

Sergei V. Kalinin

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Force-Based Probes Lead, Imaging Functionality Group
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Education

Moscow State University, Russia (ranked 1 st)	Chemistry and Materials Science	B.S., 1996
Moscow State University, Russia (ranked 1 st)	Chemistry and Materials Science	M.S., 1998
University of Pennsylvania, PA	Materials Science	Ph.D., 2002

Research Interests

Coupling between electromechanical, electrical, and transport phenomena on the nanoscale in functional oxides and molecular systems; emergent phenomena in nanostructures transition metal oxides; electrostatic and electromechanical interactions in liquids, and molecular systems; local probes of photoelectric phenomena in ferroelectrics, photovoltaic, and electroluminescent materials; developing novel SPM techniques, mathematical analysis of SPM data, quantitative measurements of local properties by SPM.

Professional Experience

Oct. 2007–p	Co-theme leader for Functional Imaging on the Nanoscale, Center for Nanophase Materials Sciences, ORNL
Dec 2010–p	Joint faculty, Center for Interdisciplinary Research and Graduate Education, University of Tennessee, Knoxville
Fall 2006–p	Adjunct Associate Professor, Department of Materials Science and Engineering, University of Tennessee, Knoxville
Oct. 2004–p	Research Staff Member, ORNL
Oct. 2002–Oct. 2004	Eugene P. Wigner Fellow, ORNL

Professional and Synergistic Activities

2011	Co-Technical program chair, ISAF-PFM, Vancouver, Canada 2011
2010–p	Volume editor, MRS Bulletin 2012
Nov 2010–p	IEEE Ferroelectric Committee member
2009	Adjunct Professor, Penn. State University
2009	Section Editor, <i>Nanotechnology</i>
2007–p	Organizer, Workshop Series, “Nanoscale Electromechanics by Piezoresponse Force Microscopy,” (10 workshops to date, including Vancouver, Canada, 2011, Beijing, China 2010, Tsukuba, Japan, 2009, Aveiro, Portugal, CNMS User Meeting, ORNL 2008, EPFL, Switzerland, 2008, CNMS User Meeting, ORNL 2007)
2005–p	Member of Editorial Board, Journal of Nanoelectronics and Optoelectronics
2006–p	Member of publications committee, American Vacuum Society
2004–2006	Member at large, Nanoscale Science and Technology Division, American Vacuum Society
2005, 2006	Instructor for Lehigh microscopy course in SPM
2004	Organizer, Fall MRS Symposium Organizer Piezoresponse Force Microscopy

Honors and Awards

2010	R&D 100 Award for “Ztherm Modulated Thermal Analysis” (with M. Nikiforov and S. Jesse, ORNL, and A. Gannepali and R. Proksch, Asylum Research).
2009	Presidential Early Career Award for Scientists and Engineers (PECASE)
2010	2010 IEEE-UFFC Ferroelectrics Young Investigator Award, 2010
2010	Burton medal for Young Investigator, Microscopy Society of America, 2010
2009	ISIF Young Investigator Award, 2009

2009	Robert L. Coble Award for Young Scholars, American Ceramic Society,
2008	R&D 100 Award for “Adaptive Band Excitation Method and Controller in Scanning Probe Microscopy” (with S. Jesse, ORNL, and R. Proksch, Asylum Research)
2008	Peter Mark Memorial Award for Young Scientists, AVS: Science and Technology Society
2008	Cosslett Award for Best Invited Paper of Microbeam Analysis Society (with Stephen Jesse)
2006	ORNL Director Award for Team Accomplishment in Science and Technology
2005	ORNL Early Career Accomplishment Award for Science and Technology
2003	Ross Coffin Purdy Award of American Ceramic Society
2002	Wigner Fellowship of Oak Ridge National Laboratory
2001	MRS Gold Graduate Student Award
2000, 1999	MRS Silver Graduate Student Award

Selected Peer-Reviewed Publications (Author of >200 peer-reviewed papers (1 *Science*, 3 *Nature Mat.*, 2 *Nature Nanotech.*, 1 *Nature Chem.*, 13 *Phys. Rev. Lett.*, 10 *Adv. Mat.*, 2 *PNAS*, 12 *Nano Lett*, 7 *ACS Nano*), 9 book chapters, 3 books edited [+2 in Russian], citations >3000, $h = 30$, 6 patents, 7 disclosures, ~120 invited and plenary talks and workshops):

Research Synopsis

1. *Polarization dynamics in ferroelectrics and multiferroics.*
We use piezoresponse force microscopy and spectroscopy to probe bias-induced phase transitions in ferroelectric and multiferroic materials on a single defect level, and decipher corresponding mesoscopic mechanisms. We further explore possibility of controlling phase transition between several possible pathways, creating novel topological structures and exploring their conduction.
2. *Ionic transport and electrochemical phenomena in oxygen ion conductors.*
Electrochemical strain microscopy and scanning transmission electron microscopy are used to probe oxygen reduction/evolution reaction in solid ionic conductors and mixed ionic-electronic conductors with dual goal of understanding gas-solid electrochemical reactions on single defect level and determining the role of local oxygen stoichiometry on physical properties.
3. *Multifrequency scanning probe microscopy techniques.*
We develop the multifrequency SPM techniques based on band excitation principle for quantitative imaging of electrical, thermomechanical, magnetic, mechanical, and electromechanical phenomena and probing of associated energy dissipation pathways.
4. *Electrochemical phenomena in Li-ion materials.*
Electrochemical strain microscopy is used to probe reversible and irreversible electrochemical phenomena in Li-ion and Li-air battery materials.
5. *Local transport measurements.*
Scanning probe microscopy is used to probe dc and ac electronic and ionic transport in lateral device structures.

Graduate and Postdoctoral Advisors

Graduate Advisor: Dawn A. Bonnell (University of Pennsylvania)

Thesis Advisor and Postgraduate-Scholar Sponsor:

Nina Balke (Currently staff member at ORNL), Oleg Ovchinnikov (currently graduate student at Vanderbilt), Brian Rodriguez (currently faculty at UC Dublin), Stephen Jesse (currently staff member at CNMS/ORNL), Maxim Nikiforov (currently Director Scholar at ANL), Katya Seal (currently at UTK), Alexander Tselev (present), Senli Guo (currently at Bruker), Alexander Tselev (present) and Evgheny Strelkov (present)

Total Graduate Students Advised: 0

Total Postdoctoral Scholars Advised: 9