ALEXANDER A. BALANDIN

Distinguished Professor, Department of Electrical and Computer Engineering
University of California Presidential Chair Professor
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EDUCATION AND PROFESSIONAL PREPARATION

- Postdoctoral Research, University of California - Los Angeles, USA, 1997 – 1999
- Ph.D. in Electrical Engineering, University of Notre Dame, Notre Dame, USA, 1996
- M.S. in Electrical Engineering, University of Notre Dame, Notre Dame, USA, 1995
- M.S. in Applied Physics, Moscow Institute of Physics and Technology, Russia, 1991
- B.S. in Mathematics, Moscow Institute of Physics and Technology, Russia, 1989

RESEARCH INTERESTS

Advanced materials and nanostructures for applications in electronics, optoelectronics and energy conversion; alternative computational paradigms; emerging devices; Raman and Brillouin spectroscopy; graphene and carbon materials; nanoscale phonon engineering and thermal transport; electronic noise in devices – ***both theory and experiment***

EMPLOYMENT HISTORY

- Distinguished Professor (2016 – present), Department of Electrical and Computer Engineering, University of California – Riverside (UCR), Riverside, California, USA
- University of California Presidential Chair Professor (2013 – present), Department of Electrical and Computer Engineering, University of California – Riverside (UCR), Riverside, California, USA
- Founding Chair (2006 – 2011), Materials Science & Engineering, University of California – Riverside (UCR), Riverside, California, USA
- Visiting Professor (2005 – 2006), Department of Engineering, University of Cambridge, Cambridge, United Kingdom
- Professor (2005 – 2016), Department of Electrical and Computer Engineering, University of California – Riverside (UCR), Riverside, California, USA
- Associate Professor (2001 – 2005) Department of Electrical Engineering, University of California – Riverside (UCR), California, USA

- Assistant Professor (1999 – 2001), Department of Electrical Engineering, University of California – Riverside (UCR), California, USA
- Research Engineer (1997 – 1999), Electrical Engineering Department, University of California – Los Angeles (UCLA), Los Angeles, California, USA
- Research Associate (1996 – 1997), Department of Electrical Engineering, University of Nebraska – Lincoln (UNL), Lincoln, Nebraska, USA
- Research & Teaching Assistant (1993 – 1996), Department of Electrical Engineering, University of Notre Dame (ND), Notre Dame, Indiana, USA
- Research Engineer (1991 – 1993), Moscow Institute of Physics and Technology (MIPT) and The Russian Space Agency (RSA), Moscow, Russia
- Research Assistant (1989 – 1991), Institute of Radio-Engineering and Electronics (IREE), Russian Academy of Sciences (RAS), Moscow, Russia

SELECTED AWARDS AND RECOGNITIONS

- Thomson Reuters Highly Cited Researcher (Category: Physics), 2015, 2016
- Deputy Editor-in-Chief, Applied Physics Letters (APL), 2016 – present
- Fellow of MRS – The Materials Research Society, 2014
- The MRS Medal – The Materials Research Society, 2013
- Fellow of IEEE – The Institute of Electrical and Electronics Engineering, 2013
- Fellow of APS – The American Physical Society, 2012
- Fellow of IOM3 – The Institute of Materials, Minerals and Mining, U.K., 2012
- Fellow of IOP – The Institute of Physics, U.K., 2012
- The Pioneer of Nanotechnology Award – IEEE, 2012
- Fellow of SPIE - The International Society for Optical Engineering, 2011
- Fellow of OSA - The Optical Society of America, 2011
- Invited Lecturer, IEEE Chapter, California, USA, 2010
- Semiconductor Research Corporation (SRC) Inventor Award, USA, 2009, 2010
- Distinguished Visiting Professor, Astrakhan State University, Russia, 2009
- Fellow of AAAS - The American Association for Advancement of Science, 2007
- Distinguished IEEE Lecturer, University of Texas, Arlington, USA, 2006
- Distinguished Lecturer, CNRS, Pierre and Marie Curie Institute, Paris, France, 2005
- Visiting Professor of Engineering, University of Cambridge, UK, 2005
- Visiting Fellow, Pembroke College, University of Cambridge, UK, 2005
- Office of Naval Research (ONR) Young Investigator Award, Arlington, USA, 2002
- National Science Foundation (NSF) Faculty CAREER Award, 2001
- University of California Regents Faculty Award, USA, 2000
- US Civil Research and Development Foundation (CRDF) Award, Arlington, USA, 1999
- Merrill Lynch Innovative Engineering Research Award, WTC, New York, USA, 1998
- Who's Who in Science and Engineering, Editions 1997 – present
- Outstanding Teaching Assistant Award, University of Notre Dame, USA, 1996
- Elected Member, *Eta Kappa Nu* Engineering Honor Society, 1994
- Yong Scientist Award, A. Popov Radio Society Conference, Moscow, Russia, 1992

- *Summa Cum Laude*, Moscow Institute of Physics and Technology (MIPT), Russia, 1991

SELECTED PLENARY LECTURES, KEYNOTE AND INVITED TALKS

- Invited Talk "Transition from quasi-2D to quasi-1D van der Waals materials: Electronic properties of monoclinic $TaSe_3$ capped with BN layers", *Materials Research Society (MRS) Spring Meeting*, Phoenix, Arizona, USA, 2017
- Invited Talk "Properties and device applications of two-dimensional charge density wave materials", *Materials Research Society (MRS) Spring Meeting*, Phoenix, Arizona, USA, 2017
- Invited Talk, "2D and 1D van der Waals materials and devices," *Robert C. Haddon Memorial Symposium*, University of California, Riverside, California, USA, 2017
- Invited Talk, "Phonons and magnons in NiO," *Workshop of the DOE Center Spins and Heat in Nanoscale Electronic Systems* (SHINES), Palm Desert, California, USA 2017
- Keynote Talk, "Graphene thermal management technologies: State-of-the-art and future prospects," *Graphene World Summit*, San Diego, California, USA, 2016
- Invited Talk, "Direct observation of the acoustic phonon spectrum modification in individual free-standing semiconductor nanowires," *Workshop on Innovative Nanoscale Devices and Systems* (WINDS), Kona, Big Island, Hawaii, USA, 2016
- Invited Talk, "Thin film transistors with 2D materials for selective gas sensing," *Semiconductor Technology for Ultra Large Scale Integrated Circuits and Thin Film Transistors* - V (ULSI-TFT), Lake Tahoe, California, USA, 2015
- Invited Talk, "Graphene based thermal coatings," *The International Conference on Metallurgical Coatings and Thin Films* (ICMCTF) – Symposium on 2D Materials, San Diego, USA, 2015
- Invited Talk, "Graphene heat spreaders and interconnects for advanced electronics," *Semiconductor Technology for Ultra Large Scale Integrated Circuits and Thin Film Transistors* - V (ULSI-TFT), Lake Tahoe, California, USA, 2015
- Invited Talk, "Low-frequency current fluctuations and 1/*f* noise in graphene," *Graphene Week*, Gothenburg, Sweden, 2014
- Invited Talk, "Graphene chemical and gas sensors," CIMTEC 2014 - *13th International Conference on Modern Materials and Technologies - 6th Forum on New Materials*, Montecatini Terme, Florence, Italy, 2014
- Invited Talk, "Graphene applications in thermal interface material," *Fifteenth International Conference on the Science and Applications of Nanotubes*, University of Southern California, Los Angeles, USA, 2014
- Invited Talk, "1/*f* Noise in graphene devices," *Fifteenth International Conference on the Science and Applications of Nanotubes*, University of Southern California, Los Angeles, USA, 2014
- Plenary Lecture, "Phonons in Graphene and van der Waals Materials" *Materials Research Society (MRS) Fall Meeting*, Boston, USA, 2013
- Keynote Conference Opening Talk, "Phononics in low-dimensional materials," *International CECAM Workshop Nanophononics*, University of Bremen, Germany, 2013
- Plenary Conference Opening Talk, "Thermal properties of graphene and applications in energy management," *Advancements in Thermal Management*, Denver, USA, 2013

- Invited Talk, "Graphene applications for thermal management of Li-ion batteries," *5th Symposium on Graphene, Ge/III-V, and Emerging Materials for Post-CMOS Applications*, Electrochemical Society (ECS), Toronto, Canada, 2013
- Keynote Invited Lecture, "Thermal properties of graphene: applications in thermal management," *PHONONS 2012*, University of Michigan, Ann Arbor, USA, 2012
- Plenary Lecture, "Properties and applications of graphene," *IEEE NANO – 11th International Conference on Nanotechnology*, Portland, Oregon, USA, 2011
- Plenary Lecture, "Nanoscale phonon engineering," *PHONONICS – International Conference on Phononic Crystals, Metamaterials and Optomechanics*, Santa Fe, New Mexico, USA, 2011
- Invited Talk, "Phonon transport in graphene," *The International Conference on the Science and Applications of Nanotubes* (NT11) , University of Cambridge, Cambridge, UK, 2011
- Keynote Talk, "Graphene applications for thermal management," *Graphene: Road to Applications*, Nature Publishing Group Conference, Boston, USA, 2011
- Invited Tutorial Talk, "Thermal conductivity of graphene: Prospects of thermal management applications," *Semi-Therm Conference*, San Jose, USA, 2011
- Invited Talk, "Electrical and noise characteristics of graphene transistors and sensors," *SPIE Smart Structures Conference*, San Diego, USA, 2011
- Invited Talk, "Graphene applications in thermal interface materials," *3rd Symposium on Graphene, Ge/III-V, and Emerging Materials for Post-CMOS Applications*, Electrochemical Society (ECS), Montreal, Canada, 2011
- Keynote Lecture, "Thermal properties of graphene," *Graphene 2011 Conference – Imagine Nano*, Bilbao, Spain, 2011 – the largest European event in Nanoscience and Nanotech
- Invited Lecture, "Phonon and thermal properties of graphene," *International Winter School on Electronic Properties of Novel Materials* (IWEPNM), Tirol, Austria, 2011
- Invited Talk, "Phonon transport in graphene materials and devices," *Symposium on Nanoscale Heat Transport – From Fundamentals to Devices*, Materials Research Society (MRS) Spring Meeting, San Francisco, California, USA, 2011
- Invited Talk, "Phonon engineering with graphene," *Massachusetts Institute of Technology Japan – U.S. Joint Seminar on Nanoscale Transport Phenomena* (MIT-NTP), Tokyo, Japan, 2011
- Invited Talk, "Graphene applications in interconnects and heat spreaders," *International Conference on Solid State Devices and Materials* (SSDM), The University of Tokyo, Tokyo, Japan, 2010
- Keynote Lecture, "Phonon engineering: From nanowires and quantum dots to graphene and topological insulators," *ICREA Workshop on Phonon Engineering*, St Feliux de Guixol, Barcelona, Spain, 2010
- Invited Talk, "Graphene-like" exfoliation of atomically-thin films of Bi_2Te_3 and related materials: Applications in thermoelectrics and topological Insulators," *Symposium on Compound Semiconductors*, Electrochemical Society (ECS), Las Vegas, USA, 2010
- Invited Talk, "New carbon materials for thermal management," *SRC Carbon Based Electronics Workshop*, University of Albany – SUNY, Albany, New York, USA, 2010
- Keynote Lecture, "Thermal conductivity of graphene and carbon materials," *International Workshop on Nanocarbon Photonics and Optoelectronics* (NPO) North Karelia, Finland, 2010

- Invited Talk, "Extraordinary thermal conductivity of graphene: Applications in thermal management," *2nd Symposium on Graphene, Ge/III-V, and Emerging Materials for Post-CMOS Applications*, Electrochemical Society (ECS), Vancouver, Canada, 2010
- Invited "Upgraded" Talk, "Properties of mechanically exfoliated atomically-thin films of bismuth telluride," *Conference on the Physics and Chemistry of Surfaces and Interfaces* (PCSI), Santa Fe, New Mexico, USA, 2010
- Invited "Session Opening" Talk, "Phonon transport in graphene," Session on Thermal Properties of Graphene, *Symposium on Graphene Materials and Devices*, Materials Research Society (MRS) Spring Meeting, San Francisco, California, USA, 2010
- Invited Lecture on Nanotechnology, "New materials for thermal management," *The Applied Power Electronics Conference and Exposition* (APEC) and *Inaugural Public Nanotechnology Initiative*, Palm Springs, California, USA, 2010
- Keynote Lecture, "Graphene properties and possible micro- and nano-device applications," *NATO Advanced Research Workshop* (ARW) on *Advanced Materials and Technologies for Micro/Nano-Devices, Sensors and Actuators*, St. Petersburg, Russia, 2009
- Keynote "Opening" Lecture, "Thermal conductivity of graphene," Joint Session of *The Joint 30th International Thermal Conductivity Conference* (ITCC) and *The 18th International Thermal Expansion Symposium* (ITES), Seven Springs Mountain Resort, Pennsylvania, USA, 2009
- Plenary Lecture, "Thermal conductivity of graphene," *9th Biennial International Conference on Fullerenes and Atomic Clusters*, The Russian Academy of Sciences (RAS) and The Russian Foundation for Basic Research (RFBR), St. Petersburg, Russia, 2009
- Invited "Session Opening" Talk, "Phonon engineering with graphene and graphene multi-layers," Session on Phonon Transport in Nanostructures, *Symposium on Phonon Engineering for Enhanced Materials Solutions*, Materials Research Society (MRS) Fall Meeting, Boston, Massachusetts, USA, 2009
- Invited Lecture, "Thermal conductivity of graphene," *The Graphene Week Conference*, The European Science Foundation (ESF), Obergurgl, Austria, 2009
- Keynote "Opening" Lecture, "Graphene properties and possible device applications," *The International Symposium on Graphene Devices: Technology, Physics, and Modeling* (ISGD), Aizu-Wakamatsu, Japan, 2008
- Keynote Talk, "Development of the high-efficiency nanostructure-based solar cells," *UC-Riverside – Tohoku University Tech Horizons Conference*, Riverside, California, USA, 2008
- Invited "Symposium Opening" Talk, "Nanoscale phonon engineering: From nanowire transistors to graphene devices," *Symposium on Phonon Engineering - Theory and Applications*, Materials Research Society (MRS) Fall Meeting, Boston, Massachusetts, USA, 2007
- Invited Talk, "Extremely high thermal conductivity of graphene," *Zing Nanomaterials Conference*, Playa del Carmen, Cancun, Mexico, 2008
- Keynote Lecture, "Carrier transport in quantum dot superlattices: Applications in solar cells and thermoelectric," *The Aerospace Corporation – NASA Space Power Workshop* (SPW), Los Angeles, California, USA, 2007
- Invited Talk, "Phonons in semiconductor quantum dot materials," *Symposium on Quantum Dot Physics and Materials*, The International Society for Optical Engineers (SPIE) *Optoelectronics: Quantum Dots and Nanoclusters*, San Jose, California, USA, 2007

- Invited Talk, "Optimization of electron and phonon transport in quantum dot superlattices for thermoelectric applications," *The 2nd International Energy Nanotechnology Conference*, American Society of Mechanical Engineers (ASME), Santa Clara, California, USA, 2007
- Invited Talk, "Phonon engineering in nanowires with the acoustically mismatched barrier shells," *Symposium on Nanoscale Heat Transport - From Fundamentals to Devices*, Materials Research Society (MRS) Spring Meeting, San Francisco, California, USA, 2007
- Invited Talk, "Phonons and phonon engineering in nanostructures: From nanowire transistors to graphene devices," *Virtual Conference on Nanoscale Science and Technology* (VC-NST), Fayetteville, Arkansas, USA, 2007
- Invited Talk, "Modeling-based optimization of the quantum dot solar cells," *UC-Riverside Tech Horizons Conference*, Riverside, California, USA, 2007
- Keynote Lecture, "Solar cell nanotechnology for improved efficiency and radiation hardness," *Symposium on Photonics for Space Environments*, The International Society for Optical Engineering (SPIE), San Diego, California, USA, 2006
- Invited Talk, "Phonon engineering in semiconductor nanowires and quantum dot superlattices," *Workshop on Nano-Technology and Information for Space Applications*, The 2nd IEEE – NASA International Conference on Space Mission Challenges for Information Technology, Pasadena, California, USA, 2006
- Invited Talk, "Phonons in Si nanowires and Si/SiGe quantum dot superlattices," *IEEE Silicon Nanoelectronics Workshop*, Honolulu, Hawaii, USA, 2006
- Keynote Lecture, "Phonon engineering in nano-devices and virus-based nano-templates," *Symposium on Noise and Information in Nanoelectronics, Sensors and Standards*, The International Society for Optical Engineering (SPIE), Austin, Texas, USA, 2005
- Plenary Lecture, *International Conference on Phonon Scattering in Condensed Matter Physics – The 11th PHONONS Conference*, St. Petersburg, Russia, 2004
- Invited Talk, "Computational modeling of electron - phonon spectra in semiconductor quantum dot arrays," *The 3rd International Conference on Computational Modeling and Simulation of Materials* (SIMTEC), Acireale, Sicily, Italy, 2004
- Invited Talk, "Carrier and phonon spectrum in quantum dot superlattices for optoelectronic and thermoelectric applications," *Nanotechnology Conference and Trade Show* (NanoTech), San Francisco, California, USA, 2003
- Plenary Lecture, "Investigation of low-frequency noise in heterostructure field-effect transistors based on wide band gap semiconductors," *The 16th International Conference on Noise in Physical Systems and 1/f Fluctuations* (ICNF), Gainesville, Florida, USA, 2001
- Plenary Talk, "1/f Noise in GaN devices," *The 7th Van der Ziel Symposium on Quantum 1/f Noise and Other Low Frequency Fluctuations in Electronic Devices*, American Institute of Physics (AIP) Conference Series, St. Louis, Missouri, USA, 1999

SELECTED LECTURES AND UNIVERSITY COLLOQUIA

- Distinguished Colloquium Speaker, "Two-dimensional materials: From fancy physics to cool applications," *University of Southern California*, Los Angeles, California, USA, 2015

- Invited Colloquium Speaker, "Two-dimensional materials: From physics to applications," Department of Electrical and Computer Engineering, *University of Texas – Austin*, Texas, USA, 2015
- Invited Speaker, "Thermal properties and applications of graphene," *Chalmers Institute of Technology*, Gothenburg, Sweden, 2014
- Invited Colloquium Speaker, "Phonon engineering in nanostructures and graphene," Department of Mechanical Engineering, *University of California – San Diego*, California, USA, 2014
- Invited Speaker, "Phonon transport in graphene: Applications in thermal management," Skoltech Colloquium Series, *Skolkovo Institute of Technology*, Moscow, Russia, 2014
- Invited Colloquium Speaker, "Two-dimensional materials: Physical properties and practical applications," Department of Electrical Engineering, *University of Houston*, Texas, USA, 2013
- Invites Colloquium Speaker, "Graphene devices: Heat and noise," Materials Science Colloquium, *California Institute of Technology*, Pasadena, California, USA, 2012
- Invited Colloquium Speaker, "Thermal effects in graphene," Mechanical Engineering Colloquium, *University of California – Berkeley*, Berkeley, California, USA, 2012
- Invited Colloquium Speaker, "Noise and heat in graphene devices," Electrical Engineering Colloquium, *University of Notre Dame*, Notre Dame, Indiana, USA, 2012
- Invited Lecture, "Graphene: properties and device applications," *Institute of Science and Technology* (IST), Vienna, Austria, 2011
- Invited Colloquium Speaker, "Properties and applications of graphene," Physical Chemistry Colloquium, *California Institute of Technology*, Pasadena, California, USA, 2010
- Distinguished Lecturer, "Overview of carbon materials and their properties: From diamond to graphene," *Astrakhan State University* (ASU), Astrakhan, Russia, 2010
- Invited Colloquium Speaker, "Two-dimensional phonon transport in graphene," *Helsinki University of Technology* (HUT), Helsinki, Finland, 2009
- Invited Colloquium Speaker, "Raman nanometrology of graphene", Department of Materials Science and Engineering, *UCLA*, Los Angeles, California, USA, 2008
- Invited Speaker, "Nanostructured solar cells," *Tohoku University*, Sendai, Japan, 2007
- Invited Colloquium Speaker, "Semiconductor nanostructures: Properties and applications for the direct energy conversion," Department of Mechanical Engineering, *University of California – Riverside* (UCR), California, 2007
- Invited Speaker, "Properties of semiconductor quantum dot superlattices," Department of Semiconductor Physics, *Moscow State University* (MSU), Moscow, Russia, 2006
- Distinguished Lecturer, "Nanoscale phonon engineering: From concepts to devices applications," *University of Texas – Arlington* (UTA), Texas, USA, 2006
- Distinguished Lecturer, "Nanoscale phonon engineering: Fundamentals and applications," *Prokhorov's General Physics Institute of the Russian Academy of Sciences*, Moscow, Russia, 2006
- Invited Colloquium Speaker, "GaN materials and devices: Traps, noise and heat," Department of Engineering, *University of Cambridge*, Cambridge, UK, 2005
- Distinguished Lecturer, "Phonon engineering at nanoscale," *Pierre and Marie Curie Institute*, CNRS, Paris, France, 2005

- Invited Colloquium Speaker, "Phonon engineering in acoustically mismatched nanowires," Department of Physics, *University of Southern California* (USC), Los Angeles, California, 2005
- Invited Colloquium Speaker, "Phonon engineering in nanoscale devices," Department of Electrical Engineering, *University of California – San Diego* (UCSD), California, 2004
- Invited Colloquium Speaker, "Phonon engineering: Physics and applications," Department of Physics, *University of California – Irvine* (UCI), Irvine, California, 2004
- Invited Colloquium Speaker, "Low-frequency noise in GaN HFETs," Department of Electrical Engineering, *University of Texas – Austin* (UTA), Austin, Texas, 1999

SELECTED INVITED TALKS AT GOVERNMENT AND INDUSTRY

- Invited Speaker, "Nanoscale phonon – magnon engineering and thermal transport," *US Department of Energy (DOE) Review and Workshop*, Washington, DC, USA, 2016
- Invited Speaker, "Graphene and 2D materials applications in thermal management and sensors," *Northrop Grumman Nanotechnology Workshop*, Northrop Grumman, Redondo Beach, California, USA, 2015
- Invited Speaker, "Graphene enhanced thermal interface materials," *Henkel*, Irvine, California, USA, 2015
- Invited Speaker, "Heat and noise van-der-Waals-materials and devices," DARPA – SRC *Center for Function Accelerated nanoMaterial Engineering* (FAME), Los Angeles, USA, 2015
- Invited Speaker, "Graphene applications in thermal management," *Bourns Inc*., Riverside, California, USA, 2014
- Invited Speaker, "Electronic noise in van-der-Waals-materials devices," *DARPA – SRC Center for Function Accelerated nanoMaterial Engineering* (FAME), Los Angeles, USA, 2013
- Invited Speaker, "Energy conversion in Van-der-Waals-materials," *DARPA – SRC Center for Function Accelerated nanoMaterial Engineering* (FAME), UCLA, Los Angeles, USA, 2013
- Invited Speaker, "Low-noise topological insulator and graphene devices," *DARPA – SRC FCRP Program Review and Workshop*, MIT, Boston, Massachusetts, USA, 2011
- Invited Speaker, "Graphene-like" exfoliated topological insulators: Optical, electrical and thermal characterization," *DARPA Workshop on Topological Insulators*, UCLA, Los Angeles, California, USA, 2010
- Invited Speaker, "Graphene heat spreaders and composite substrates for improved thermal management," *Interconnect Focus Center* (IFC) Seminar Series, Semiconductor Research Corporation (SRC) and Georgia Institute of Technology, Atlanta, Georgia, 2010
- Invited Speaker, "Phonon and thermal nanoengineering," *SRC – DARPA Functional Engineered Nano Architectonics Workshop*, Los Angeles, California, USA, 2010
- Invited Speaker, "Overview of DoD funded solar power research at NDL" *South California Research Institute for Solar Energy* (SC-RISE), Riverside, USA, 2010
- Invited Speaker, "Phonon engineering: Innovative approaches for the electron mobility enhancement at nanoscale," *AFOSR Joint Electronics Program Review and Workshop*, US Air Force Office of Scientific Research (AFOSR), Arlington, Virginia, USA, 2009
- Invited Speaker, "Highlights of graphene electronics research," *Intel – SRC – DARPA Advanced Electronics Workshop*, Intel Corporation, Portland, Oregon, 2008

- Invited Speaker, "Carbon materials for thermal management," *SRC – DARPA Functional Engineered Nano Architectonics Workshop*, San Diego, California, 2008
- Invited Speaker, "Acoustic phonon engineering in semiconductor nanostructures," *DARPA Workshop on Nanoscale Phonon Engineering* (NOPE), Arlington, Virginia, USA 2005
- Invited Speaker, "Phonon engineering: From concept to device applications," *NSF Workshop on Silicon Nanoelectronics and Beyond*, Arlington, Virginia, USA 2005
- Invited Speaker, "Micro-Raman characterization of stress/strain in semiconductors," *Raytheon Vision Systems* (RVS), Goleta, California, USA, 2005
- Invited Speaker, "Nanoscale phonon engineering," *Superconducting Electronics Workshop and Program Review*, Office of Naval Research (ONR), Red Bank, New Jersey, USA, 2005
- Invited Lecturer, "Nanophononics: Concept and device applications," *California Nanosystems Institute* (CNSI), UCLA, Los Angeles, California, USA, 2005
- Invited Speaker, "Thermal conductivity of AlGaN materials: Implications for high-power electronics," *NASA Jet Propulsion Laboratory* (JPL), Pasadena, California, USA, 2004
- Invited Speaker, "Thermal properties of GaN films and AlGaN alloys," *Office of Naval Research Workshop on Advanced Materials*, Tampa, Florida, USA, 2004
- Invited Speaker, "Phonon engineering for enhancement of device operation," *Workshop on Novel Device Concepts*, Naval Postgraduate School, Monterey, California, USA, 2003
- Invited Speaker, "Phonon confinement effects in nanowires," *Ames Research Center*, National Aeronautics and Space Administration (NASA), Moffett Field, USA, 2002

AWARD RECEIVED BY GRADUATE STUDENTS

- Guanxiong Liu, *The Best Poster Award* for the presentation "Quasi-1D van der Waals materials: applications in interconnects," DARPA – SRC Center for Function Accelerated nanoMaterial Engineering (FAME) Review and Workshop, Los Angeles, USA, 2017 (co-authored with A.A. Balandin)
- Guanxiong Liu, *The Best Poster Award* for the presentation "Charge density waves in two-dimensional materials," Materials Research Society (MRS) Spring Meeting, Phoenix, Arizona, USA, 2016 (co-authored with A.A. Balandin)
- Zhong Yan, *The Best Paper Award* for the paper "Graphene heat spreader for thermal management of high power GaN transistors," International Microelectronics and Packaging Society (IMAPS) Conference, Los Gatos, California, 2012 (co-authored with A.A. Balandin)
- Desalegne Teweldebrhan, *The Best Student Paper Award – MRS Silver Medal* for the paper "Tuning graphene properties with electron-beam irradiation," Materials Research Society (MRS), San Francisco, California, USA, 2011 (co-authored with A.A. Balandin)
- Guanxiong Liu, The Best Student Paper Award – MRS Symposium on 2D Functional Materials for the paper "Flicker noise in graphene and 2D materials," Materials Research Society (MRS), San Francisco, California, USA, 2011 (co-authored with A.A. Balandin)
- Javed Khan, *The Best Student Paper Award – The 2nd Place Award* for the paper "Graphene-like" exfoliation of $TiTe_2$ quasi-2D crystals," The Annual Spring Meeting of the Electrochemical Society (ECS), Montreal, Canada, 2011 (co-authored with A.A. Balandin)

- Guanxiong Liu, *The Young Scientist Award* for the "Low-frequency noise in back-gated graphene field-effect transistors" at the *38th Conference on the Physics and Chemistry of Surfaces and Interfaces* (PCSI), San Diego, California (co-authored with A.A. Balandin)
- Zhong Yan, *The Young Scientist Award* for the "Few-layer graphene top-surface heat spreaders for high-power electronics" at the *38th Conference on the Physics and Chemistry of Surfaces and Interfaces* (PCSI), San Diego, California (co-authored with A.A. Balandin)
- Samia Subrina, *The 2rd Place Award in the International Research Poster Competition* for "Thermal management of 3D electronics with graphene heat spreaders," *Society of Women Engineers* (SWE), Tampa, Florida, USA, 2010 (co-authored with A.A. Balandin)
- Guanxiong Liu, *The Best Student Research Presentation Award* for "Electronic noise in graphene transistors," *Advanced Workshop on Frontiers in Electronics* (WOFE), Rincon, Puerto Rico, 2009 (co-authored with A.A. Balandin)
- Desalegne Teweldebrhan, *UCR Alliance for Graduate Education and Professoriate Award* to report "Irradiated graphene," *Graphene Week*, College Park, Maryland, USA, 2009
- Suchismita Ghosh, *The Inventor Recognition Award* for "Graphene lateral heat spreaders," *TECHCON Conference*, Austin, Texas, USA, 2009 (co-authored with A.A. Balandin)
- Javed Khan and Craig Nolen, *The 2nd Place Award in the Graduate Student Competition* for "Wireless sensor networks with graphene-based rechargeable power sources," *IEEE EDS Meeting at UC Riverside*, California, 2009 (Judges: EDS Presidents C. Claeys and R. Jindal)
- Samia Subrina, *The 3rd Place Award in the International Research Poster Competition* for "Thermal management of electronics with graphene heat spreaders," *Society of Women Engineers* (SWE), Long Beach, California, USA, 2009 (co-authored with A.A. Balandin)
- Vivek Goyal, *The Best Research Poster Award* for "Heat propagation in graphene: Theory and experiment," *DARPA –SRC Workshop and Review*, Los Angeles, California, USA, 2009 (co-authored with A.A. Balandin) – selected from ~ 50 entries from the top US universities
- Suchismita Ghosh, *The 2rd Place Award in the International Research Poster Competition* for "Giant thermal conductivity of graphene: Thermal management applications," *Society of Women Engineers* (SWE), Baltimore, Maryland, USA, 2008 (co-authored with A.A. Balandin)
- Irene Calizo, *Graduate Dean Dissertation Fellowship Award* for her PhD dissertation "Raman nanometrology of graphene," UC Riverside, California, USA, 2008
- Irene Calizo, *The 2rd Place Award in the International Research Poster Competition* for "Robust micro-Raman identification of the atomic layers of graphene," *Society of Women Engineers* (SWE), Nashville, Tennessee, USA, 2008 (co-authored with A.A. Balandin)
- Manu Shamsa, *The Best Student Paper Award – MRS Silver Medal* for the paper "Thermal conductivity of nanocrystalline diamond films," *Materials Research Society* (MRS), San Francisco, California, USA, 2007 (co-authored with A.A. Balandin)
- Manu Shamsa, *IBM International Dissertation Fellowship Award*, IBM T.J. Watson Research Center, Yorktown Heights, New York, USA, 2007 - 2009
- Manu Shamsa and Khan Alim, *The 3rd Place Award in the Best Research Competition* for the presentation "Functionalized nanostructures with the negative differential resistance," *DARPA –SRC Workshop and Review*, Los Angeles, California, USA, 2006 (co-authored with A.A. Balandin) – selected from ~ 50 entries from the top US universities

- Manu Shamsa, *The Best Research Poster Award* for the paper "Modeling of thermal conduction mechanisms in the amorphous inter-layer dielectrics," *Materials Research Society* (MRS), San Francisco, California, USA, 2006 (co-authored with Intel engineers)
- Khan Alim and Mayank Varshney, *The 2nd Place Award in the Best Research Competition* for the presentation "New approaches for heat removal from beyond-CMOS nanoelectronic circuits," *DARPA –SRC Workshop and Review*, Los Angeles, California, USA, 2005 (co-authored with A.A. Balandin) – selected from ~ 50 entries from the top US universities
- Jie Zou, *The Best Student Paper Award – MRS Silver Medal* for the paper "The lattice thermal conductivity in semiconductor nanowires," *Materials Research Society* (MRS), San Francisco, California, USA, 2002 (co-authored with A.A. Balandin)

TEACHING AND GRADUATE STUDENT SUPERVISION

- I graduated 26 PhDs and served in the PhD dissertation committee for other ~30 PhD students. I took part in ~100 PhD qualification (oral) exams as the chair or committee member for PhD students from ECE, MSE, Physics, ME and CEE departments.
- As the *first* ECE Department's hire in the broadly defined area of *Materials and Devices*, I developed the *first* courses and study plans for both undergraduate and graduate students specializing in *Nano Materials, Devices and Circuits* (NMDC).
- As the *Founding Chair* of the campus-wide *Materials Science and Engineering* (MS&E) Inter-disciplinary Program at UCR, I led curriculum development, introduced the *first* MS&E courses, and helped with a number of materials courses at participating departments.
- I taught the following undergraduate courses
    - *EE116 Engineering Electromagnetics* – I (required for all EE majors)
    - *EE117 Engineering Electromagnetics* – II (developed laboratory for this course)
    - *EE107 Solid-State Electronics* (offered this course for the first time at UCR)
    - *EE133 Solid-State Electronics* (developed and taught this course instead of EE107)
    - *EE175 Senior Design Project* (made major contributions to its development)
- I taught the following graduate courses
    - *EE202 Fundamentals of Semiconductor Materials and Nanostructures* (developed this core course and offered it for the first time; taught it each year since 2000)
    - *EE207 Noise in Electronic Materials and Devices* (developed and taught this advanced graduate course to cover gaps in education pertinent to measurements)
    - *EE216 Nanoscale Phonon Engineering* (developed and taught advanced graduate course required for research)
    - *EE259 Colloquium in Electrical Engineering* (colloquium organization)
    - *EE290 Directed Studies*; *EE297 Dissertation Research*; *EE299 Research for Thesis*

GRADUATED PHD STUDENTS AND THEIR JOBS

- Dr. Fariborz Kargar (PhD, UCR, 2017); Dissertation: "Experimental investigation of acoustic phonon confinement effects in nanostructured materials," job: Postdoctoral Researcher, UCR, Riverside, California, USA

- Dr. Chenglong Jiang (PhD, UCR, 2017); Dissertation: "Phonon and electron properties of transition metal dichalcogenides: Applications in high-temperature electronics," job: Project Scientist, UCR, Riverside, California, USA
- Dr. Hoda Malekpour (PhD, UCR, 2016); Dissertation: "Optothermal Raman studies of thermal properties of graphene based films," job: Project Scientist, UCR, California, USA
- Dr. Sylvester Ramirez (PhD, UCR, 2016); Dissertation: "Anisotropic thermal properties of nanostructured magnetic, carbon and hybrid magnetic – carbon materials," job: Engineer, Raytheon, San Diego, California, USA
- Dr. Rameez Samnakay (PhD, UCR, 2016); Dissertation: "2D Materials and devices," job: R&D Engineer, Intel Corporation, Portland, Oregon, USA
- Dr. Richard Gulotty (PhD, UCR, 2015); Dissertation: "CVD growth and device applications of graphene," job: Researcher, Argonne National Laboratory, Chicago, USA
- Dr. Jackie Renteria (PhD, UCR, 2014); Dissertation: "Van der Waals materials and devices," job: Director of Engineering, ADTI Media, Temecula, California, USA
- Dr. P. Goli (PhD, UCR, 2014); Dissertation: "Graphene enhanced thermal interface materials, job: Senior Chemist, Henkel, Irvine, California, USA
- Dr. Zhong Yan (PhD, UCR, 2013); Dissertation: "Graphene heat spreader for high-power transistors," job: Assistant Professor, Nanjing, China
- Dr. Farhan Shahil (PhD, UCR, 2013); Dissertation: "Graphene-enhanced thermal interface materials for energy efficient electronics," job: R&D Engineer, Intel Corporation, Portland, Oregon, USA
- Dr. Craig Nolen (PhD, UCR, 2012); Dissertation: "Large-area identification and quality control technology for graphene and 2D materials," job: R&D Engineer, Intel Corporation, Portland, Oregon, USA
- Zahid Hossain (PhD, UCR, 2012); Dissertation: "Fabrication and characterization of transistors with 2D channels," job: R&D Engineer, Micron Technology, Boise, USA
- Dr. Guanxiong Liu (PhD, UCR, 2012); Dissertation: "Fabrication and characterization of graphene devices," job: R&D Engineer, Bluestone Global, New York, USA
- Dr. Javed Khan (PhD, UCR, 2012); Dissertation: "Nanostructured materials for energy generation," job: R&D Engineer, Intel Corporation, Portland, Oregon, USA
- Jie Yu (PhD, UCR, 2012); Dissertation: "Graphene-on-diamond devices," job: R&D Engineer, Lam Research, San Jose, California, USA
- Dr. Vivek Goyal (PhD, UCR, 2011); Dissertation: "Thermal characterization of nanostructured materials," job: R&D Engineer, Intel Corporation, Portland, Oregon, USA
- Dr. Desalegne Teweldebrhan (PhD, UCR, 2011); Dissertation: "2D Dirac materials: from graphene to topological insulators," job: R&D Lead Engineer, Intel Corporation, Portland, Oregon, USA
- Dr. Suchismita Ghosh (PhD, UCR, 2010); Dissertation: "Thermal conduction in graphene and graphene multi-layers," job: R&D Lead Engineer, Intel Corporation, Portland, Oregon, USA
- Dr. Muhhamad Rahman (PhD, UCR, 2010); Dissertation: "Fabrication and characterization of nanowire transistors with enhanced performance," job: R&D Engineer, Intel Corporation, Portland, Oregon, USA

- Dr. Samia Sabrina (PhD, UCR, 2010); Dissertation: "Modeling of thermal transport in graphene devices," job: Associate Professor, BUET, Bangladesh
- Dr. Irene Calizo (PhD, UCR, 2009); Dissertation: "Raman nanometrology of graphene," job: Assistant Professor, Florida International University, Florida, USA (previous: National Institute of Standards and Technology (NIST))
- Dr. Qinghui Shao (PhD, UCR, 2009); Dissertation: "Optimized design and materials for nanostructure based solar cells," Staff Research Engineer, Lawrence Livermore National Laboratory (LLNL), Livermore, California, USA
- Dr. Manu Shamsa (PhD, UCR, 2007); Dissertation: "Thermal transport in advanced engineered materials" job: R&D Engineer, Intel Corporation, Portland, Oregon, USA
- Dr. Khan A. Alim (PhD, UCR, 2006); Dissertation: "Raman characterization of hybrid bio-inorganic nanostructures," job: Engineer, POC, Torrance, California, USA
- Dr. Y. Bao (PhD, UCR, 2005); Dissertation: "Electrical characterization and applications of quantum dot superlattices," job: Lead Engineer, Semiconductor Industry, China
- Dr. J. Zou (PhD, UCR, 2002), Dissertation: "Thermal conduction in silicon nanowires and gallium nitride films," job: Associate Professor, East Illinois University, Illinois, USA

SUPERVISED POSTDOCTORAL RESEARCHERS AND THEIR POSITIONS

- Dr. Jackie Renteria (Postdoctoral, 2014 - 2015); current job: Director of Engineering, ADTI Media, Temecula, California, USA
- Dr. D.L. Nika (Postdoctoral, 2006 – 2010); current job: Professor and Chair, Department of Physics, *Moldova State University*, Chisinau, Republic of Moldova
- Dr. I. Bejenari (Fulbright Scholar, 2008 – 2009); current job: Research Associate, Technical University of Moldova, Chisinau, Republic of Moldova
- Dr. W.L. Liu (Postdoctoral, 2003 – 2006); current job: Lead Engineer, *Touch Down Technology*, Los Angeles, California, USA
- Dr. V. Fonoberov (Postdoctoral, 2002 – 2006); current job: R&D Leader, *Aimdyn, Inc*., Santa Barbara, California, USA
- Dr. V.O. Turin (Postdoctoral, 2003 – 2005); current job: Professor, Department of Electronics and Systems, *Orel State Technological University*, Orel, Russia
- Dr. S. Dmitriev (Visiting, 2003); current job: Assistant Professor, Laboratory of Low-Dimensional Structures, Moldova State University, Chisinau, Republic of Moldova
- Dr. O. Lazarenkova (Postdoctoral, 2001 – 2003); current job: Research Engineer, *NASA Jet Propulsion Laboratory*, Pasadena, California, USA

HIGHLIGHTS OF INTERNSHIPS OF PHD STUDENTS

- Ruben Salgado, Air Force Research Laboratory, Wright-Patterson, Ohio, USA, 2016
- Richard Gulotti, Argonne National Laboratory, Chicago, Illinois, USA, 2013 – 2015
- Sylvester Ramirez, Bourns Inc., Riverside, California, USA, 2013
- Guanxiong Liu, *IBM T.J. Watson Research Center*, Yorktown Heights, New York, USA, 2010
- Muhammad Rahman, *IMEC*, Leuven, Belgium, 2010

- Pradyumna Goli, CFD Research Corporation, Huntsville, Alabama, USA, 2010
- Dr. Qinghui Shao, Lawrence Livermore National Laboratory, Livermore, USA, 2009
- Javed Khan, NASA Jet Propulsion Laboratory, Pasadena, California, USA, 2009
- Suchismita Ghosh, *Intel Corporation,* Portland, Oregon, USA, 2008
- Irene Calizo, *Lawrence Livermore National Laboratory* (LLNL), California, USA, 2008
- Manu Shamsa, *IBM T.J. Watson Research Center*, Yorktown Heights, New York, USA, 2006
- Manu Shamsa, *Intel Corporation,* Portland, Oregon, USA, 2006

PROFESSIONAL SERVICE

- Deputy Editor-in-Chief, Applied Physics Letters (2015 – present)
- Associate Editor, Applied Physics Letters (2014 – 2015)
- Senior Editor, IEEE Transactions on Nanotechnology (2012 – 2014)
- IEEE Nanotechnology Award Committee (2011 – 2013)
- SPIE Fellow Committee (2011 – 2014)
- Associate Editor, IEEE Transactions on Nanotechnology (2009 – 2012)
- Editor, *Innovative Graphene Technologies: Development, Characterization and Evaluation* (Smithers Rapra, London, U.K., 2013)
- Editor (with Andre Geim, Manchester University, 2010), *Two-Dimensional Functional Materials* (Cambridge Press, 2012) – Proceedings of MRS Fall Meeting Symposium on 2D Materials
- Editor (with K.L. Wang, UCLA), *Handbook of Semiconductor Nanostructures and Nanodevices* (ASP, Los Angeles, 2006), volumes: (1) Self-Assemblies, Quantum Dots, and Nanowires; (2) Nanofabrication and Nanoscale Characterization; (3) Spintronics and Nanoelectronics; (4) Nanophotonics and Optoelectronics; (5) Nanodevices and Circuits
- Editor, *Noise and Fluctuations Control in Electronic Devices* (ASP, Los Angeles, 2002)
- Member, Advisory Board, *Advances in Nanotechnology* (ASP, Los Angeles), 2000 – present
- Editor (with M. Jamal Dean, McMaster U.), *Noise in Devices and Circuits III*, Proceedings of SPIE, Vol. 5844, 2005
- Reviewer, *Engineering Electromagnetics* textbooks (undergraduate and graduate level) published by McGraw-Hill, Wiley, Oxford University Press and Prentice Hall, 2003 – 2008

UNIVERSITY SERVICE

- Founding Chair, UCR Materials Science and Engineering Program (MS&E), 2006 – 2012
  Major Accomplishments: I wrote the MS&E program proposal and led the campus efforts for its approval and program establishment despite California's unfavorable economic circumstances at that time. The program, focused on *materials for nanotechnology, energy and sustainability*, included 40 faculty members from eight participating departments. The undergraduate program leading to BS in MS&E was approved by the UC Riverside Academic Senate in 2007. The inaugural class of ~20 students was welcomed in 2008. The first BS students graduated in 2010. The campus-wide graduate program leading to MS and

PhD degrees in MS&E was approved by the University of California President Mark G. Yudof on August 24, 2009. The first cohort of ~10 PhD graduate students was accepted for Fall quarter of 2010. The new Materials Science and Engineering (MSE) building completed in 2011 substantially expanded MS&E research and teaching facilities. As a Founding Chair I led the program development for 6 years. In January 2012, I stepped down to focus on research and technology commercialization. In the beginning of 2012, MS&E program already had ~45 PhD students and enjoyed high *US News & World* Report ranking. It was considered a major success by all peers. In 2012, the program was selected for televised highlights at the Materials Research Society (MRS) Fall meeting in Boston.

- Member, UCR Strategic Planning Committee, *Subcommittee on Academic Excellence* chaired by UCR Chancellor Timothy White, 2009 – 2010
  Activities: worked on strategic planning issues and provided input for the report "*UCR 2020: The Path to Preeminence – A Living Document to Guide our Future*."
- Member, Materials Science and Engineering Faculty Search Committee, 2009 – 2010
- Chair, Materials Science and Engineering Faculty Search Committee, 2007 – 2009
  Major Accomplishments: lead the committee's efforts to hire the first MS&E core faculty members, which resulted in three new professors joining the BCOE
- Principal Investigator, NSF Research Experience for Undergraduates (REU) Site on Nanomaterials and Devices, UCR, 2006 – 2009
- Member, Materials Science and Engineering (MS&E) Building Committee, 2005 – 2010
- Director, Summer Undergraduate Research Institute in Science and Engineering (SUNRISE), Undergraduate Institute on Nanomaterials, NSF REU Site, UCR, 2006 – 2008
- Other Professional Service Activities for the University of California
  - Faculty Supervisor, UCR Student Chapter of ECS, 2011 – 2014
  - Faculty Supervisor, UCR Student Chapter of OSA, 2010 – 2014
  - Member, UC-Riverside Academic Senate Committee on Research, 2006 – 2008
  - Chair, Electrical Engineering Graduate Committee, 2006 – 2008
  - Graduate Advisor, Department of Electrical Engineering, 2006 - 2008
  - Chair, Electrical Engineering Undergraduate Committee, 2003 – 2005
  - Undergraduate Advisor, Department of Electrical Engineering, 2003 – 2005
  - Undergraduate Advisor, Computer Engineering, Joint Program offered by Department of Electrical Engineering and Department of Computer Science, 2004 – 2005
  - Chair, ABET – 2000 Electrical Engineering Committee, 2003 – 2005
  - Member, College of Engineering Dean Search Committee Member, 2004 – 2005
  - Member, UCR ad hoc Committee for Tenure and Promotion, 2002 – present
  - Member, Electrical Engineering Faculty Search Committee, 1999 – 2003
  - Member, UCR Focus Group on Nanotechnology, 1999 – 2005

CURRENT MAIN RESEARCH FIELDS AND CONTRIBUTIONS

Graphene Thermal Field: We performed the first measurements of thermal conductivity of graphene by developing a new thermal measurement technique based on micro-Raman spectroscopy. Presently, the optothermal technique is adopted by many laboratories with

various modifications for graphene and other 2D materials. We developed the first detailed theory of heat conduction in graphene and explained why thermal conductivity of graphene can be higher than that of bulk basal planes of graphite. We synthesized the first thermal interface materials (TIM) with graphene and conducted the first computer CPU and Li-ion battery pack practical testing with graphene TIMs. The technology is presently in R&D and commercialization stages. The first graphene thermal paper (Nano Letter, 2008) was cited 4,574 times. My review of graphene thermal properties (Nature M, 2011) was cited 1,317 times. The field is experiencing a period of "explosive" growth, both in the fundamental science and practical aspects.

1/*f* Noise in 2D Materials and Devices: The low-frequency 1/*f* noise is interesting from both fundamental science and practical applications points of view. I turned to experimental investigation of 1/*f* noise in electronic devices back in 1997 while a postdoc at UCLA (*f* is the frequency). The first material system and devices that I studied were AlGaN/GaN HFETs. My main research contributions included understanding noise sources and mechanism in this materials system, and reduction of the noise level by several orders of magnitude using specific device designs and "piezo" doping. In 2009, after the advent of graphene, I wrote the second paper on 1/*f* noise in graphene devices (IBM JT Watson group wrote the first paper), and undertook detail investigation of 1/*f* noise in graphene and quasi-2D systems such as Bi_2Se_3 and MoS_2. To conduct this research I built a dedicated noise laboratory at UC Riverside. The main research results included understanding of the noise mechanism in graphene (it cannot be described by McWhorter model); use of few-layer graphene to address the (almost) century old problem of surface vs. volume noise origin; determining contact contribution to noise in graphene and MoS_2 FETs; studying electron beam irradiation effects on noise in graphene; publishing the first paper on 1/*f* noise in topological insulators; reducing 1/*f* noise in graphene FETs by using graded thickness or BN encapsulation. I wrote the first review paper of noise in graphene (Nature N., 2013).

Nanoscale Phonon Engineering: In 1997 I came up with an idea that changed spectrum of acoustic phonons in nanostructures should affects the phonon heat conduction. In some sense, I connected the dots. The changes in the acoustic phonon spectrum were studied in the context of electron mobility but not in the thermal transport. The effects of the phonon – boundary scattering were studied before my work but all assuming the bulk phonon dispersion. My PRB (1997) paper (with K.L. Wang, UCLA) was the first that described the phonon confinement effect on thermal transport, and introduced the term "phonon engineering". In retrospect, the idea of engineering phonon spectrum (similar to engineering electronic spectrum in nanostructures) was interesting and fruitful. It led to emergence of a new research direction in nanoscience. After a decade of mostly theoretical work, there are now many experimental papers that confirmed our theoretical predictions. The term "phonon engineering" became conventionally accepted and used as a conference name. The phonon spectrum modifications in nanostructures have been proven by direct measurements using Brillouin spectroscopy. I built a dedicated Phonon Optimized Engineered Materials (POEM) center at UC Riverside to investigate these effects.

Device Applications of 2D Materials: Inspired by graphene success, I looked for other possible useful 2D materials. In 2010, we published the first paper on exfoliation of individual quintuples of Bi_2Te_3 family of materials (Nano Letter, 2010), which reveal thermoelectric and topological insulator effects. Our NSF-NRI Nano2020 grant allowed us to expand this research into new direction of TMD materials with the charge-density wave (CDW) effects. We investigated possible electronic and sensor applications of 2D materials. The main research results include the first demonstration of tuning CDW transition temperature with the film thickness (Nano Letter, 2012); the use of the low-frequency current fluctuations in graphene and MoS_2 as an additional sensing parameter for selective detection of gas molecules; proposal of non-Boolean information processing with graphene devices without energy band gap; demonstration of voltage controlled oscillators with CDW devices.

JOURNAL PUBLICATIONS

MOST RECENT PUBLICATIONS IN REVERSE CHRONOLOGICAL ORDER

Year 2017

1. Guanxiong Liu, Sergey Rumyantsev, Matthew A. Bloodgood, Tina T. Salguero, Michael Shur, and Alexander A. Balandin, Low-frequency electronic noise in quasi-1D $TaSe_3$ van der Waals nanowires, Nano Letters, 17, 377 (2017).

2. Denis L Nika and Alexander A. Balandin, Phonons and thermal transport in graphene and graphene-based materials, Reports on Progress in Physics, 80, 036502 (2017)

3. M. M. Lacerda, F. Kargar, E. Aytan, R. Samnakay, B. Debnath, J. X. Li, A. Khitun, R. K. Lake, J. Shi, and A. A. Balandin, Variable-temperature inelastic light scattering spectroscopy of nickel oxide: Disentangling phonons and magnons, Applied Physics Letters, 110, 202406 (2017).

4. D. Gutierrez, H. Chiang, T. Bhowmick, A.D. Volodchenkov, M. Ranjbar, G. Liu, C. Jiang, C. Warren, Y. Khivintsev, Y. Filimonov, J. Garay, R. Lake, A.A. Balandin, A. Khitun, Magnonic holographic imaging of magnetic microstructures, Journal of Magnetism and Magnetic Materials, 428, 348 (2017).

5. Michael Balynsky, Alexander Kozhevnikov, Yuri Khivintsev, Tonmoy Bhowmick, David Gutierrez, Howard Chiang, Galina Dudko, Yuri Filimonov, Guanxiong Liu, Chenglong Jiang, Alexander A. Balandin, Roger Lake, and Alexander Khitun, Magnonic interferometric switch for multi-valued logic circuits, Journal of Applied Physics, 121, 024504 (2017).

6. S. Ramirez, K. Chan, R. Hernandez, E. Recinos, E. Hernandez, R. Salgado, A.G. Khitun, J.E. Garay, A.A. Balandin, Thermal and magnetic properties of nanostructured densified ferrimagnetic composites with graphene - graphite fillers, Materials and Design, 118, 75 (2017).

7. A.D. Volodchenkov, S. Ramirez, R. Samnakay, R. Salgado, Y. Kodera, A.A. Balandin, J.E. Garay, Magnetic and thermal transport properties of $SrFe_{12}O_{19}$ permanent magnets with anisotropic grain structure, Materials and Design, 125, 62 (2017).

Year 2016

8. Guanxiong Liu, Bishwajit Debnath, Timothy R. Pope, Tina T. Salguero, Roger K. Lake and Alexander A. Balandin, A charge-density-wave oscillator based on an integrated

tantalum disulfide–boron nitride– graphene device operating at room temperature," Nature Nanotechnology, 11, 845 (2016).

9. Fariborz Kargar, Bishwajit Debnath, Joona-Pekko Kakko, Antti Saynatjoki, Harri Lipsanen, Denis L. Nika, Roger K. Lake and Alexander A. Balandin, Direct observation of confined acoustic phonon polarization branches in free-standing semiconductor nanowires, Nature Communications, 7, 13400 (2016).

10. Diana Berman, Sanket A. Deshmukh, Badri Narayanan, S.K.R.S. Sankaranarayanan, Zhong Yan, Alexander A. Balandin, Alexander Zinovev, Daniel Rosenmann and Anirudha V. Sumant, Metal-induced rapid transformation of diamond into single and multilayer graphene on wafer scale, Nature Communications, 7, 12099 (2016).

11. Maxim A. Stolyarov, Guanxiong Liu, Matthew A. Bloodgood, Ece Aytan, Chenglong Jiang, Rameez Samnakay, Tina T. Salguero, Denis L. Nika, Sergey L. Rumyantsev, Michael S. Shur, Krassimir N. Bozhilove and Alexander A. Balandin, Breakdown current density in h-BN-capped quasi-1D $TaSe_3$ metallic nanowires: prospects of interconnect applications, Nanoscale, 8, 15774 (2016).

12. A. Politano, G. Chiarello, R. Samnakay, G. Liu, B. Gürbulak, S. Duman, A. A. Balandin and D. W. Boukhvalov, The influence of chemical reactivity of surface defects on ambient-stable InSe-based nanodevices, Nanoscale, 8, 8474 (2016).

13. Hoda Malekpour, Pankaj Ramnani, Srilok Srinivasan, Ganesh Balasubramanian, Denis L. Nika, Ashok Mulchandani, Roger K. Lake and Alexander A. Balandin, Thermal conductivity of graphene with defects induced by electron beam irradiation, Nanoscale, 8, 14608 (2016).

14. Alejandro A. Barragan, Hoda Malekpour, Stephen Exarhos, Alexander A. Balandin and Lorenzo Mangolini, Grain-to-grain compositional variations and phase segregation in copper-zinc-tin-sulfide films, ACS Applied Materials and Interfaces, 8, 22971 (2016).

15. G. Liu, S. L. Rumyantsev, C. Jiang, M. S. Shur and A. A. Balandin, Selective gas sensing with h-BN capped MoS2 heterostructure thin film transistors, Electron Device Letters, 36, 1202 (2015).

16. F. Kargar, S. Ramirez, B. Debnath, H. Malekpour, R.K. Lake and A. A. Balandin Acoustic phonon spectrum and thermal transport in nanoporous alumina arrays, Applied Physics Letters, 107, 171904 (2015).

17. V. M. Fomin and A. A. Balandin Phonon spectrum engineering in rolled-up micro- and nano-architectures, Applied Sciences, 5, 728 (2015).

Journal Publications During the October 1, 2012 – October 1, 2015 Period

1) P. Goli, J. Khan, D. Wickramaratne, R.K. Lake and A.A. Balandin, "Charge density waves in exfoliated films of van der Waals materials: Evolution of Raman spectrum in $TiSe_2$," Nano Letters, 12, 5941 (2012).

2) A.A. Balandin, "Low-frequency 1/f noise in graphene devices," Nature Nanotechnology, 8, 549 (2013).

3) G. Liu, S. Rumyantsev, M.S. Shur and A.A. Balandin, "Origin of 1/f noise in graphene multilayers: Surface vs. volume," Applied Physics Letters, 102, 093111 (2013).

4) M.Z. Hossain, S. Rumyantsev, M.S. Shur and A.A. Balandin, "Reduction of 1/f noise in graphene after electron-beam irradiation," Applied Physics Letters, 102, 153512 (2013).

5) S. Rumyantsev, G. Liu, R.A. Potyrailo, M.S. Shur and A.A. Balandin, "Selective sensing of individual gases using graphene devices," IEEE Sensors Journal, 13, 2818 (2013).

6) S.L. Rumyantsev, D. Coquillat, R. Ribeiro, M. Goiran, W. Knap, M.S. Shur, A.A. Balandin and M.E. Levinshtein, "The effect of a transverse magnetic field on 1/f noise in graphene," Applied Physics Letters, 103, 173114 (2013).

7) G. Xu, Y. Zhang, X. Duan, A.A. Balandin and K.L. Wang "Variability effects in graphene: Challenges and Opportunities for device engineering and applications," Proceedings of the IEEE, 101, 1670 (2013).

8) G. Liu, S. Ahsan, A.G. Khitun, R.K. Lake and A.A. Balandin "Graphene-based non-Boolean logic circuits," Journal of Applied Physics, 114, 154310 (2013).

9) A.V. Muraviev, S.L. Rumyantsev, G. Liu, A.A. Balandin W. Knap and M.S. Shur, "Plasmonic and bolometric teraherz detection by graphene field-effect transistor," Applied Physics Letters, 103, 181114 (2013).

10) A.I. Cocemasov, D.L. Nika and A.A. Balandin "Phonons in twisted bilayer graphene," Physics Review B, 88, 035428 (2013).

11) R. Gulotty, M. Castellino, P. Jagdale, A. Tagliaferro and A.A. Balandin, "Effects of functionalization on thermal properties of single-wall and multi-wall carbon nanotubepolymer nanocomposites," ACS Nano, 7, 5114 (2013).

12) D.L. Nika, A.I. Cocemasov, D.V. Crismari and A.A. Balandin "Thermal conductivity inhibition in phonon engineered core-shell cross-section modulated Si/Ge nanowires," Applied Physics Letters, 102, 213109 (2013).

13) Z. Yang, C. Jiang, T. Pope, C. Tsang, J.L. Stickney, P. Goli, J. Renteria, T. Salguero and A.A. Balandin, "Phonon and thermal properties of exfoliated thin films of tantalum diselenide," Journal of Applied Physics, 114, 204301 (2013).

14) H. Malekpour, K.-H. Chang, J.-C. Chen, C.-Y. Lu, D. L. Nika, K. S. Novoselov and A. A. Balandin "Thermal conductivity of graphene laminate," Nano Letters, 14, 5155 (2014).

15) P. Goli, H. Ning, X. Li, C.Y. Lu, K. S. Novoselov and A. A. Balandin, "Thermal properties of graphene - copper - graphene heterogeneous films," Nano Letters, 14, 1497 (2014).

16) H. Li, H. Ying, X. Chen, D. L. Nika, A. I. Cocemasov, W. Cai, A. A. Balandin and S. Chen, "Thermal conductivity of twisted bilayer graphene," Nanoscale, 6, 13402 (2014).

17) D. L. Nika, A. I. Cocemasov, and A. A. Balandin "Specific heat of twisted bilayer graphene: Engineering phonons by atomic plane rotations," Applied Physics Letters, 105, 031904 (2014).

18) A. A. Balandin, "Phonon engineering in graphene and van der Waals materials," MRS Bulletin, 39, 817 (2014).

19) B. Koo, P. Goli, A. V. Sumant, P. C. Santos Claro, T. Rajh, C. S. Johnson, A. A. Balandin, and E. V. Shevchenko, " Toward Lithium ion batteries with enhanced thermal conductivity," ACS Nano, 8, 7202 (2014).

20) J. D. Renteria, D. L. Nika and A. A. Balandin, "Graphene thermal properties: Applications in thermal management and energy storage," Applied Sciences, 4, 525 (2014).

21) P. Goli, S. Legedza, A. Dhar, R. Salgado, J. Renteria and A. A. Balandin, "Graphene-enhanced hybrid phase change materials for thermal management of Li-ion batteries," Journal of Power Sources, 248, 37 (2014).

22) J. Renteria, R. Samnakay, S. L. Rumyantsev, C. Jiang, M. S. Shur and A. A. Balandin, "Low-frequency 1/f noise in molybdenum disulfide transistors: Relative contributions of the channel and contacts," Applied Physics Letters, 104, 153104 (2014).

23) J. Renteria, R. Samnakay, C. Jiang, T. R. Pope, Z. Yan, D. Wickramaratne, T. T. Salguero, A. G. Khitun, R. K. Lake and A. A. Balandin, "All-metallic electrically gated 2H-TaSe2 thin-film switches and logic circuits," Journal of Applied Physics, 115, 034305 (2014).

24) R. Samnakay, D. Wickramaratne, T. R. Pope, R. K. Lake, T. T. Salguero and A. A. Balandin, "Zone-folded phonons and the commensurate-incommensurate charge-density-wave transition in 1T-TaSe2 thin films," Nano Letters, 15, 2965 (2015).

25) C. Jiang, S. L. Rumyantsev, R. Samnakay, M. S. Shur and A. A. Balandin, "High-temperature performance of MoS2 thin-film transistors: Direct current and pulse current-voltage characteristics," Journal of Applied Physics, 117, 064301 (2015).

26) R. Samnakay, C. Jiang, S. L. Rumyantsev, M. S. Shur and A. A. Balandin, "Selective chemical vapor sensing with few-layer MoS2 thin-film transistors: Comparison with graphene devices," Applied Physics Letters, 106, 023115 (2015).

27) M. A. Stolyarov, G. Liu, S. L. Rumyantsev, M. Shur and A. A. Balandin, "Suppression of 1/f noise in near-ballistic h-BN-graphene-h-BN heterostructure fieldeffect transistors," Applied Physics Letters, 107, 023106 (2015).

28) S. L. Rumyantsev, C. Jiang, R. Samnakay, M. S. Shur and A. A. Balandin, "1/f Noise characteristics of MoS2 thin-film transistors: Comparison of single and multilayer structures," Electron Device Letters, 36, 517 (2015).

29) G. Liu, S. L. Rumyantsev, C. Jiang, M. S. Shur and A. A. Balandin, "Gas sensing with h-BN capped MoS2 heterostructure thin film transistors," Electron Device Letters, accepted, in press (2015).

30) J. D. Renteria, S. Ramirez, H. Malekpour, B. Alonso, A. Centeno, A. Zurutuza, A. I. Cocemasov, D. L. Nika and A. A. Balandin, "Strongly anisotropic thermal conductivity of free-standing reduced graphene oxide films annealed at high temperature," Advanced Functional Materials, 25, 4664 (2015).

31) A. I. Cocemasov, D. L. Nika and A. A. Balandin, "Engineering of the thermodynamic properties of bilayer graphene by atomic plane rotations: the role of the out-of-plane phonons," Nanoscale, 7, 12851 (2015).

32) Z. Yan, D. L. Nika and A. A. Balandin, "Thermal properties of graphene and few-layer graphene: applications in electronics," IET Circuits, Devices and Systems, 9, 4 (2015).

33) A. A. Balandin, "Graphene heat spreaders and interconnects for advanced electronic applications," ECS Transactions, 67, 167 (2015).

Other Selected Publications in Reverse Chronological Order

2012

[1] Z. Yan, G. Liu, J.M. Khan and A.A. Balandin "Graphene quilts for thermal management of high-power GaN transistors," Nature Communications 3, 827 (2012).

[2] S. Chen, Q. Wu, C. Mishra, J. Kang, H. Zhang, K. Cho, W. Cai, A.A. Balandin and R.S. Ruoff, "Thermal conductivity of isotopically modified graphene," Nature Materials, 11, 203 (2012).

[3] S. Rumyantsev, G. Liu, M. Shur, R.A. Potyrailo and A.A. Balandin, "Selective gas sensing with a single pristine graphene transistor," Nano Letters, 12, 2294 (2012).

[4] P. Goli, J. Khan, D. Wickramaratne, R.K. Lake and A.A. Balandin, "Charge density waves in exfoliated films of van der Waals materials: Evolution of Raman spectrum in $TiSe_2$," Nano Letters, 12, 5941 (2012)

[5] J. Yu, G. Liu, A.V. Sumant, V. Goyal and A.A. Balandin "Graphene-on-diamond devices with increased current-carrying capacity: Carbon sp^2-on-sp^3 technology," Nano Letters, 12, 1603 (2012).

[6] D.L. Nika, A.S. Askerov and A.A. Balandin "Anomalous size dependence of the thermal conductivity of graphene ribbons," Nano Letters, 12, 3238 (2012).

[7] K.M.F. Shahil and A.A. Balandin, "Graphene - multilayer graphene nanocomposites as highly efficient thermal interface materials," Nano Letters, 12, 861 (2012).

[8] D.L. Nika and A.A. Balandin, "Two-dimensional phonon transport in graphene," Journal of Physics: Condensed Matter, 24, 233203 (2012).

[9] V. Goyal and A.A. Balandin, "Thermal properties of the hybrid graphene-metal nano-micro-composites: Applications in thermal interface materials," Applied Physics Letters, 100, 073113 (2012).

[10] G. Liu, S. Rumyantsev, M. Shur and A.A. Balandin, "Graphene thickness-graded transistors with reduced electronic noise," Applied Physics Letters, 100, 033103 (2012).

[11] K.M.F. Shahil and A.A. Balandin, "Thermal properties of graphene and multilayer graphene: Applications in thermal interface materials," Solid State Communications, 152, 1331 (2012).

[12] J. Khan, C.M. Nolen, D. Teweldebrhan, D. Wickramaratne, R.K. Lake and A.A. Balandin "Anomalous electron transport in back-gated field-effect transistors with $TiTe_2$ semimetal thin-film channels," Applied Physics Letters, 100, 043109 (2012).

[13] A.A. Balandin and D.L. Nika "Phonons in low-dimensions: Engineering phonons in nanostructures and graphene," Materials Today, 15, 266 (2012).

[14] D.L. Nika*, A.I. Cocemasov, C.I. Isacova, A.A. Balandin, V.M. Fomin and O.G. Schmidt "Suppression of phonon heat conduction in cross-section modulated nanowires," Physical Review B 85, 205439 (2012).

[15] K. Evanoff, J. Khan, A.A. Balandin, A. Magasinski, W.J. Ready, T.F. Fuller and G. Yushin*, "Towards ultrathick battery electrodes: Aligned carbon nanotube-enabled architecture," Advanced Materials, 24, 533 (2012).

[16] V. Goyal, A.V. Sumant, D. Teweldebrhan and A.A. Balandin, "Direct low-temperature integration of nanocrystalline diamond with GaN substrates for improved thermal management of high-power electronics," Advanced Functional Materials, 22, 1525 (2012).

[17] K.M.F. Shahil, M.Z. Hossain, V. Goyal, A. A. Balandin, "Micro-Raman spectroscopy of mechanically exfoliated few-quintuple layers of Bi_2Te_3, Bi_2Se_3 and Sb_2Te_3 materials," Journal of Applied Physics, 11, 054305 (2012).

2011

[18] A.A. Balandin, "Thermal properties of graphene and nanostructured carbon materials," Nature Materials, 10, 569 - 581 (2011).

[19] A.A. Balandin, "The heat is on: Graphene applications," IEEE Nanotechnology Magazine, 5, 15 - 19 (2011).

[20] X. Yang, G. Liu, M. Rostami, A.A. Balandin and K. Mohanram, "Graphene ambipolar multiplier phase detector," IEEE Electron Device Letters, 32 1328 (2011).

[21] C.N. Nolen, G. Denina, D. Teweldebrhan, B. Bhanu and A.A. Balandin, "High-throughput large-area automated identification and quality control of graphene and few-layer graphene films," ACS Nano, 5, 914 (2011).

[22] S.L. Rumyantsev, G. Liu, M. Shur and A.A. Balandin, "Observation of the "memory steps" in graphene at elevated temperatures," Applied Physics Letters, 98, 222107 (2011).

[23] S. Amini, H. Kalaantari, J. Garay, A.A. Balandin and R. Abbaschian*, "Growth of graphene and graphite nanocrystals from a molten phase," Journal of Materials Science, 46, 6255 (2011).

[24] G. Liu, D. Teweldebrhan and A.A. Balandin, "Tuning of graphene properties via controlled exposure to electron beams," IEEE Transactions on Nanotechnology, 10, 865 (2011).

[25] D.L. Nika, E.P. Pokatilov and A.A. Balandin, "Theoretical description of thermal transport in graphene: The issues of phonon cut-off frequencies and polarization branches," Physica Status Solidi B, 248, 2609 (2011).

[26] G. Liu, W. Stillman, S.L. Rumyantsev, M. Shur and A.A. Balandin, "Low-frequency electronic noise in graphene transistors: Comparison with carbon nanotubes," International Journal of High Speed Electronics and Systems, 20, 161 (2011).

[27] M.Z. Hossain, S.L. Rumyantsev, K.M.F. Shahil, D. Teweldebrhan, M. Shur and A.A. Balandin, "Low-frequency current fluctuations in "graphene-like" exfoliated thin-films of bismuth selenide topological insulators," ACS Nano, 5, 2657 (2011).

[28] M.Z. Hossain, S.L. Rumyantsev, D. Teweldebrhan, K.M.F. Shahil, M. Shur and A.A. Balandin, "1/f Noise in conducting channels of topological insulator materials," Physica Status Solidi A, 208, 144 (2011).

[29] A.A. Balandin, "Excellent thermal properties of graphene and prospects of graphene's applications in thermal management," Advancing Microelectronics Magazine, 38, 6 (2011).

[30] D.L. Nika, E.P. Pokatilov, A.A. Balandin, V.M. Fomin, A. Rastelli and O.G. Schmidt, "Reduction of the lattice thermal conductivity in one-dimensional quantum-dot superlattices due to phonon filtering," Physical Review B, 84, 165415 (2011).

[31] R. Fernandez, D. Teweldebrhan, C. Zhang, A.A. Balandin and S. Khizroev "A comparative analysis of Ag and Cu heat sink layers in L_{10}-FePt films for heat-assisted magnetic recording," Journal of Applied Physics, 109, 07B763 (2011).

2010

[32] S. Ghosh, W. Bao, D.L. Nika, S. Subrina, E.P. Pokatilov, C.N. Lau and A.A. Balandin, "Dimensional crossover of thermal transport in few-layer graphene," Nature Materials, 9, 555 (2010).

[33] S. Rumyantsev, G. Liu, W. Stillman, M. Shur and A.A. Balandin, "Electrical and noise characteristics of graphene field-effect transistors: Ambient effects and noise sources," J. Physics: Condensed Matter, 22, 395302 (2010).

[34] X. Yang, G. Liu, A.A. Balandin and K. Mohanram, "Triple-mode single-transistor graphene amplifier and its applications," ACS Nano, 4 5532 (2010).

[35] S. Amini, J. Garay, G. Liu, A.A. Balandin and R. Abbaschian*, "Growth of large-area graphene films from metal-carbon melts," Journal of Applied Physics, 108, 094321 (2010).

[36] J. Lin, D. Teweldebrhan, K. Ashraf, G. Liu, X. Jing, Z. Yan, R. Li, M. Ozkan, R. Lake, A.A. Balandin and C. Ozkan*, "Gating of single-layer graphene with single-stranded deoxyribonucleic acids," Small, 10, 1150 (2010).

[37] D. Teweldebrhan, V. Goyal, M. Rahman and A.A. Balandin, "Atomically-thin crystalline films and ribbons of bismuth telluride," Applied Physics Letters, 96, 053107 (2010). - Issue's Cover

[38] D. Teweldebrhan, V. Goyal and A.A. Balandin, "Exfoliation and characterization of bismuth telluride atomic quintuples and quasi-two-dimensional crystals," Nano Letters, 10, 1209 (2010).

[39] K.M.F. Shahil, M.Z. Hossain, D. Teweldebrhan and A.A. Balandin, "Crystal symmetry breaking in few-quintuple Bi_2Te_3 films: Applications in nanometrology of topological insulators," Applied Physics Letters, 96, 153103 (2010).

[40] V. Goyal, D. Teweldebrhan and A.A. Balandin, "Mechanically-exfoliated stacks of thin films of Bi_2Te_3 topological insulators with enhanced thermoelectric performance," Applied Physics Letters, 97, 133117 (2010).

[41] V. Goyal, S. Subrina, D.L. Nika and A.A. Balandin, "Reduced thermal resistance of silicon - synthetic diamond composite substrates at elevated temperatures," Applied Physics Letters, 97, 031904 (2010).

[42] A.A. Balandin, S. Ghosh, D.L. Nika and E.P. Pokatilov, "Thermal conduction in suspended graphene layers," Fullerenes, Nanotubes and Carbon Nanostructures, 18, 474 (2010).

2009

[43] I. Bejenari, V. Kantser and A.A. Balandin, "Thermoelectric properties of electrically gated bismuth telluride nanowires," Physical Review B, 81, 075316 (2009).

[44] G. Liu, W. Stillman, S. Rumyantsev, Q. Shao, M. Shur and A.A. Balandin, "Low-frequency electronic noise in the double-gate single-layer graphene transistors," Applied Physics Letters, 95, 033103 (2009)

[45] Q. Shao, G. Liu, D. Teweldebrhan, A. A. Balandin, S. Rumyantsev, M. Shur and D. Yan, "Flicker noise in bilayer graphene transistors," IEEE Electron Device Letters, 30, 288 (2009)

[46] D. Teweldebrhan and A.A. Balandin, "Modification of graphene properties due to electron-beam irradiation," Applied Physics Letters, 94, 013101 (2009)

[47] I. Calizo, I. Bejenari, M. Rahman, G. Liu and A.A. Balandin "Ultraviolet Raman microscopy of single and multilayer graphene," Journal of Applied Physics, 106, 043509 (2009)

[48] I. Calizo, S. Ghosh, F. Miao, W. Bao, C.N. Lau and A.A. Balandin "Raman nanometrology of graphene: Temperature and substrate effects," Solid State Communications, 149, 1132 (2009)

[49] A.A. Balandin, "Chill Out: New Materials and Designs Can Keep Chips Cool," invited feature article, IEEE Spectrum, 29, October issue (2009)

[50] D.L. Nika, S. Ghosh, E.P. Pokatilov and A.A. Balandin, "Lattice thermal conductivity of graphene flakes: Comparison with bulk graphite," Applied Physics Letters, 94, 203103 (2009)

[51] D.L. Nika, E.P. Pokatilov, A.S. Askerov and A.A. Balandin, "Phonon thermal conduction in graphene: Role of Umklapp and edge roughness scattering," Physical Review B 79, 155413 (2009) - Editors' Selection

[52] S. Subrina, D. Kotchetkov and A. A. Balandin "Heat removal in silicon-on-insulator integrated circuits with graphene lateral heat spreaders," IEEE Electron Device Letters, 30, 1281(2009)

[53] S. Ghosh, D.L. Nika, E.P. Pokatilov and A.A. Balandin, "Heat conduction in graphene: Experimental study and theoretical interpretation," New Journal of Physics 11, 095012 (2009)

[54] S. Ghosh, D. Teweldebrhan, J.R. Morales, J.E. Garay and A.A. Balandin, "Thermal properties of optically transparent pore-free nanostructured yttria-stabilized zirconia," Journal of Applied Physics, 106, 113507 (2009)

2008

[55] A.A. Balandin, S. Ghosh, W. Bao, I. Calizo, D. Teweldebrhan, F. Miao and C.N. Lau, "Superior thermal conductivity of single-layer graphene," Nano Letters, 8, 902 (2008)

[56] F. Parvizi, D. Teweldebrhan, S. Ghosh, I. Calizo, A.A. Balandin, H. Zhu and R. Abbaschian, "Properties of graphene produced by the high pressure – high temperature growth process," Micro & Nano Letters, 3, 29 (2008)

[57] S. Ghosh, I. Calizo, D. Teweldebrhan, E.P. Pokatilov, D.L. Nika, A.A. Balandin, W. Bao, F. Miao and C. N. Lau, "Extremely high thermal conductivity of graphene: Prospects for thermal management applications in nanoelectronic circuits," Applied Physics Letters, 92, 151911 (2008)

[58] Q. Shao, G. Liu, D. Teweldebrhan and A.A. Balandin, "High-temperature quenching of electrical resistance in graphene interconnects," Applied Physics Letters, 92, 202108 (2008)

[59] M. Shamsa, P.M. Solomon, K.A. Jenkins, A.A. Balandin and W. Haensch, "Investigation of thermal crosstalk between SOI FETs by the sub-threshold sensing technique," IEEE Trans on Electron Devices, 55, 1733 (2008)

[60] A.A. Balandin, M. Shamsa, W.L. Liu, C. Casiraghi and A.C. Ferrari, "Thermal conductivity of ultrathin tetrahedral amorphous carbon films," Applied Physics Letters, 93, 043115 (2008)

[61] M. Shamsa, S. Ghosh, I. Calizo, V. Ralchenko, A. Popovich and A.A. Balandin, "Thermal conductivity of nitrogeneated ultrananocrystalline diamond films on silicon," J. Applied Physics, 103, 083538 (2008)

[62] D.L. Nika, E.P. Pokatilov and A.A. Balandin, "Phonon - engineered mobility enhancement in the acoustically mismatched silicon/diamond transistor channels," Applied Physics Letters, 93, 173111 (2008)

2007

[63] I. Calizo, A.A. Balandin, W. Bao, F. Miao and C.N. Lau, "Temperature dependence of the Raman spectra of graphene and graphene multi-layers," Nano Letters, 7, 2645 (2007)

[64] I. Calizo, F. Miao, W. Bao, C.N. Lau and A.A. Balandin "Variable temperature Raman microscopy as a nanometrology tool for graphene layers and graphene-based devices," Applied Physics Letters, 91, 071913 (2007)

[65] I. Calizo, W. Bao, F. Miao, C.N. Lau and A.A. Balandin "The effect of substrates on the Raman spectrum of graphene: Graphene-on-sapphire and graphene-on-glass," Applied Physics Letters, 91, 201904 (2007)

[66] Q. Shao, A.A. Balandin, A.I. Fedoseyev and M. Turowski, "Intermediate-band solar cells based on quantum dot supra-crystals," Applied Physics Letters, 91, 163503 (2007)

[67] D. L. Nika, E. P. Pokatilov, Q. Shao and A.A. Balandin, "Charge carrier states and light absorption in the ordered quantum dot superlattices," Physical Review B, 76, 125417 (2007)

[68] C. Nobile, V.A. Fonoberov, S. Kudera, A. D. Torre, T. Kipp, L. Manna, R. Cingolani, A.A. Balandin and R. Krahne, "Confined optical phonon modes in aligned nanorod arrays detected by resonant inelastic light scattering," Nano Letters, 7, 476 (2007)

[69] A.A. Balandin, E.P. Pokatilov and D.L. Nika "Phonon engineering in hetero- and nanostructures," J. Nanoelectronics and Optoelectronics, 2, 140 (2007)

[70] E.P. Pokatilov, D.L. Nika, A.S. Askerov and A.A. Balandin, "Size-quantized oscillations of the electron mobility limited by the optical and confined acoustic phonons in the nanoscale heterostructures," J. Applied Physics, 102, 054304 (2007)

2006

[71] V.A. Fonoberov, K.A. Alim, A.A. Balandin, F. Xu and J.L. Liu, "Photoluminescence investigation of the carrier recombination processes in ZnO quantm dots and nanocrystals," Physical Review B, 73, 165317 (2006)

[72] V.A. Fonoberov and A.A. Balandin, "ZnO quantum dots: properties and optoelectronic applications," J. Nanoelectronics and Optoelectronics, 1, 19 (2006)

[73] V.A. Fonoberov and A.A. Balandin, "Giant enhancement of the carrier mobility in silicon nanowires with diamond coating," Nano Letters, 6, 2442 (2006)

[74] S.V. Kalinin, S. Jesse, W.L. Liu and A.A. Balandin, "Evidence for flexoelectricity in tobacco mosaic viruses used as nanotemplates," Applied Physics Letters, 88, 153902 (2006)

[75] M. Shamsa, W.L. Liu, A. A. Balandin, C. Casiraghi, W.I. Milne, A.C. Ferrari, "Thermal conduction in diamond-like carbon thin films," Applied Physics Letters, 89, 161921 (2006)

[76] W.L. Liu, M. Shamsa, I. Calizo, A.A. Balandin, V. Ralchenko, A. Popovich, A. Saveliev, "Thermal conduction in nanocrystalline diamond films: Effects of the grain boundary scattering and nitrogen doping," Applied Physics Letters, 89, 171915(2006)

[77] D.S. Choi, A.A. Balandin, M.S. Leung, G. Stupian, N. Presser, S.W. Chung, J.R. Heath, A. Khitun, K.L. Wang, "Transport study of a single bismuth nanowire," Applied Physics Letters, 89, 141503 (2006)

[78] E.P. Pokatilov, D.L. Nika and A.A. Balandin, "Electron mobility enhancement in AlN/GaN/AlN heterostructures with InGaN nanogrooves," Applied Physics Letters, 89, 112110 (2006)

[79] V.O. Turin and A.A. Balandin, "Electro-thermal simulations of the self-heating effects in GaN-based field-effect transistors," J. Applied Physics, 100, 054501 (2006)

[80] E.P. Pokatilov, D.L. Nika and A.A. Balandin, "The built-in field effect on the electron mobility in AlN/GaN/AlN quantum wells," Applied Physics Letters, 89, 113508 (2006)

2005

[81] K. Alim, V.A. Fonoberov and A.A. Balandin, "Origin of optical phonon frequency shifts in ZnO quantum dots," Applied Physics Letters, 86, 053103 (2005)

[82] K. Alim, V.A. Fonoberov, M. Shamsa and A.A. Balandin, "Micro-Raman investigation of optical phonons in ZnO quantum dots," J. Applied Physics, 97, 124313 (2005)

[83] V.A. Fonoberov and A.A. Balandin, "Polar optical phonons in wurtzite spheroidal quantum dots: theory and applications to ZnO and ZnO/MgZnO nanostructures," J. Phys: Condens. Matter, 17, 1085 (2005)

[84] M. Shamsa, W.L. Liu, A.A. Balandin and J.L. Liu “Phonon-hopping thermal conduction in quantum dot superlattices," Applied Physics Letters, 87, 202105 (2005)

[85] W.L. Liu and A.A. Balandin, “Thermal conduction in AlGaN alloys and thin films,“ J. Applied Physics, 97, 073710 (2005)

[86] Y. Bao, W.L. Liu, M. Shamsa, K. Alim, A.A. Balandin and J.L. Liu, "Electrical and thermal conductivity of Ge/Si quantum dot superlattices," J. Electrochemical Society, 152, G432 (2005)

[87] W.L. Liu and A.A. Balandin, “Thermoelectric effects in wurtzite GaN and AlGaN alloys,“ J. Applied Physics, 97, 123705 (2005)

[88] A.A. Balandin and V.A. Fonoberov, “Phonon confinement effects in hybrid virus-inorganic nanotubes for nanoelectronic applications,“ Nano Letters, 5, 1920 (2005)

[89] A.A. Balandin, "Nanophononics: Phonon engineering in nanostructures and nanodevices," J. Nanoscience and Nanotechnology, 5, 7 (2005)

[90] W.L. Liu, K. Alim, A.A. Balandin, D.M. Mathews and J.A. Dodds, "Assembly and characterization of hybrid virus-inorganic nanotubes," Applied Physics Letters, 86, 253108 (2005)

[91] E.P. Pokatilov, D.L. Nika and A.A. Balandin, "Acoustic-phonon propagation in rectangular semiconductor nanowires with elastically dissimilar barriers," Physical Review B, 72, 113311 (2005)

[92] E.P. Pokatilov, D.L. Nika and A.A. Balandin, "Acoustic phonon engineering in coated cylindrical nanowires," J. Superlattices and Microstructures, 38, 168 (2005)

[93] A.A. Balandin and V.A. Fonoberov, "Vibrational modes of nano-template viruses," J. Biomedical Nanotechnology, 1, 90 (2005)

2003

[94] Y. Bao, A.A. Balandin, J.L. Liu and Y.H. Xie, "Experimental investigation of Hall mobility in Ge/Si quantum dot superlattices," Applied Physics Letters, 84, 3355 (2004)

[95] V.A. Fonoberov and A.A. Balandin, "Origin of ultraviolet photoluminescence in ZnO quantum dots: Confined excitons vs. surface-bound excitons," Applied Physics Letters, 85, 5971 (2004)

[96] V.A. Fonoberov and A.A. Balandin, "Radiative lifetime of excitons in ZnO nanocrystals: The dead-layer effect," Physical Review B, 70, 195410 (2004)

[97] V.A. Fonoberov and A.A. Balandin, "Optical properties of wurtzite and zincblende GaN/AlN quantum dots," J. Vacuum Science and Technology B, 22, 2190 (2004)

[98] V.A. Fonoberov and A.A. Balandin, "Interface and confined optical phonons in wurtzite nanocrystals," Physical Review B, 70 (2004)

[99] V.A. Fonoberov and A.A. Balandin, "Low-frequency vibrational modes of viruses used for nanoelectronic self-assembly," physica status solidi (b): Rapid Research Notes, 12, R67 (2004)

[100] E.P. Pokatilov, D. Nika and A.A. Balandin, "A phonon depletion effect in ultrathin heterostructure with acoustically mismatched layers,"Applied Physics Letters, 85, 825 (2004)

[101] E.P. Pokatilov, D. Nika and A.A. Balandin, " Confined electron - confined phonon scattering rates in wurtzite AlN/GaN/AlN heterostructures,"J. Applied Physics, 95, 5626 (2004)

[102] W.L. Liu and A.A. Balandin, "Temperature dependence of thermal conductivity of $Al_xGa_{1-x}N$ thin films measured by the differential 3ω technique," Applied Physics Letters, 85, 5230 (2004)

[103] V.O. Turin and A.A. Balandin,"Performance degradation of GaN field-effect transistors due to thermal boundary resistance at GaN/substrate interface," Electronics Letters, 40, 81 (2004)

Earlier Years

[104] A.A. Balandin and O.L. Lazarenkova, "Mechanism for thermoelectric figure-of-merit enhancement in regimented quantum dot superlattices," Applied Physics Letters, 82, 415 (2003)

[105] V.A. Fonoberov and A.A. Balandin, "Excitonic properties of strained wurtzite and zincblende GaN/AlN quantum dots," J. Applied Physics, 94, 7178 (2003)

[106] O.L. Lazarenkova and A.A. Balandin, "Electron and phonon energy spectra in a three-dimensional regimented quantum dot superlattice," Physical Review B, 66, 245319 (2002)

[107] V. A. Fonoberov, E. P. Pokatilov and A. A. Balandin, "Exciton States and Optical Transitions in Colloidal CdS Quantum Dots: Shape and Dielectric Mismatch Effects", Physical Review B, 66, 085310 (2002)

[108] J. Zou, D. Kotchetkov, A.A. Balandin, D.I. Florescu, and F.H. Pollak, "Thermal conductivity of GaN films: effects of impurities and dislocations" J. Applied Physics, 92, 2534 (2002)

[109] D. Kotchetkov, J. Zou, A.A. Balandin, D.I. Florescu and F.H. Pollak, Effect of dislocations on thermal conductivity of GaN layers, Applied Physics Letters, 79, 4316 (2001)

[110] O.L. Lazarenkova and A. Balandin, Miniband formation in a quantum dot crystal, J. Applied Physics, 89, 5509 (2001)

[111] J. Zou and A. Balandin, Phonon heat conduction in a semiconductor nanowire, J. Applied Physics, 89, 2932 (2001)

[112] A. Khitun, A. Balandin, J.L. Liu and K.L. Wang, "The effect of long-range order in a quantum dot array on the in-plane lattice thermal conductivity," J. Superlattices and Microstructures, 30, 1 (2001)

[113] A. Balandin, "Gate-voltage dependence of low-frequency noise in the GaN/AlGaN heterostructure field-effect transistors", Electronics Letters, 36, 912 (2000)

[114] A. Balandin, K.L. Wang, S.J. Cai, R. Li, C.R. Viswanathan, E.N. Wang and M. Wojtowicz, "Investigation of flicker noise and deep-levels in GaN/AlGaN transistors", J. Electronic Materials, 29, 297 (2000)

[115] R. Vrijen, E. Yablonovitch, K. Wang, H.W. Jiang, A. Balandin, V. Roychowdhury, T. Mor, and D. DiVincenzo, "Electron-spin-resonance transistors for quantum computing in silicon-germanium heterostructures," Physical Review A, 62, 012306 (2000)

[116] A. Balandin, G. Jin and K.L. Wang, "Issues of practical realization of a quantum dot register for a quantum computer," J. Electron Materials, 20, 549 (2000)

[117] A. Balandin, K.L. Wang, N. Kouklin and S. Bandyopadhyay, "Raman spectroscopy of electrochemically self-assembled CdS quantum dots," Applied Physics Letters, 76, 137 (2000)

[118] A. Khitun, A. Balandin, K.L. Wang and G. Chen, "Enhancement of the thermoelectric figure of merit of SiGe quantum wires due to spatial confinement of acoustic phonons," Physica E, 8, 13 (2000)

[119] A. Khitun, A. Balandin, J.L. Liu, and K.L. Wang, "In-plane lattice thermal conductivity of a quantum-dot superlattice," J. Applied Physics, 88, 696 (2000)

[120] A. Balandin, S. Morozov, G. Wijeratne, S.J. Cai, R. Li, J. Li, K.L. Wang, C.R. Viswanathan and Yu. Dubrovskii, "Effect of channel doping on the low-frequency noise in GaN/AlGaN HFETs," Applied Physics Letters, 75, 2064 (1999)

[121] A. Balandin, S. Morozov, S. Cai, R. Li, K.L. Wang, G. Wijeratne and C.R. Viswanathan, "Low flicker-noise GaN/A1GaN heterostructure field-effect transistors for microwave communications," IEEE Trans. Microwave Theory and Techniques, 47, 1413 (1999)

[122] A. Balandin and K.L. Wang, "Feasibility study of the quantum XOR gate based on coupled asymmetric quantum dots," J. Superlattices and Microstructures, 25, 509 (1999)
[123] J.L. Liu, W.G. Wu, A. Balandin, G.L. Jin and K.L. Wang, "Intersubband absorption in boron-doped multiple Ge quantum dots," Applied Physics Letters, 74, 185 (1999)

[124] J.L. Liu, W.G. Wu, A. Balandin, G.L. Jin, Y.H. Luo, S.G. Thomas, Y. Lu and K.L. Wang, "Observation of intraband transitions in modulation-doped Ge quantum dots," Applied Physics Letters, 75, 1745 (1999)

[125] A. Balandin and K.L. Wang, "Significant decrease of the lattice thermal conductivity due to phonon confinement in a free-standing semiconductor quantum well," Physical Review B, 58, 1544 (1998).

[126] A. Balandin and K.L. Wang, "Effect of phonon confinement on the thermoelectric figure of merit of quantum wells," J. Applied Physics, 84, 6149 (1998)

[127] A. Svizhenko, A. Balandin, S. Bandyopadhyay and M.A. Stroscio, "Electron interaction with confined acoustic phonons in quantum wires subjected to a magnetic field," Physical Review B, 57, 4687 (1998)

[128] A. Balandin, S. Cai, R. Li, K.L. Wang, V.R. Rao and C.R. Viswanathan, "Flicker noise in GaN/AlGaN doped channel heterostructure field effect transistors," IEEE Electron Device Letters, 19, 475 (1998)

[129] A. Balandin, S. Morozov, G. Wijeratne, S.J. Cai, R. Li, K.L. Wang and C.R. Viswanathan, "Effect of channel doping on the low-frequency noise in GaN/AlGaN heterostructure field-effect transistors," Applied Physics Letters, 75, 2064 (1999)

[130] S. Bandyopadhyay, A. Balandin, V. Roychowdhury and F. Vatan, "Nanoelectronic implementations of reversible and quantum logic," J. Superlattices and Microstructures, 23, 445 (1998)