K B Vinaya Kumar

Office: Electrical and Computer Engineering, 114 Phillips Hall,
116 Hoy RD, Cornell University, ITHACA, NY-14853, USA.
Email: vinayjgi@gmail.com, vk256@cornell.edu, Mobile: +1(607) 379-1720

Website
Google Scholar
LinkedIn

Research Interests:

Micro Electro Mechanical Systems (MEMS), Internet-of-Things (IoT) sensors, Lab-on-chip devices, Analog Circuit Design, Chip-scale particle accelerator.

Work Experience:

Staff Researcher: July-2018 International Iberian Nanotechnology Laboratory (INL), Portugal
Postdoctoral Associate: December 2015-June 2018, Sonic MEMS Lab, Cornell University, USA
Research Associate: July 2015-December 2015, Sensors Lab, Indian Institute of Science, India.

Education:

PhD (2011- 2015), Department of Instrumentation & Applied Physics and Electronic System Engineering
(Advisors: *Prof. K Rajanna and Prof. N S Dinesh*)
Indian Institute of Science (IISc)**,** Bangalore, India (Best PhD Thesis award from ISSS)

M.Tech. (2009-2011), Nanoscience and Nanotechnology
Kuvempu University**,** Karnataka, India.

B.E. (2005-2009), Electronics and Communication
Sri Bhagawan Mahaveer Jain College**,** Karnataka, India

Research Experience:

2016-present **Pyroelectric-based high voltage generation for gas sensor/vacuum pump/robotic actuator**
- Developed pyroelectric lithium niobate-based ionizers to ionize VOCs
- Integrated ionizer, piezoelectric fans and microfabricated electrode array in a portable 3D printed package for portable gas-sensing
- Demonstrated a transimpedance amplifier to detect nano ampere (nA) of current from ionizer
- Working on miniaturized ion pump for chip-scale atomic sensor application
- High voltage generation for soft robotic actuator application

2015-present **MEMS-based compact particle accelerator (in collaboration with LBNL)**
- Designed and Developed a PC board and silicon based Electrostatic Quadrupole (ESQ) wafers
- Demonstrated a high voltage pulse generator using SiC MOSFET
- Designing a coplanar/microstrip resonator to generate high voltage for particle accelerator

2016-present **Transient/Vaporizable sensor array**
- Used vaporizable polymer as a support layer for sensor array
- Metal heaters were deposited to patterned and vaporize polymer
- Graphene was transferred on to the polymer membrane to demonstrate accelerometer sensor

2011-2015 **Microneedle and micropump-based insulin delivery system**
- Designed and Developed a Silicon, Metal and Polymer microneedle array
- Developed and characterized a peristaltic micropump for drug delivery
- Precision flow controlling was demonstrated using developed micropump
- Microneedle and micropump was integrated to deliver the insulin into the diabetic rat

2013-2014 **Low range (millibar) pressure calibrator using micropump**
- Developed an automatic pressurization system to calibrate low range (millibar) pressure sensors
- Developed a closed loop control system to detect and adjust the pressure leaks in the chamber
- The complete system has been integrated into a portable product

2009-2011 **Structural, Electrical and Optoelectronic properties of CuO cluster of nanoparticles**
- Synthesized Cupric oxide (CuO) clusters of nano particles of size ~ 25-30 nm
- DC electrical conductivity for CuO clusters of nanoparticles was carried out from 300 to 500 K
- Direct band gap of 3.77eV was measured using optical absorption spectrum

Teaching and Mentoring Experience:

Teaching Assistant for "Sensors and Measurement Techniques" course at Indian Institute of Science, Jan-Jun 2014. **One** Masters (M.tech.) project on pressure calibration project, **One** Undergraduate (B.E.) project on high voltage pulse generation using SiC MOSFET and **Two**, Undergraduate projects on sensor integration with embedded controller

K B Vinaya Kumar

Scientific Honors, Awards and Recognitions:

1. R&D 100 Award-2017 Finalist "MEMS-ACCEL-Microelectromechanical-Systems-Based Particle Accelerator", USA
2. Best Ph.D. Thesis award from Institute for Smart Structures and Systems (**ISSS**), India, 2015
3. Work appeared in the **cover page of "Journal of Micromechanics and Microengineering**" 26, no. 6, 2016
4. Work appeared in the **cover page of "*Review of Scientific Instruments Journal",*** Vol 88 no. 6, 2017
5. Recipient of International **Travel Grant** from "Department of Science and Technology (DST)" Government of India and Center for International Co-operation of Science (CICS) for attending "Workshop on Enabling Future Health Care: The Role of Micro and Nano technologies", NAPA, USA, August 23rd to 26th 2015.
6. Recipient of International **Travel Grant** from "Indian Council for Medical Research (ICMR)" Government of India for attending "Workshop on Enabling Future Health Care: The Role of Micro and Nano technologies", NAPA, USA, August 23rd to 26th 2015.
7. Recipient of the "**GARP fund**" from Indian Institute of Science (IISc) for attending the Sensors in Medicine conference, London, UK, March 24th – 26th 2015.
8. **Scholarship** during Ph.D. tenure from "Ministry of Human Resource and Development (MHRD)", Government of India, from August 2011 to July 2015.

Invited talks:

1. Electron Devices Society, Cornell University, USA, September 2016 Title: "Microneedle and Micropump-based Transdermal Drug Delivery system"
2. University of Bradford, Bradford, UK, March 2015 Title: "Solid and Hollow Microneedle to improve the transdermal drug delivery"

Active peer reviewer:

IEEE sensor conference series (2017), Microelectronics Engineering journal, Micromachines.

Patents:

1. Thomas Schenkel, Amit Lal, Arun Persaud, Qing Ji, Peter Seidl, Will Waldron, Serhan Ardanuc, **K B Vinayakumar**, "Particle accelerator apparatus, methods, and applications" WO2017192834A1
2. K. Rajanna **,** N.S Dinesh **, K B Vinayakumar**, Naveen Kumar G, and M. M. Nayak, *"Portable low pressure calibration device"* **6728/CHE/2014,** filed Indian Patent

Publications in Journal/Proceedings:

1. **K B Vinayakumar**, Ved Gund, Amit Lal "Miniaturized Low Power Vacuum Pump Using Pyroelectric Crystal", Manuscript in preparation for **Applied Physics Letter**
2. **K. B. Vinayakumar**, S. Ardanuc, A. Persaud, P. A. Seidl, Q. Ji, T. Schenkel, A. Lal "Demonstration of waferscale on-board voltage amplifier and electrostatic quadrupole focusing array for compact linear accelerators" Manuscript in preparation for **IEEE Transaction on Instrumentation and Measurement**.
3. Ved Gund, Alexander Ruyack, Amanda Leonardi, **K. B. Vinayakumar**, Chris Ober, and Amit Lal "Electronic Singulation of Silicon Pillars from Flexible Substrates Utilizing Vaporizable Polymer" Manuscript in preparation for **Advanced Materials**
4. P.A. Seidl,A. Persaud,W. Ghiorso, Q. Ji, W.L. Waldron, T. Schenkel, A. Lal, and **K.B. Vinayakumar** "Demonstration of a compact linear accelerator" ***Review of Scientific Instruments,*** Vol 89, 053302 (2018)
5. **K. B. Vinayakumar**, A. Persaud, P. A. Seidl, Q. Ji, W. L. Waldron, T. Schenkel, S. Ardanuc, and A. Lal "Waferscale Electrostatic Quadrupole Array for Multiple Ion Beam Manipulation**" IEEE MEMS 2018**, Belfast, Northern Ireland, UK, 21-25 January 2018
6. V. Gund , A. Ruyack, **K B Vinayakumar**, C. K. Ober, A. Lal "Individually detachable polymer-silicon micro-parts for vaporizable electronics" Solid-State Sensors, Actuators and Microsystems (**TRANSDUCER**S), 2017 19th International Conference, Taiwan
7. A. Persaud, Q. Ji, E. Feinberg, P.A. Seidl, W.L. Waldron, T. Schenkel, A. Lal, **K B Vinayakumar**, and S. Ardanuc, "A compact linear accelerator based on a scalable microelectromechanical-system RF-structure" ***Review of Scientific Instruments,*** Vol 88 no. 6, (2017) **(Cover Page)**
8. A. Persaud, P. A. Seidl, Q. Ji, W. L. Waldron, T. Schenkel, S. Ardanuc, **K. B. Vinayakumar**, Z.A. Schaffer, A. Lal, "*A compact MEMS-based ion accelerator"* **Physics Procedia**, 2017, Vol 90
9. **K B Vinayakumar**, V. Gund, N. Lambert, S. Lodha, and A. Lal, *"Enhanced Lithium Niobate based pyroelectric ionization for chip-scale ion mobility-based gas sensing"*, **IEEE Sensors**, 2016 USA
10. Anitha Shiva, Nagaraj K.S, Karthik J, **K.B.Vinayakumar**, G.M. Hegde and K. N Bhat, "Fabrication of nanoindents on pdms for drug delivery" Accepted in **ISSS journal of micro and smart systems**.

11. **K B Vinayakumar**, K Rajanna, NS Dinesh and MM Nayak, "*Out-of-plane cup shaped stainless steel microneedle array for drug delivery*" **IEEE NEMS**, 2016 Japan
12. **K B Vinayakumar**, Girish nadiger, Vikas r shetty, N.S Dinesh, M.M Nayak and K Rajanna, "*Packaged peristaltic Micropump for Controlled Drug Delivery Application*" ***Review of Scientific Instruments*** 88, no.1 (2016)
13. **K B Vinayakumar**, Prachit G. Kulkarni, M. M. Nayak, N. S. Dinesh, Gopalkrishna M. Hegde, S. G. Ramachandra, and K. Rajanna. "*A hollow stainless steel microneedle array to deliver insulin to a diabetic rat*." ***Journal of Micromechanics and Microengineering*** 26, no. 6 (2016): 065013 **(Cover Page)**
14. **K B Vinayakumar**, G. Naveen Kumar, M. M. Nayak, N. S. Dinesh, and K. Rajanna. "*Peristaltic pump-based low range pressure sensor calibration system*." ***Review of Scientific Instruments*** 86, no. 11 (2015): 115113.
15. **K B Vinayakumar,** G. M. Hegde, M. M. Nayak, N.S Dinesh, K. Rajanna, *"Development of Cup Shaped Microneedle Array for Transdermal Drug Delivery"* **Biointerphases** 10(2), June 2015, 021008-1.
16. **K B Vinayakumar**, G. M. Hegde, M. M. Nayak, N.S Dinesh, K. Rajanna, *"Fabrication and characterization of gold coated hollow silicon microneedle array for drug delivery"* **Microelectronic Engineering** 128 (2014) 12–18
17. **K B Vinaya Kumar**, M. M. Nayak, N.S Dinesh, K. Rajanna, *"Characterization and Performance Study of Packaged Micropump for Drug Delivery"* 8th International Microsystems, Packaging, Assembly and Circuits Technology Conference (**IMPACT**) Taipei, Taiwan on Oct 22-25, 2013.

Oral/Poster Presentations:

1. Q Ji, A Persaud, PA Seidl, WL Waldron, T Schenkel, S Ardanuc, **K B Vinayakumar**, A Lal " Acceleration of Ion Beams using a scalable microelectronmechanical-system-based RF structures", 17th International Conference on Ion Sources, CERN, Geneva, Oct 2017
2. A Persaud, PA Seidl, Q Ji, WL Waldron, T Schenkel, S Ardanuc**, K B Vinayakumar**, ZA Schaffer, A Lal *"MEMS based ion beams for fusion*" **APS Meeting**, 2016 USA
3. **K B Vinayakumar**, S Souravi, S Anitha, G M Hegde, M M Nayak, N S Dinesh, K Rajanna, *"Tip Functionalized Polymer Microneedle Array for Transdermal Drug Delivery"*, **IWPSD**, December 7-10, 2015 at IISc, Bangalore
4. **K B Vinaya Kumar**, M. M. Nayak, N.S Dinesh, K. Rajanna, *"Microneedle and Micropupm-based Precision Drug Delivery System"*, Workshop on Enabling Future Health Care: the Role Micro and Nano Technology, **NAPA**, USA August 24-26, 2015
5. **K B Vinaya Kumar** M. M. Nayak, N.S Dinesh, K. Rajanna*. "Out-Of-Plane Microneedle Array for Drug Delivery"* **Sensors in Medicine**, London, UK, March 24– 26, 2015
6. **K B Vinayakumar,** G.Naveen kumar, M.M.Nayak, N.S.Dinesh and K.Rajanna*, "Pressure Calibrator Using Peristaltic Micropump"* **seventh ISSS** International Conference on Smart Materials, Structures and Systems, Bangalore, India July 08 -11, 2014.
7. **K B Vinaya Kumar,** G. M. Hegde, M. M. Nayak, N.S Dinesh, K. Rajanna, *"Microneedle Technology For Transdermal Drug Delivery"* **Sixth ISSS** National Conference on MEMS, Smart Materials, Structures and Systems which will be held at R&DE (Engrs) Pune on Sept 6-7, 2013.
8. **K B Vinaya kumar,** K. Kiran Kumar, V.A.P Sharma, N.Balashanmugam, G.M.Hegde, K.Rajanna, M.M.Nayak, N.S Dinesh. *"Metal microneedle precision fabrication technology and limitations"* **CMTI** organized First National Conference on Micro and Nano fabrication from Jan 21-23, 2013 Bangalore, India **(Cover Page)**
9. **K B Vinaya Kumar,** N. P. Vamsi Krishna, Suma B. N, G. M. Hegde, K. Rajanna, M. M. Nayak and N.S Dinesh, *"Fabrication of Silicon and Stainless Steel Microneedles for Bio-compatibility Packaging Applications",* **NCEDA**R 2012 organized by IPC India on at J N Tata Auditorium, IISc Bangalore, India.
10. **K. B. Vinayakumar** , J. Manjanna, G.D. Prasanna, H.S. Jayanna, H. C. Barshilia, S. Kobayashi *"Formation of supeparamagnetic CuO cluster of nanoparticles"* **NanoSEC 2011** Organized by Indian Ceramic society, IISc, Bangalore. India.
11. **K. B. Vinayakumar**, J. Manjanna, S. Kobayashi and H.C. Bela, "Superparamagnetic behavior of antiferromagnetic Cuo nanoclusters" **NCNM 2010**, Palakkad, Kerala, India.

Media and Press Interest:

*"***Taking the sting off needles***" published in the daily newspaper* ***The Hindu*** *on Aug 25, 2014,*
*"***Microneedle that stings less"** *published in* ***The New Indian Express*** *on Aug 24, 2014*