RAJESH KAPPERA

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SUMMARY

- **2014 MRS Graduate Student Gold Award**
- **First author Nature Materials** and **Invited paper** in APL Materials
- **6 Conference presentations** in MRS and APS Symposiums
- **Ph.D. in Electrical Engineering** at Rutgers University, NJ
- **Faculty Guest Researcher** at Los Alamos National Laboratory, NM
- **Research Excellence Award** from ECE department, Rutgers University
- **2 years industrial experience** in the R & D department of **EPV Solar, NJ**
- **Master of Science in Electrical Engineering** from Villanova University, PA
- **Fundamentals of Engineering** (FE/EIT) certification
- Expertise on **SEM, AFM, Raman, XPS, Photo and e-beam lithography**

EDUCATION

Doctor of Philosophy in Electrical Engineering — GPA: **4.0/4.0**
Rutgers University, NJ — Jan 2010 - Present

Master of Science in Electrical Engineering — GPA: **3.89/4.0**
Villanova University, PA — Dec 2008

Bachelor of Engineering in Electrical Engineering
Osmania University, Hyderabad, India — May 2006

SELECTED PUBLICATIONS

- **Phase-Engineered low-resistance contacts for ultra-thin MoS_2 transistors**, ***R. Kappera***, D. Voiry, S.E. Yalcin, B. Branch, G. Gupta, A.D. Mohite and M. Chhowalla. **Nature Materials**, doi: 10.1038/nmat4080
- **Covalent functionalization of monolayered transition metal dichalcogenides by phase engineering**, D. Voiry, A. Goswami, ***R. Kappera***, C. C. Silva, T. Fujita, M. Chen and M. Chhowalla, **Nature Chemistry**, doi: 10.1038/nchm.2108
- **High performance 2D TMD field effect transistors with metallic 1T phase contacts*, R. Kappera***, D. Voiry, S. Lei, W. Jen, P.M. Ajayan, G. Gupta, A.D. Mohite and M. Chhowalla, *in preparation*
- **Spatially resolved photoexcited charge carrier dynamics in monolayer MoS_2,** H. Yamaguchi, J-C Blacon, ***R. Kappera***, S. Najmaei, S. Lei, B. D. Mangum, P.M. Ajayan, M. Chhowalla and A. D. Mohite. *Accepted ACS Nano*
- **Origin of high catalytic activity in Molybdenum disulfide nanostructures following chemical intercalation,** D. R. Cummins, U. Martinez, ***R. Kappera***, J. Jacenski, D. Kelly, M. Chhowalla and M. K. Sunkara. *Submitted to ACS Nano*
- **Imaging charge transport pathways in progressively reduced graphene oxide using electrostatic force microscopy, S. E. Yalcin, C. Galande, *R. Kappera***, A. M. Dattelbaum, M. Chhowalla and A.D. Mohite. *Submitted to ACS Nano*
- **Metallic 1T Phase Source/Drain Electrodes for CVD MoS_2 Field Effect transistors**, ***R. Kappera***, D. Voiry, S.E. Yalcin, J. Lou, P.M. Ajayan, G. Gupta, A.D. Mohite and M. Chhowalla. **APL Materials (invited article)**, 2014, 2, pp 092516
- **Evolution of the Electronic Band Structure and Efficient Photo-Detection in Atomic Layer of InSe**, S. Lei, L. Ge, S. Najmaei, A. George, ***R. Kappera***, J. Lou, M. Chhowalla, H. Yamaguchi, G. Gupta, R. Vajtai, A. D. Mohite, P. M. Ajayan. **ACS Nano**, 2014, 8, pp 1263
- **Axonal Alignment and Enhanced Neuronal Differentiation of Neural Stem Cells on Graphene-Nanoparticle Hybrid Structures**, A. Solanki, S-T. Chueng, P. T. Yin, ***R. Kappera***, M. Chhowalla and K-B. Lee. **Advanced Materials**, 2013, 35, pp 5477

SYMPOSIUM PRESENTATIONS

- **High performance MoS_2 field effect transistors with phase engineered low resistance contacts**, ***R. Kappera***, D. Voiry, S.E. Yalcin, B. Branch, G. Gupta, A.D. Mohite and M. Chhowalla. **2014 MRS Fall** Symposium J
- **Enhanced transport in chemically vapor deposited monolayer MoS_2 with metallic phase source/drain contacts**, ***R. Kappera***, D. Voiry, S. Lei, S. E. Yalcin, W. Jen, S. Najmaei, J. Lou, P.M. Ajayan, G. Gupta, A.D. Mohite and M. Chhowalla. **2014 MRS Fall** Symposium J
- **Monolayered Transition Metal Dichalcogenides Field Effect Transistors with Ohmic Metallic 1T Phase contacts**, ***R. Kappera***, D. Voiry, S. Lei, S. Najmaei, S.E. Yalcin, J. Lou, P.M. Ajayan, G. Gupta, A.D. Mohite and M. Chhowalla. **2014 MRS Spring** Symposium NN: 2D Materials and Devices beyond Graphene
- **Exploiting Semiconductor to Metallic Phase Transformation in Layered Transition Metal Dichalcogenides for Ohmic metallic contacts**, ***R. Kappera***, D. Voiry, W. Jen, S.E. Yalcin, G. Gupta, A.D. Mohite and M. Chhowalla. **2014 APS Physics March** meeting, Session Q37: Beyond Graphene Devices: Function, Fabrication and Characterization

- **Monolayered MoS_2 Field Effect Transistors with Ohmic Metallic 1T Phase Contacts**, ***R. Kappera***, D. Voiry, Hisato Yamaguchi, G. Gupta, A.D. Mohite and M. Chhowalla. **2013 MRS Fall** Symposium RR: Large-Area Graphene and Other 2D-Layered Materials – Synthesis, Properties and Applications
- **Solution Processed Layered Transition Metal Oxide Thin Films**, ***R. Kappera***, D. Voiry, D. Alves, M. Acerce and M. Chhowalla, **2012 MRS Fall** Symposium F: Oxide thin films for Renewable Energy applications

TECHNICAL SKILLS

- **Programming Languages**: C, C++
- **Tools**: MATLAB, Simulink, LabView, OriginLab, MS Office
- **Spectroscopy**: FTIR, Raman, X-ray photoelectron spectroscopy, UV-Visible, Impedance spectroscopy
- **Imaging**: SEM, AFM, Photoluminescence, Scanning photocurrent mapping
- **Characterization**: Electrochemistry, Electrical, Opto-electronic device testing
- **Patterning**: Electron-beam lithography, Photo lithography, Focused ion beam (FIB) patterning
- **Depositions**: CVD, PVD, Thermal evaporation, E-beam evaporation, Sputtering
- Miscellaneous: Manipulations in glove box, all hardware and software trouble shooting

WORK EXPERIENCE

Faculty Guest Researcher, CINT, Los Alamos National Laboratory, Los Alamos, NM *Apr 2013 - Present*

***FOCUS**: Two dimensional materials growth and characterization*

- **Chemical vapor deposition** of MoS_2, WS_2 and a hybrid material $MoWS_2$
- High **precise local phase transformation** of transition metal dichalcogenides (TMDs) nanosheets
- **Electrical characterization** of various materials by device fabrication through lithography
- Careful analysis of **transmission line measurements (TLM)** to extract contact resistance
- **Low temperature measurements** to extract Schottky barrier height and investigate **metal-insulator transition** in monolayer MoS_2 devices
- **Photoluminescence and Scanning photocurrent mapping** of Graphene and TMD devices
- Study of **Opto-electronic** properties of monolayer MoS_2 and WS_2 devices
- **Catalytic properties** of monolayer TMDs and its dependence on structural and phase variations
- **Organic Photovoltaic and Perovskite solar cell** fabrication and testing

Doctoral Research Assistant, Electrical Engineering Dept., Rutgers University, NJ *Jan 2010 - Present*

***FOCUS**: Two dimensional materials growth, synthesis and characterization*

- **Chemical vapor deposition** of Graphene
- **Solution processing** of Graphene Oxide, TMDs (MoS_2, WS_2, $MoSe_2$, WSe_2) and their corresponding oxides (MoO_3 and WO_3)
- **Phase transformation of TMDs** from semiconducting to metallic phase and vice-versa
- **Raman Spectroscopy** to analyze atomic structure of various materials
- **Photoconductivity & Photoluminescence** of 2-D materials such as MoS_2 and WS_2
- Processing of thin film materials for enhanced efficiencies in **organic photovoltaics**
- Study of thin films such as graphene, graphene oxide and molybdenum disulfide for **biosensing applications**
- Study of graphene as an electrode material in **thick film energy conversion devices**
- Introduction of novel **quantum dots/hybrid nanostructures** to enhance opto-electronic properties of thin films
- Growth of **semiconducting nanofibers** of various materials through the process of electro-spinning

Teaching Assistant, Electrical Engineering Dept., Rutgers University, NJ

Course: 14:332:336 Digital Electronics (Course, Lab), 16:332:361 Electronic Devices (Course, Lab)

- Conduct Recitations where lectures were reviewed
- Supervise lab sessions where project activities were performed
- Hold office hours in which students' queries were answered

Research Engineer, R & D Department, EPV Solar, Lawrenceville, NJ *June 2008 - Jan 2010*

Job Function: Current-Voltage (***IV***) Measurements, Quantum Efficiency (***QE***) Measurements, Accelerated Light Soaking (***ALS***) Measurements**,** data analysis and reports to enhance yield of high efficiency solar modules

- Determined all **electrical and optical characteristics of thin film solar cells**
- Designed apparatus for IV measurements of various semiconductor devices
- Worked on various material etching such as Aluminum, Silicon, Zinc oxide, Tin oxide.
- Interfaced with R&D PECVD, TCO and device group to generate ideas for better product development
- Familiar with operation of various **Physical and Chemical vapor deposition (PVD, CVD) systems**
- Experienced in **Laser scribing** of solar modules

Research Assistant, Electrical Engineering Dept., Villanova University, PA *Sep 2006 - May 2008*

Project – "**Mission and Sensor Fusion based Autonomous Control Development**"

This work was aimed at the development of a platform which can send path signals to autonomous vehicles to reach the target avoiding the obstacles on the path. This project was funded by the **Office of Naval Research**.

- Developed a fuzzy logic based **obstacle and collision avoidance algorithm**
- Validated system stability, survivability, and real-time collision avoidance of the **fuzzy logic based distributed control architecture** theoretically and through simulation
- Developed a **Multiple Input Multiple Output (MIMO) model** which allows the navigation computations to be multiplexed providing the capability to adapt to different environments and mission
- Integrated various hardware components and computer system configuration items to implement the algorithm for demonstration on **mobile robot platforms**

Project Lead, Autonomous Surface Vehicle Competition (ASVC), Orlando Florida *May 2007 - Aug 2007*

- Led a group of graduate and undergraduate students to build an autonomous surface vehicle
- Competition held by Unmanned Vehicle systems International (AUVSI) and Office of Naval Research (ONR)
- Won the **best presentation and best design award**

ACHIEVEMENTS and **ACTIVITIES**

- **2014 MRS Fall Graduate Student Gold Award**
- Rutgers ECE **Research Excellence** award
- Rutgers ECE **Outstanding graduate student** award
- **Fundamentals of Engineering (FE) Certification**
- **Judge for North Jersey Regional Science Fair** at Rutgers
- **Session leader** for Rutgers International student orientation
- **Teaching** and **Research assistantship** in at Rutgers and Villanova University
- **Volunteer cultural leader** for Indian associations at Rutgers and Villanova University
- **Tuition scholarship** for entire bachelors program as a reward for academic excellence
- Excellent **Time management** and **Leadership skills**

REFERENCES

Prof. Manish Chhowalla, Department of Material Science and Engineering, Rutgers University, Tel: +1 (732) 445-5619, manish1@rci.rutgers.edu

Prof. Andrea Ferrari, Nanomaterials and Spectroscopy group, Department of Engineering, University of Cambridge, Tel: +44 – 1223 - 748351, acf26@eng.cam.uc.uk

Dr. Andrew Dattelbaum, Group leader, Material physics and device applications (MPA-11) division, Los Alamos National laboratory, Tel: +1 (505) 665 0142, amdattel@lanl.gov

Prof. Alexander Balandin, Department of Electrical Engineering, University of California, Riverside Tel: +1 (909) 787 2425, balandin@ece.ucr.edu