharya and Prof. Dr. Horst Hahn

CGPA: 9.4/10

PUBLICATIONS

1. A Rahmanudin, DJ Tate, N Bull, RM Hernandez, SK Garlapati, S Faraji, KC Persaud, ML Turner, "Robust High-Capacitance Polymer Gate Dielectrics for Stable Low-Voltage Organic Field Effect Transistor Sensors", accepted by **Advanced Electronic Materials**, 2019. Impact factor: 4.193
2. S Ummethala, T Harter, K Koehnle, Z Li, S Muehlbrandt, Y Kutuvantavida, JN Kemal, J Schaefer, H Massler, A Tessmann, SK Garlapati, A Bacher, L Hahn, M Walther, T Zwick, S Randel, W Freude, C Koos, "Wireless Transmission at 0.3 THz Using Direct THz-to-Optical Conversion at the Receiver", accepted by **Nature Photonics**, 2019. Impact factor: 37.85
3. SK Garlapati, M Divya, B Breitung, R Kruk, H Hahn, S Dasgupta, "Printed electronics based on inorganic semiconductors: from processes and materials to devices", **Advanced Materials**, 2018, 30, 1707600. Impact factor: 21.95
4. SK Garlapati, GC Marques, JS Gebauer, S Dehm, M Bruns, M Winterer, MB Tahoori, J Aghassi-Hagmann, H Hahn, S Dasgupta, "High performance printed oxide field-effect transistors processed using photonic curing", **Nanotechnology**, 2018, 29, 235205. Impact factor: 3.446
5. BK Sharma, A Stoesser, SK Mondal, SK Garlapati, S Dehm, V. S. K Chakravadhanula, R Kruk, H Hahn, S Dasgupta, "High performance all-printed amorphous oxide FETs and logics with electronically compatible electrode/channel interface", **ACS applied materials & interfaces**, 2018, 10 (26), 22408. Impact factor: 8.097

6. SK Garlapati, JS Gebauer, S Dehm, M Bruns, M Winterer, H Hahn, S Dasgupta, “Room-temperature processing of printed oxide FETs using ultraviolet photonic curing”, **Advanced Electronic Materials**, 2017, 3, 1600476. Impact factor: 4.193
7. GC Marques, SK Garlapati, D Chatterjee, S Dehm, S Dasgupta, J Aghassi and MB Tahoori, “Electrolyte gated FETs based on oxide semiconductors: Fabrication and Modeling”, **IEEE Transactions on Electron Devices**, 2017, 64, 279. Impact factor: 2.605
8. GC Marques, SK Garlapati, S Dehm, S Dasgupta, H Hahn, MB Tahoori, J Aghassi-Hagmann, “Digital power and performance analysis of inkjet printed ring oscillators based on electrolyte gated oxide electronics”, **Applied Physics Letters**, 2017, 111, 102103. Impact factor: 3.495
9. M Häming, TT Baby, SK Garlapati, B Krause, H Hahn, S Dasgupta, L Weinhardt, C Heske, “The effect of NaCl on room-temperature processed indium oxide nanoparticle thin films for printed electronics”, **Applied surface science**, 2017, 396, 912-919. Impact factor: 4.439
10. AS Parvathy, A Molinari, A Benes, C Loho, VSK Chakravadhanula, SK Garlapati, R Kruk, O Clemens, “Structure and conductivity of epitaxial thin films of barium ferrite and their hydrated forms $\text{BaFeO}_{2.5-x}\delta(\text{OH})_{2x}$ ”, **Journal of Physics D: Applied Physics**, 2017, 50, 115302. Impact factor: 2.373
11. J Liu, W Zhou, J Liu, Y Fujimori, T Higashino, H Imahori, X Jiang, J Zhao, T Sakurai, Y Hattori, W Matsuda, S Seki, SK Garlapati, S Dasgupta, E Redel, L Sun, C Wöll, “Exploring the potential of highly ordered porphyrin frameworks for solar cells: An all-solid SURMOF-based photovoltaic device with extremely high photocarrier generation efficiency”, **Journal of Materials Chemistry A**, 2016, 4 (33), 12739. Impact factor: 9.931
12. SK Garlapati, TT Baby, S Dehm, M Hammad, V. S. K Chakravadhanula, R Kruk, H Hahn, S Dasgupta, “Ink-Jet Printed CMOS Electronics from Oxide Semiconductors”, **Small**, 2015, 11 (29), 3591. Impact factor: 9.598
13. TT Baby, SK Garlapati, S Dehm, M Häming, R Kruk, H Hahn, “A General Route toward Complete Room Temperature Processing of Printed and High Performance Oxide Electronics”, **ACS Nano**, 2015, 9 (3), 3075-3083. Impact factor: 13.709
14. SK Garlapati, N Mishra, S Dehm, R Hahn, R Kruk, H Hahn, S Dasgupta, “Electrolyte-gated, high mobility inorganic oxide transistors from printed metal halides”, **ACS applied materials & interfaces**, 2013, 5 (22), 11498-11502. Impact factor: 8.097

BOOK CHAPTERS

- TT Baby, GC Marques, F Neuper, SA Singaraju, SK Garlapati, F von Seggern, R Kruk, S Dasgupta, B Sykora, B Breitung, AP Sukkurji, U Bog, R Kumar, H Fuchs, T Reinheimer, M Mikolajek, JR Binder, M Hirtz, M Ungerer, L Koker, U Gengenbach, N Mishra, P Gruber, M Tahoori, J Aghassi-Hagmann, H von Seggern, and H Hahn, “Printing technologies for integration of electronic devices and sensors,” in [Functional Nanostructures and Sensors for CBRN Defence and Environmental Safety and Security (FNS-CBRN Defence – 2018)], NATO Science for Peace and Security Series C: Environmental Security, Springer, Dordrecht (in print)
- A Upadhyay, SK Garlapati, R Bhunia, S Dasgupta, “Printed piezoelectric materials for devices and applications” in *Metal Oxides Book series: Piezoelectric materials (Elsevier)*, 2020, under review.

CONFERENCES

1. Poster presentation on "Low cost, solution processed OFETs for chemical sensing", ISOEN-2019, Fukuoka, Japan.
2. Poster presentation on “High performance, solution processed OFETs to detect volatile organic compounds” in *InnoLAE -2019, Cambridge, UK*. **Received runner-up poster award.**
3. Oral presentation on “Solution processed, low power OFETs based sensors” in *InnoLAE -2018, Cambridge, UK*.
4. **Invited talk** on “Organic electronics for gas sensing applications”, *RSC Innovative Chemical sensing - 2018, London, UK*.
5. Oral presentation on “Photonic curing of printed metal oxide field-effect transistors” in *MRS -2016, Boston, USA*.

6. GC Marques, SK Garlapati, S Dehm, S Dasgupta, J Aghassi and MB Tahoori, “Compact modeling of inkjet printed, high mobility, electrolyte-gated transistors”, 55th workshop on Microelectronics, 2016, Karlsruhe, Germany. Proceedings in IEEE solid state society chapter. **Received best paper award**
7. Oral presentation on “Printed, high performance CMOS electronics from oxide semiconductors” in *Materials Science and Engineering 2014, Darmstadt, Germany*.
8. Oral presentation on “Printed, high performance inorganic oxide transistors from halide precursors” in *Deutsche Physikalische gesellschaft 2013, Regensburg, Germany*.

AWARDS and ACHIEVEMENTS

- Achieved the status of **Associate Fellow of The Higher Education Academy (AFHEA)** in recognition of attainment against the UK Professional Standards Framework for teaching and learning support in higher education.
- Recipient of a grant, conference fee and travel charges, to attend DPG (German Physical Society) conference in 2013 in Germany.
- Awarded **DAAD (Germany Academic Exchange Service) Fellowship-2010** to pursue M. Tech project in Germany.
- Recipient of **Scholarship of Ministry of Human Resources Development (MHRD)**, Government of India, during M. Tech in Indian Institute of Technology Madras.
- All India 88th Rank in GATE-2008 (Graduate Aptitude Test in Engineering) in Metallurgical Engineering.
- 1st Runner-up in Technical Quiz in “Amalgam-2010” a National Level Technical Symposium held at Indian Institute of Technology Madras, India.
- 1st Runner-up in Material Hunt in “Amalgam-2010” a National Level Technical Symposium held at Indian Institute of Technology Madras, India.

TEACHING EXPERIENCE

- Completed a semester course on “**Teaching for Researchers**” at the University of Manchester, 2018-19.
- Gave guest lectures and conducted tutorials to post-graduate and undergraduate students at the University of Manchester, 2018-19.
- Worked as a part-time tutor for high school and junior college students during Bachelors studies (2005-09) in Hyderabad, India.

SKILLS and TECHNIQUES

- Computational skills:
Origin, MS office, Windows and Linux
- Preparation techniques:
Inkjet printing, sonoplot printing, spin coating, RF and DC magnetron sputtering, photolithography, thermal evaporation, UV curing, etc.
- Characterization techniques:
Electrical measurements using parameter analyzers and pulse generators. Structural characterization techniques such as X-ray diffraction, scanning electron microscopy, atomic force microscopy, cyclic voltammetry, impedance spectroscopy, spectroscopy techniques (UV-Visible, FTIR), dynamic light scattering, etc.

LEADERSHIP and MANAGEMENT SKILLS

- Elected as a student president and organized a national level technical symposium (AYAS-2009) at JNTU, Hyderabad, India, during Bachelor studies.
- Managed an academic project that involved multiple universities, during doctoral studies, and delivered project goals and published results in scientific journals.
- Have managed an industrial project (PlasticArmpit) and worked closely with multiple industries (Arm, Unilever and Pragmatic).
- Co-supervised 2 undergraduate and 4 post-graduate students during PhD and postdoc careers.