Sergei V. Kalinin

PROFESSIONAL EXPERIENCE

June 2014 – present Director, Institute for Functional Imaging of Materials, ORNL

Oct. 2007 – Oct. 2016 co-theme leader for Electronic and Ionic Functionality (previously Functional Imaging on the Nanoscale), Center for Nanophase Materials Sciences, ORNL

Jan 2013 – present adjunct professor, Sung Kyun Kwan University, South Korea

Dec 2010 – present joint faculty, Center for Interdisciplinary Research and Graduate Education, University of Tennessee, Knoxville

Dec 2009 – present adjunct faculty, Department of Materials Science and Engineering, Pennsylvania State University

Fall 06 – present Adjunct Associate Professor, Department of Materials Science and Engineering, University of Tennessee, Knoxville

Fall 05 – present Adjunct Assistant Professor, Department of Materials Science and Engineering, North Carolina State University

Oct. 04 – present Research Staff Member, Oak Ridge National Laboratory

Oct. 02 – Oct. 2004 Eugene P. Wigner Fellow, Oak Ridge National Laboratory

Sept. 02 Ph.D., Department of Materials Science and Engineering, University of Pennsylvania, Thesis: *Nanoscale Electric Phenomena in Oxide Materials by Scanning Probe Microscopy*, Advisor: Prof. Dawn A. Bonnell, **GPA** 4.0/4.0

Jan. 1998 M.S. summa cum laude, Department of Materials Science, Moscow State University, RUSSIA, Thesis: *Cryosol synthesis of nanocomposite materials*, Advisor: Prof. Alexey A. Vertegel, **GPA** 5.0/5.0, ranked first in class for the whole period of education

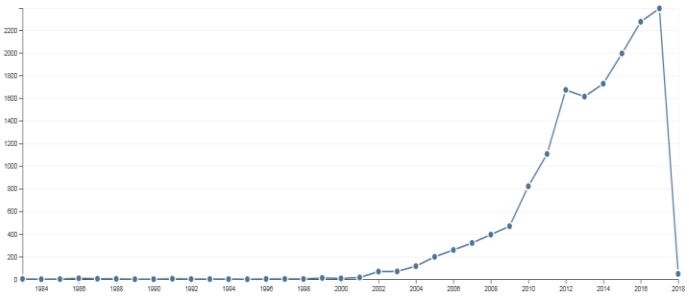
HONORS AND AWARDS

- Pollak lecture, Technion, **2019**
- Fellow, Foresight Institute, **2018**
- Zernicke lecture, U. Groeningen, **2018**
- Fellow, IoP, **2017**
- Fellow, IEEE, **2017**
- Fellow, Materials Research Society, **2017**
- One of the top 100 most cited Russian physicists, **2017**
- RD100 Award finalist for "G-Mode Scanning Probe Microscopy and Spectroscopy", **2016**
- Finalist, Blavatnik National Award for Young Scientists, Physics, **2016, 2017**

- Microscopy Today Innovation Award for "General Mode (G-mode) Microscopy & Spectroscopy", **2016**
- Fellow, American Physical Society, **2015**
- Fellow, AVS, **2015**
- IEEE Senior member, **2015**
- Medal for Scanning Probe Microscopy, Royal Microscopical Society, **2015**
- ORNL Distinguished Scientist Award, **2013**
- ORNL Team Award in Science and Technology (led the team), **2011**
- Microscopy Today Innovation Award for "Electrochemical Strain Microscopy", **2011**
- Roland B. Snow Award, American Ceramics Society, **2010**
- Presidential Early Career Award for Scientists and Engineers (PECASE), **2009**
- R&D 100 Award for "Ztherm Modulated Thermal Analysis" (with M. Nikiforov and S. Jesse, ORNL, and A. Gannepali and R. Proksch, Asylum Research), **2010**
- Microscopy Today Innovation Award for "Adaptive Band Excitation Method in Scanning Probe Microscopy", **2010**
- Significant Event Award, ORNL **2010**
- 2010 IEEE-UFFC Ferroelectrics Young Investigator Award, **2010**
- Burton medal for Young Investigator, Microscopy Society of America, **2010**
- ISIF Young Investigator Award, **2009**
- Robert L. Coble Award for Young Scholars, American Ceramic Society, **2009**
- Southeast FLC Excellence in Technology Transfer Award for "Adaptive Band Excitation Method and Controller in Scanning Probe Microscopy", **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 (principal S. Jesse). **2008**
- CNMS Division Director Award, **2007** and **2009**
- ORNL Director Award for Outstanding Team Accomplishment in Science and Technology (led the team), **2006**
- Team Scientific Research Award from ORNL (led the team), **2006**
- ORNL Early Career Accomplishment Award for Science and Technology, **2005**
- Ross Coffin Purdy Award of American Ceramic Society, **2003**
- Wigner Fellowship of Oak Ridge National Laboratory, **2002**
- MRS best poster award (**Fall 2009**, **Spring 2005**, **Fall 2003**)
- AVS Graduate Student Award, **2002**
- MRS Gold Graduate Student Award - **Fall 2001** Meeting

- MRS Silver Graduate Student Award - **Fall 1999** Meeting, **Fall 2000** Meeting
- Ceramographics Contest at 2000 ACerS meeting (2nd and 3d award in Problem Solving and 3d award in Scanning Probe Microscopy sections)
- Bochvar Prize for excellence in studies (Moscow State University) **1998**
- Novoselova prize for best student research work in Inorganic Chemistry, MSU, **1997**
- Soros undergraduate student fellowship **1994/1995**, **1995/1996** and **1996/1997**
- Moscow State University Lomonosov Scholarship for Excellency in Studies, **1996/1997**
- State Scholarship for Young Scientists from Russian Academy of Sciences, **1994-1996**

PUBLICATIONS



In total, >560 peer-reviewed papers (2 *Science*, 2 *Nature*, 8 *Nature Mat*., 4 *Nature Nanotech*., 1 *Nature Chem*., 4 *Nature Phys*., 22 *Nature Comm*., 13 *Sci. Rep*., 17 *Phys. Rev. Lett*., 40 *Adv. (Func., Electronic, Energy) Mat*., 2 *PNAS*, 27 *Nano Lett*, 41 *ACS Nano*, 2 *Small*), 20 reviewed papers in conference proceedings, 11 book chapters, 2 books [+2 in Russian], citations >14500, *h* = 60 by ISI (75 by *Google Scholar*), 15 patents, 7 disclosures, ~200 invited and plenary talks and workshops

PROFESSIONAL SERVICES

- Conference organizer, IMRS Cancun, Mexico, 2017
- Chair-elect, Nanoscale Science and Technology Division, AVS, 2016
- Editor, NPJ *Computational Materials*, since 2015
- Member, Program Development Subcommittee MRS, since **2014**, Award Diversity Subcommittee, since **2017**
- Editorial board, *Advances in Chemical and Structural Imaging*, since 2014
- Editorial advisory board, *ACS Nano*, since 2014
- Co-Technical program chair, ISAF-PFM, Penn State, 2014
- Co-Technical program chair, IEEE-ISAF-PFM, Prague, Czech Republic, 2013
- Member of editorial board, Applied Physics Letters/Journal of Applied Physics (since 2012)
- Member of editorial board, Scientific Reports (Nature Publishing group)
- Member of editorial board, Frontiers
- Conference organizer, MRS 2014 Spring Meeting
- Organizer, PFM School and 12th PFM workshop (ORNL March 2013)
- Co-organizer, 3d International Workshop of Imaging Energy Materials, ORNL 2012
- Co-Organizer, 11th Workshop on Nanoscale Electromechanics by Piezoresponse Force Microscopy, Aveiro, Portugal 2012 (as a part of ISAF-ECAPD-PFM conference)

- Co-Technical program chair, ISAF-PFM, Vancouver, Canada 2011
- Co-Organizer, 10th Workshop on Nanoscale Electromechanics by Piezoresponse Force Microscopy, Vancouver, Canada 2011
- IEEE Ferroelectric Committee member, since November 2010
- Organizer, Workshop on Scanning Probe Microscopy for Energy Materials, ORNL, September 2010
- Co-Organizer, 9th Workshop on Nanoscale Electromechanics by Piezoresponse Force Microscopy, Prague, Czech Republic, September 2010
- Co-Organizer, 8th Workshop on Nanoscale Electromechanics by Piezoresponse Force Microscopy, Beijing, China 2010
- Volume editor, *MRS Bulletin* 2012.
- Editorial board member, *Nanotechnology*, 2010 – present (2010-2013 – Section editor for patterning and nanofabrication)
- (since 2009 – present) Associate Editor, *J. Appl. Phys*. special volume on Piezoresponse Force Microscopy and Nanoscale Ferroelectrics (Proceedings of PFM Workshop series, 3 published and 1 planned for 2013))
- Organizer, 6th Workshop on Nanoscale Electromechanics by Piezoresponse Force Microscopy, Oak Ridge, TN, 2009
- Co-Organizer, 5th Workshop on Nanoscale Electromechanics by Piezoresponse Force Microscopy, NIMS, Japan, 2009
- Organizer, 4th Workshop on Nanoscale Electromechanics by Piezoresponse Force Microscopy, Aveiro, Portugal, 2009
- DOE DMSE Panel on Scanning Probe Microscopy, Annapolis, MD, October 2009
- Organizer, 3rd Workshop on Nanoscale Electromechanics by Piezoresponse Force Microscopy, Oak Ridge, TN, 2008
- Member of program committee, Non-contact AFM 2008, Madrid, Spain
- Organizer, 2nd Workshop on Piezoresponse Force Microscopy, EPFL, Switzerland, May 2008
- DOE DMSE Panel on Long-Range Interactions, Annapolis, MD, October 2007
- Organizer, Workshop on Nanoscale Electromechanics by Piezoresponse Force Microscopy, Oak Ridge, TN, 2007
- Member of Editorial Board, *Journal of Nanoelectronics and Optoelectronics*, 2005-present
- Member of publications committee, American Vacuum Society, 2006 - 2013
- Member at large, Nanoscale Science and Technology Division, American Vacuum Society, 2004-2006
- Session chair, "Seeing on the Nanoscale-III", Veeco Instruments (2005), "Seeing on the Nanoscale-IV" (2006).
- Instructor for Lehigh microscopy course in SPM (2005, 2006)

- MRS Symposium Organizer (Spring 2018, Spring 2017, Spring 2011, Spring 2009, Fall 2007, Fall 2004 Meeting)
- Member of NSF MRI panel (2004)
- Reviewed manuscripts for Physical Review Letters, Physical Review B, Applied Physics Letters, Journal of Applied Physics, Journal of the American Ceramic Society, Journal of Physical Chemistry, Journal of Electronic Materials, Nanotechnology, Nano Letters, Applied Physics A, Journal of Materials Research and MRS Symposia Proceedings.
- AVS session chair (2006 Meeting, 2005 Meeting, 2004 Meeting, 2001 Meeting); MRS session chair (Fall 2006 Meeting, Fall 2004 Meeting, Fall 2002 Meeting)

MEMBER

AAAS, IEEE, Materials Research Society, American Vacuum Society, American Ceramic Society, American Physical Society, Electrochemical Society

LIST OF PUBLICATIONS

Video lectures

1. IFIM, https://www.youtube.com/watch?v=0hwZTUvFzko&feature=youtu.be
2. 30 years of SPM, https://www.brighttalk.com/webcast/8013/229945/celebrating-30-years-of-afm-and-stm
3. SERGEI V. KALININ, *Atomic Forge*,

   https://www.youtube.com/watch?v=mZMhRPAJRsw&feature=youtu.be

Books

4. (editor, 5 book collection) SERGEI V. KALININ and IAN FOSTER, *Big, Deep, and Smart Data in Physical Scinces*, World Scientific, in progress
5. (editor) E. STACH, J. SETHIAN, O. OVCHINNIKOVA, and S.V. KALININ, *Big, Deep, and Smart Data in Physical Imaging: Scanning and Electron Microscopy and Chemical Imaging*, World Scientific, in progress
6. (editor) DAWN A. BONNELL and SERGEI V. KALININ, *Scanning Probe Microscopy for Energy Research*, World Scientific, 2013
7. **(editor)** SERGEI V. KALININ and ALEXEI GRUVERMAN (Eds.), *Functional Imaging of Advanced Materials by Scanning Probe Microscopy*, Springer 2010
8. **(editor)** SERGEI V. KALININ and ALEXEI GRUVERMAN (Eds.), *Scanning Probe Microscopy: Electrical and Electromechanical Phenomena on the Nanoscale*, Vol. I, II, Springer (2006).
9. **(author)** S.V. KALININ and V.V. ZAGORSKY, *Handbook on chemistry for secondary school students*, Moscow, Mezdynarodnaya programma obrazovania, 1 ed. –1996, 2ed. –1997 (in Russian)
10. **(author)** S.V. KALININ, *Concise handbook on chemistry for secondary school students*, Moscow, Kultura i traditsii, 1 ed. - 1993, 2 ed. - 1995. (in Russian)

Journal Special Issues

11. **(editors)** SERGEI V. KALININ and S. PENNYCOOK, *Building matter atom by atom by scanning probes and electron beams*, MRS Bulletin 2016
12. **(editors)** N. BASSIRI-GHARB, SERGEI V. KALININ, and N. VALANOOR, *Selected Papers from the Piezoresponse Force Microscopy Workshop Series: Part of the Joint ISAF-ECAPD-PFM 2013 Conference*, special issue of J. Appl. Phys. **116** (2014).
13. **(editors)** J. LI, SERGEI V. KALININ, and A. KHOLKIN, *Selected Papers from the Piezoresponse Force Microscopy Workshop Series: Part of the Joint ISAF-ECAPD-PFM 2012 Conference*, special issue of J. Appl. Phys. **113** (2013).
14. **(organizer)** *Scanning Probe Microscopy in Nanoscale Science Research Centers (NSRC) of the US Department of Energy (DOE)*, special issue of Advanced Functional Materials (2013)

15. **(editors)** S.V. KALININ, Z.G. YE, and A.L. KHOLKIN, *Piezoresponse Force Microscopy and Nanoscale Phenomena in Polar Materials*, special issue of J. Appl. Phys. **112** (2012).
16. **(editors)** S.V. KALININ and A.L. KHOLKIN, *Piezoresponse force microscopy and nanoscale phenomena in polar materials*, special issue of J. Appl. Phys. **110** (2011).
17. **(editor)** SERGEI V. KALININ, J. JOSHUA YANG and ANNA DEMMING, *Non-volatile memory based on nanostructures*, Nanotechnology 25, 24 June 2011
18. **(editors)** S.V. KALININ, N. SETTER, and A.L. KHOLKIN, *Invited Papers from the International Symposium on Piezoresponse Force Microscopy and Nanoscale Phenomena in Polar Materials, Aveiro, Portugal*, 2009, special issue of J. Appl. Phys. **108** (2010).
19. **(editor)** SERGEI V. KALININ, NAVA SETTER and ANDREI KHOLKIN (Eds.), *NanoScale Electromechanics: Principles, Devices, and Applications*, MRS Bulletin, September 2009
20. **(editor)** SERGEI V. KALININ and HIROSHI FUNAKUBO, *Materials*, special issue on "Advances in Ferroelectric & Piezoelectric Materials".
21. **(editor)** S.V. KALININ, B. GOLDBERG, B. HUEY, AND L.M. ENG (Eds.), *Scanning Probe and Other Novel Microscopies of Local Phenomena in Nanostructured Materials*, Mat. Res. Soc. Proceedings Vol. 838E (electronic) (2005).

Book chapters

22. S. JESSE, L. COLLINS, S. NEUMAYER, S. SOMNATH, and SERGEI V. KALININ, *Dynamic Modes in Kelvin Probe Force Microscopy: Band Excitation and G-Mode*, in *Kelvin Probe Force Microscopy* Ed. By Thilo Glaetsel and Sacha Sadewasser, Springer 2017
23. E. STRELCOV, M. AHMADI, and SERGEI V. KALININ, *Nanoscale Transport Imaging of Active Lateral Devices: Static and Frequency Dependent Modes*, in *Kelvin Probe Force Microscopy* Ed. By Thilo Glaetsel and Sacha Sadewasser, Springer 2017
24. A. KUMAR, S.V. KALININ, and Y. KIM, *Exploring Electro-Chemo-Mechanical Phenomena on the Nanoscale Using Scanning Probe Microscopy*, in *Electro-Chemo-Mechanics of Solids*, Springer, 2017
25. ANNA N. MOROZOVSKA, EUGENE A. ELISEEV and SERGEI V. KALININ, *Topological Defects in Ferroic Materials*, in *Topological Structures in Ferroic Materials*, Springer 2016
26. A.N. MOROZOVSKA, O.V. VARENYK, and S.V. KALININ, *Impact of Flexoelectric Effect on Electro-mechanics of Moderate Conductors*, in *Flexoelectricity in Solids*, Ed. by A.K. Tagantsev and P.V. Yudin, World Scientific 2016
27. A.N. MOROZOVSKA, S.V. KALININ, and E.A. ELISEEV, *Flexoelectricity Impact on the Domain Wall Structure and Polar Properties*, in *Flexoelectricity in Solids*, Ed. by A.K. Tagantsev and P.V. Yudin, World Scientific 2016
28. S.V. KALININ AND D.A. BONNELL, *The Role of Local Probes in the Next Decade of Energy Research and Development*, in "*Scanning Probe Microscopy for Energy Research*," edited by D.A. Bonnell and S.V. Kalinin, World Scientific, 2013
29. A. KUMAR, F. CUICCI, A. MOROZOVSKA, S. JESSE, S. KALININ, *Electrochemical Strain Microscopy of Oxygen Ion Conductors: Fuel Cells and Oxide Electronics*, in "*Scanning Probe*

Microscopy for Energy Research," edited by D.A. Bonnell and S.V. Kalinin, World Scientific, 2013

30. T. ARRUDA, N. BALKE, S. JESSE, S. KALININ, *Electrochemical Strain Microscopy of Li-Ion and Li Air Battery Materials*, in "*Scanning Probe Microscopy for Energy Research*," edited by D.A. Bonnell and S.V. Kalinin, World Scientific, 2013

31. BRIAN J. RODRIGUEZ, ROGER PROKSCH, PETER MAKSYMOVYCH, and SERGEI V. KALININ, *Scanning Probe Microscopy – Forces and Currents in the Nanoscale World*, in "Handbook of Nanoscopy Vol.1", edited by G. Van Tendeloo, D. van Dyck, and S. Pennycook, Wiley-VCH; 1 edition (May 21, 2012)

32. SERGEI V. KALININ, BRIAN J. RODRIGUEZ, AND A. KHOLKIN, *Piezoresponse Force Microscopy and Spectroscopy*, Springer NanoEncyclopedia,

33. BRIAN J. RODRIGUEZ and SERGEI V. KALININ, *KPFM and PFM of Biological Systems*, in *Kelvin Probe Force Microscopy: Measuring and Compensating Electrostatic Forces* (Springer Series in Surface Sciences), Sascha Sadewasser (Editor), Thilo Glatzel (Editor)

34. R. O'HAYRE, M. LEE, F. PRINZ, and S.V. KALININ, *Scanning Impedance Microscopy and Nanoimpedance Microscopy*, in SERGEI V. KALININ and ALEXEI GRUVERMAN (Eds.), *Scanning Probe Microscopy: Electrical and Electromechanical Phenomena on the Nanoscale*, Vol. I, Springer (2006).

35. A. KHOLKIN, A. ROELOFS, S.V. KALININ, and A. GRUVERMAN, Review of Ferroelectric Domain Imaging by Piezoelectric Force Microscopy, in SERGEI V. KALININ and ALEXEI GRUVERMAN (Eds.), *Scanning Probe Microscopy: Electrical and Electromechanical Phenomena on the Nanoscale*, Vol. I, Springer (2006).

36. A. GRUVERMAN, and S.V. KALININ, *Bioelectromechanical Imaging by Scanning Probe Microscopy: The Galvani Experiment on the Nanoscale*, in SERGEI V. KALININ and ALEXEI GRUVERMAN (Eds.), *Scanning Probe Microscopy: Electrical and Electromechanical Phenomena on the Nanoscale*, Vol. I, Springer (2006).

37. SERGEI V. KALININ and DAWN A. BONNELL, *Scanning Probe Microscopy Of Piezoelectric And Transport Phenomena In Electroceramic Materials*, in NATO ASI Series, P. Vilarinho (Ed.), Kluwer Academic Publishers (2004).

38. SERGEI V. KALININ and DAWN A. BONNELL, *Polarization and Charge Dynamics in Ferroelectric Materials with Scanning Probe Microscopy*, in *Nanoscale Phenomena in Ferroelectric Thin Films*, Ed. S. Hong, Kluwer (2004)

39. SERGEI V. KALININ and DAWN A. BONNELL, *Imaging mechanism and Quantification of Scanning Force Microscopy of Ferroelectric Surfaces*, in *Nanoscale Characterization of Ferroelectric Materials*, Eds. M. Alexe and A. Gruverman, Springer (2004), cond-mat/0301535

40. SERGEI V. KALININ and DAWN A. BONNELL, *Electrostatic and Magnetic Force Microscopy, in Scanning Probe Microscopy: Theory, Techniques and Applications*, Ed. D.A. Bonnell, Wiley VCH, 2000

Papers: Published

41. D.K. PRADHAN, S. KUMARI, E. STRELCOV, D.K. PRADHAN, R.S. KATIYAR, SERGEI V. KALININ, N. LAANAIT, and R.K. VASUDEVAN, *Reconstructing phase diagrams from local measurements via Gaussian Processes: Mapping the temperature-composition space to confidence*, NPJ Materials by Design, in print

42. M. AHMADI et al., *Exploring anomalous polarization dynamics in organometallic halide perovskites*, Adv. Mat., in print

43. M. ZIATDINOV, O. DYCK, A. MAKSOV, X. LI, X. SANG, K. XIAO, R. UNOCIC, R. VASUDEVAN, S. JESSE, and SERGEI V. KALININ, *Deep Learning of Atomically Resolved Scanning Transmission Electron Microscopy Images: Chemical Identification and Tracking Local Transformations*, ACS Nano, in print

44. M.R. LI, E.E. MCCABE, P.W. STEPHENS, M. CROFT, L. COLLINS, S.V. KALININ, Z. DENG, M. RETUERTO, A. SEN GUPTA, H. PADMANABHAN, V. GOPALAN, C.P. GRAMS, J. HEMBERGER, F. ORLANDI, P. MANUEL, W.M. LI, C.Q. JIN, D. WALKER, and M. GREENBLATT, *Magnetostriction-polarization coupling in multiferroic* Mn_2MnWO_6, Nat. Comm., in print

45. S. SOMNATH, K. LAW, A. MOROZOVSKA, P. MAKSYMOVYCH, Y. KIM, X. LU, M. ALEXE, R. ARCHIBALD, S.V. KALININ, S. JESSE, and R. VASUDEVAN, *Ultrafast current imaging by Bayesian inversion*, Nature Comm., in print

46. A.V. IEVLEV, A. BELIANINOV, S. JESSE, D. ALLISON, M. DOKTYCZ, S. RETTERER, S.V. KALININ, and O.S. OVCHINNIKOVA, *Automated Interpretation and Extraction of Topographic Information from Time of Flight Secondary Ion Mass Spectrometry Data*, Sci. Rep. in print

47. I. FABRIKANT, E. KARAPETIAN, and S.V. KALININ, *Interaction between a punch and an arbitrary crack or inclusion in a transversely isotropic half-space*, Z. Angew. Math. Phys., in print

48. J.M. BLACK, J. COME, S. BI, M. ZHU, W. ZHAO, A.T. WONG, J.H. NOH, P.R. PUDASAINI, P. ZHANG, M.B. OKATAN, S. DAI, S.V. KALININ, P.D. RACK, T.Z. WARD, G. FENG, and N. BALKE, *Role of Electrical Double Layer Structure in Ionic Liquid Gated Devices*, ACS Appl. Mater. Interfaces

49. L. Wang et al., *Electronic Reconstruction Enhanced Tunneling Conductance at Terrace Edges of Ultrathin Oxide Films*, Advanced Materials, in print

50. A.N. MOROZOVSKA, E.A. ELISEEV, N. BORODINOV, O. OVCHINNIKOVA, N.V. MOROZOVSKY, and S.V. KALININ, *Thermal Contrast in Nanoscale Infrared Spectroscopy (AFM-IR): Low Frequency Limit*, submitted, arXiv:1705.09341

51. Y. CAO, L.Q. CHEN, and S.V. KALININ, *Role of flexoelectric coupling in polarization rotations at the ac domain walls in ferroelectric perovskites*, Appl. Phys. Lett. **110**, 202903 (2017).

52. Y. CAO, A. MOROZOVSKA, and S.V. KALININ, *Pressure induced switching in ferroelectrics: on the junction between physics and electrochemistry*, Phys. Rev. B submitted, arXiv:1708.02699

53. L. COLLINS, M. AHMADI, T. WU, B. HU, S.V. KALININ, and S. JESSE, *Breaking the Time Barrier in Kelvin Probe Force Microscopy: Fast Free Force Reconstruction Using the G-Mode Platform*, ACS Nano, in print

54. O. DYCK, S. KIM1, S.V. KALININ, and S. JESSE, *Single atom manipulation and control in a scanning transmission electron microscope*, Appl. Phys. Lett., submitted, arXiv preprint arXiv:1708.01523

55. S. JESSE, B.M. HUDAK, E. ZARKADOULA, J. SONG, A. MAKSOV, M. FUENTES-CABRERA, P. GANESH, I. KRAVCHENKO, P.C. SNIJDERS, A.R. LUPINI, A. BORISEVICH, and S.V. KALININ, *Direct atomic fabrication and dopant positioning in Si using electron beams with active real time image-based feedback*, submitted

56. E.A. ELISEEV, I. VOROTIAHIN, Y.M. FOMICHOV, M.D. GLINCHUK, S.V. KALININ, Y.A. GENENKO, and A.N. MOROZOVSKA, *Defect driven flexo-chemical coupling in thin ferroelectric films*, arXiv:1708.00904

57. L. VLCEK, A. Maksov, M. Pan, R. VASUDEVAN, and S.V. KALININ, *Knowledge Extraction from Atomically Resolved Images*, ACS Nano, in print

58. L. COLLINS, J. KILPATRICK, S.V. KALININ, and B.J. RODRIGUEZ, *Nanoscale electrical measurements in liquids using AFM – progress and outlook*, Rev. Progr. Phys, accepted

59. S.V. KALININ, Y. KIM, D. FONG, and A.N. MOROZOVSKA, *Surface Screening Mechanisms in Ferroelectric Thin Films and its Effect on Polarization Dynamics and Domain Structures*, Rev. Prog. Phys., submitted, arXiv:1612.08266

60. S.V. KALININ and S.J. PENNYCOOK, *Single atom fabrication with electron and ion beams: From surfaces and two-dimensional materials towards three-dimensional atom by atom assembly*, MRS Bull, in print

61. N JIANG, E. ZARKADOULA, P. NARANG, A. MAKSOV, I. KRAVCHENKO, A. BORISEVICH, S. JESSE, and S.V. KALININ, *Atom by atom fabrication by electron beam via induced phase transformations*, MRS Bull., in print

62. M. ZIATDINOV, A. MAKSOV, and S.V. KALININ, *Learning Surface Molecular Structures via Machine Vision*, NPJ Computational Materials **3**, 1 (2017).

63. F. KURNIA, J. CHEUNG, X. CHENG, J. SULLAPHEN, S.V. KALININ, N. VALANOOR, and RAMA K. VASUDEVAN, *Nanoscale Probing of Elastic-Electronic Response to Vacancy Motion in NiO Nanocrystals*, ACS Nano **11**, 8387 (2017).

64. L. COLLINS, M. AHMADI, T. WU, B. HU, S.V. KALININ, and S. JESSE, *Breaking the Time Barrier in Kelvin Probe Force Microscopy: Fast Free Force Reconstruction Using the G-Mode Platform*, ACS Nano, in print

65. D.K. PRADHAN, S. KUMARI, L. LI, R.K. VASUDEVAN, P.T. DAS, V.S. PULI, D.K. PRADHAN, A. KUMAR, P. MISRA, A.K. PRADHAN, S.V. KALININ, and R.S. KATYAR, *Studies on dielectric, optical, magnetic, magnetic domain structure, and resistance switching characteristics of highly c-axis oriented NZFO films*, J. Appl. Phys. **122**, 033902 (2017).

66. E.A. ELISEEV, A.N. MOROZOVSKA, M.D. GLINCHUK, and S.V. KALININ, *Lost surface waves in nonpiezoelectric solids*, Phys. Rev. **B 96**, 045411 (2017). arXiv:1612.08906

67. S. JESSE, S. SOMNATH, L. COLLINS, and S.V. KALININ, *Full Information Acquisition in Scanning Probe Microscopy*, Microscopy Today **25**, 34 (2017).

68. (news and views) X. CRISPIN and S.V. KALININ, *Semiconducting Polymers: Probing the solid-liquid interface*, Nature Materials **16**, 704 (2017)

69. R.K. VASUDEVAN, Y. CAO, N. LAANAIT, A. IEVLEV, L. LI, J.C. YANG, Y.H. CHU, L.Q. CHEN, S.V. KALININ, and P. MAKSYMOVYCH, *A new twist on domain wall conduction*, Nat. Comm., in print

70. R. KANNAN, A. IEVLEV, N. LAANAIT, M.A. ZIATDINOV, R.K. VASUDEVAN, S. JESSE, and S.V KALININ, *Deep Data Analysis via Physically Constrained Linear Unmixing: Universal Framework, Domain Examples, and a Community-wide platform*, Adv. Struct. Chem. Img., in print

71. S. DAS, B. WANG, Y. CAO, M.R. CHO, Y.J. SHIN, S.M. YANG, L. WANG, M. KIM, S.V. KALININ, L.Q. CHEN, and T.W. NOH *Controlled manipulation of oxygen vacancy distribution with nanoscale flexoelectricity*, Nature Comm. **8**, 615 (2017).

72. J.H. JANG, Y.M. KIM, Q. HE, R. MISHRA, L. QIAO, M.D. BIEGALSKI, A.R. LUPINI, S.T. PANTELIDES, S.J. PENNYCOOK, S.V. KALININ, and A.Y. BORISEVICH, In-Situ *Observation of Oxygen Vacancy Dynamics and Ordering in the Epitaxial* $LaCoO_3$ System, ACS Nano **11**, 6942 (2017).

73. E.J. GUO, J.R. PETRIE, M.A. ROLDAN, Q. LI, R.D. DESAUTELS, T. CHARLTON, A. HERKLOTZ, J. NICHOLS, J. VAN LIEROP, J.W. FREELAND, S.V. KALININ, H.N. LEE, and M.R. FITZSIMMONS, *Spatially Resolved Large Magnetization in Ultrathin* $BiFeO_3$, Adv. Mat. **29**, 1700790 (2017).

74. A.R. DAMODARAN, S. PANDYA, J.C. AGAR, Y. CAO, R.K. VASUDEVAN, R. XU, S. SAREMI, Q. LI, J. KIM, M.R. MCCARTER, L.R. DEDON, T. ANGSTEN, N. BALKE, S. JESSE, M. ASTA, S.V. KALININ, and L.W. MARTIN, *Three-State Ferroelastic Switching and Large Electromechanical Responses in* PbTiO3 Thin Films, Adv. Mat. 29, 1702069 (2017)

75. B. YANG, C.C. BROWN, J. HUANG, L. COLLINS, X. SANG, R.R. UNOCIC, S. JESSE, S.V. KALININ, A. BELIANINOV, J. JAKOWSKI, D.B. GEOHEGAN, B.G. SUMPTER, K. XIAO, and O.S. OVCHINNIKOVA, *Enhancing Ion Migration in Grain Boundaries of Hybrid Organic-Inorganic Perovskites by Chlorine*, Adv. Func. Mat. 27, 1700749 (2017).

76. S. SOMNATH, S. JESSE, G.J. VAN BERKEL, S.V. KALININ, and O.S. OVCHINNIKOVA, *Improved Spatial Resolution for Spot Sampling in Thermal Desorption Atomic Force Microscopy - Mass Spectrometry via Rapid Heating Functions*, Nanoscale **9**, 5708 (2017).

77. T.T.A.LUMMEN, J. LEUNG, A. KUMAR, X. WU, Y. REN, B.K. VANLEEUWEN, R.C. HAISLMAIER, M. HOLT, K. LAI, S.V. KALININ, and V. GOPALAN, *Emergent low-symmetry phases and large property enhancements in Ferroelectric* KNbO3 *bulk crystals*, Advanced Materials **29**, 1700530 (2017).

78. I.S. VOROTIAHIN, E.A. ELISEEV, Q. LI, S.V. KALININ, Y.A. GENENKO, and A.N. MOROZOVSKA, *Tuning the Polar States of Ferroelectric Films via Surface Charges and Flexoelectricity*, submitted, arXiv:1704.00136

79. L. LI, Y. CAO, S. SOMNATH, Y. YANG, S. JESSE, Y. EHARA, H. FUNAKUBO, L.Q. CHEN, S.V. KALININ, and R.K. VASUDEVAN, *Direct Imaging of the Relaxation of Individual Ferroelectric Interfaces in a Tensile-Strained Film*, Advanced Electronic Materials **3**, 1600508 (2017).

80. R. VASUDEVAN, H. DIXIT, A. TSELEV, L. QIAO, T. MEYER, V. COOPER, P. MAKSYMOVYCH, A. BADDORF, P. GANESH, and S.V. KALININ, *Segregation driven tunable metal-insulator transition on magnetic semiconducting epitaxial manganite thin film surfaces*, in preparation

81. N. YANG, P. ORGIANI, E. DI BARTOLOMEO, V. FOGLIETTI, P. TORELLI, A. IEVLEV, G. ROSSI, S. LICOCCIA, G. BALESTRINO, S.V. KALININ, and C. ARUTA, *Effects of Dopant Ionic Radius on Cerium Reduction in Epitaxial Cerium Oxide Thin Films*, J. Phys. Chem. **C 121**, 8841 (2017).

82. A.N MOROZOVSKA, E.A. ELISEEV, N.V. MOROZOVSKY, and S.V. KALININ, *Ferroionic states in ferroelectric thin films*, Phys. Rev. **B 95**, 195413 (2017).

83. A.N MOROZOVSKA, E.A. ELISEEV, N.V. MOROZOVSKY, and S.V. KALININ, *Piezoresponse of ferroelectric films in ferroionic states: Time and voltage dynamics*, Appl. Phys. Lett. **110**, 182907 (2017)

84. S.M YANG, A.N. MOROZOVSKA, R. KUMAR, E.A. ELISEEV, Y. CAO, L. MAZET, N. BALKE, S. JESSE, R.K. VASUDEVAN, C. DUBOURDIEU, and S.V. KALININ, *Mixed electrochemical-ferroelectric states in nanoscale ferroelectrics*, Nature Physics **13**, 812 (2017).

85. (**news and views**) S.V KALININ, *Multiferroics: Making a point of control*, Nature Physics **13**, 115 (2017).

86. R.K. VASUDEVAN, N. BALKE, P. MAKSYMOVYCH, S. JESSE, and S.V. KALININ, *Ferroelectric or non-ferroelectric: why so many materials exhibit ferroelectricity on the nanoscale*, Applied Physics Reviews **4**, 021302 (2017). arXiv:1701.01128

87. A.I. KURCHAK, E.A. ELISEEV, S.V. KALININ, M.V. STRIKHA, and A.N. MOROZOVSKA, PN *junctions dynamics in graphene channel induced by ferroelectric domains motion*, submitted, arXiv:1703.06500

88. R.K. VASUDEVAN, M. ZIATDINOV , C. CHEN , and S.V. KALININ, *Analysis of citation networks as a new tool for scientific research*, MRS Bulletin **41**, 1009 (2016).

89. T.L. MEYER, A. HERKLOTZ, V. LAUTER, J.W. FREELAND, J. NICHOLS, E.J. GUO, S. LEE, T.Z. WARD, N. BALKE, S.V. KALININ, M.R. FITZSIMMONS, and H.N. LEE, *Enhancing interfacial magnetization with a ferroelectric*, Physical Review **B 94**, 174432 (2016).

90. P PONATH, A O'HARA, H.X. CAO, A.B. POSADAS, R. VASUDEVAN, M.B. OKATAN, S. JESSE, M. BERG, Z. LI, D. ZHANG, A.J. KELLOCK, A. DE LOZANNE, J. ZHOU, S.V. KALININ, D.J. SMITH, and A.A. DEMKOV, *Contradictory nature of* Co *doping in ferroelectric* $BaTiO_3$, Phys. Rev. **B 94**, 205121 (2016).

91. A.N. MOROZOVSKA, E.A. ELISEEV, Y.A. GENENKO, I.S. VOROTIAHIN, M.V. SILIBIN, Y. CAO, Y. KIM, M.D. GLINCHUK, and S.V. KALININ, *Flexocoupling impact on size effects of piezoresponse and conductance in mixed-type ferroelectric semiconductors under applied pressure*, Phys. Rev. **B 94**, 174101 (2016)

92. S.V. KALININ, A. BORISEVICH, and S. JESSE, *Fire up the Atom Forge*, Nature **539**, 485 (2016).

93. X. SANG, A. LUPINI, J. DING, S.V. KALININ, S. JESSE, and R. UNOCIC, *Precision controlled atomic resolution scanning transmission electron microscopy using spiral scan pathways*, Sci Rep. **7**, 43585 (2017).

94. N. BALKE, S. JESSE, B. CARMICHAEL, M.B. OKATAN, I. KRAVCHENKO. S.V. KALININ, and A. TSELEV, *Quantification of In-Contact Probe-Sample Electrostatic Forces with Dynamic Atomic Force Microscopy*, Nanotechnology **28**, 065704 (2017).

95. D. SEOL, S. JESSE, S.J. PARK, W. LEE, S.V. KALININ, and Y. KIM, *Nanosculpting of complex oxides by massive ionic transfer*, Nanotechnology 27, 505703 (2016).

96. M. ZIATDINOV, A. BANERJEE, A. MAKSOV, T. BERLIJN, W. ZHOU, H.B. CAO, J.Q. YAN, C.A. BRIDGES, D.G. MANDRUS, S.E. NAGLER, A.P. BADDORF, and S.V. KALININ, *Atomic-scale observation of structural and electronic orders in the layered compound* α-$RuCl_3$, Nature Comm. **7**, 13774 (2016).

97. F. KURNIA, C. LIU, G. LIU, R.K. VASUDEVAN, S.M. YANG, S.V. KALININ, N. VALANOOR, and J.N. HART, *Localised nanoscale resistive switching in GaP thin films with low power consumption*, J. Mat. Chem. **C 5**, 2153 (2017).

98. Y. CAO and S.V. KALININ, *Phase-field modeling of chemical control of polarization stability and switching dynamics in ferroelectric thin film*, Phys. Rev. **B 94**, 235444 (2016), arXiv:1609.04866

99. M. ZIATDINOV, A. MAKSOV, L. LI, A. SEFAT, P. MAKSYMOVYCH, and S.V. KALININ, *Deep data mining in a real space: Separation of intertwined electronic responses in a lightly-doped* $BaFe_2As_2$, Nanotechnology **27**, 475706 (2016).

100. M. ZIATDINOV, S. FUJII, M. KIGUCHI, T. ENOKI, S. JESSE, and S.V. KALININ, *Data Mining Graphene: Correlative Analysis of Structure and Electronic Degrees of Freedom in Graphenic Monolayers with Defects*, Nanotechnology **27**, 495703 (2016).

101. M. CHYASNAVICHYUS, M.A. SUSNER, A.V. IEVLEV, E.A. ELISEEV, S.V. KALININ, N. BALKE, A.N. MOROZOVSKA, M.A. MCGUIRE, and P. MAKSYMOVYCH, *Size-effect in layered ferrielectric* $CuInP_2S_6$, Appl. Phys. Lett. **109**, 172901 (2016).

102. A. IEVLEV, P. MAKSYMOVYCH, M. TRASSIN, J. SEIDEL, R. RAMESH, S.V. KALININ, and O. OVCHINNIKOVA, *Chemical state evolution in ferroelectric films during tip-induced polarization and electroresistive switching*, ACS Applied Materials **8**, 29588 (2016).

103. Y. CAO, S. YANG, S. JESSE, I. KRAVCHENKO, P. YU, L.Q. CHEN, S.V. KALININ, N. BALKE, and Q. LI, *Exploring Polarization Rotation Instabilities in Super-Tetragonal* $BiFeO_3$ *Epitaxial Thin Films and Their Technological Implications*, Advanced Electronic Materials **2**, 1600307 (2016).

104. R. VASUDEVAN, M. ZIATDINOV, S. JESSE, and S.V. KALININ, *Phases and interfaces from real space atomically resolved data: physics based deep data image analysis*, Nano Lett. **16**, 5574 (2016).

105. S. SOMNATH, A. BELIANINOV, S.V. KALININ, and S. JESSE, *Rapid Mapping of Polarization Switching through Complete Information Acquisition*, Nat. Comm. **7**, 13290 (2016).

106. J. WANG, D.C. SORESCU, S. JEON, A. BELIANINOV, S.V. KALININ, A.P. BADDORF, and P. MAKSYMOVYCH, *Atomic intercalation - a practical method to measure the nanoscale adhesion energy of graphene on graphite*, Nat. Comm., in print

107. J.M. BLACK, M. ZHU, P. ZHANG, R.R. UNOCIC, M.B. OKATAN, S. DAI, P.T. CUMMINGS, S.V. KALININ, G. FENG, and N. BALKE, *Fundamental aspects of electric double layer force-distance measurements at liquid-solid interfaces using atomic force microscopy*, Scientific Reports, in print

108. S. SOMNATH, L. COLLINS, M. MATHESON, S. SUKUMAR, S.V. KALININ, and S. JESSE, *Imaging via complete cantilever dynamic detection: General Dynamic Mode Imaging and Spectroscopy in Scanning Probe Microscopy*, Nanotechnology **27**, 414003 (2016).

109. C.Y. KUO, Z. HU, J.C. YANG, S.C. LIAO, Y.L. HUANG, R.K. VASUDEVAN, M.B. OKATAN, S. JESSE, S. V. KALININ, L. LI, H.J. LIU, C.H. LAI, T.W. PI, S. AGRESTINI, K. CHEN, P. OHRESSER, A. TANAKA, L. H. TJENG, and Y.H. CHU, *Single domain multiferroic* $BiFeO_3$ *films*, Nat. Comm. **7**, 12712 (2016).

110. V. IBERI, L. LIANG, A. IEVLEV, M.G. STANFORD, M.W. LIN, X. LI, M. MAHJOURI-SAMANI, S. JESSE, B.G. SUMPTER, S.V. KALININ, D.C. JOY, K. XIAO, A. BELIANINOV, and O.S. OVCHINNIKOVA, *Nanoforging Single Layer* $MoSe_2$ *Through Defect Engineering with Focused Helium Ion Beams*, Sci. Rep. **6**, 30481 (2016).

111. L. COLLINS, A. BELIANINOV, S. SOMNATH, N. BALKE, S.V. KALININ, and S. JESSE, *Full data acquisition in Kelvin Probe Force Microscopy: Mapping dynamic electric phenomena in real space*, Sci. Rep. **6**, 30557 (2016).

112. S. JESSE, A. BELIANINOV, J. FOWLKES, A. LUPINI, P. RACK, R. UNOCIC, B. SUMPTER, S.V. KALININ, and O. OVCHINNIKOVA, *Directing Matter: Towards Atomic Scale* 3D *Nanofabrication*, ACS Nano **10**, 5600 (2016).

113. X. SANG, A.R. LUPINI, R.R. UNOCIC, M. CHI, A.Y. BORISEVICH, S.V. KALININ, E. ENDEVE, R.K. ARCHIBALD, and S. JESSE, *Dynamic scan control in STEM:* spiral scans, Advances in Structural and Chemical Imaging **2**, 1 (2016)

114. S.M. YANG, L. MAZET, M.B. OKATAN, S. JESSE, G. NIU, T. SCHROEDER, S. SCHAMM-CHARDON, C. DUBOURDIEU, A.P. BADDORF, and S.V. KALININ, *Decoupling indirect topographic cross-talk in band excitation piezoresponse force microscopy imaging and spectroscopy*, Appl. Phys. Lett. **108**, 252902 (2016).

115. N. YANG, Y. SHI, S. SCHWEIGER, E. STRELCOV, A. BELIANINOV, V. FOGLIETTI, P. ORGIANI, G. BALESTRINO, S.V. KALININ, J.L. RUPP, and C. ARUTA, *The role of associated defects in oxygen ion conduction and surface exchange reaction for epitaxial samaria doped ceria thin films as catalytic coatings*, ACS Appl. Mat. Interfaces **8**, 14613 (2016).

116. J. DING, E. STRELCOV, S.V. KALININ, and N. BASSIRI-GHARB, *Electrochemical reactivity and proton transport mechanisms in nanostructured ceria*, Nanotechnology **27**, 345401 (2016).

117. S. BREWER, C. DENG, C. CALLAWAY, S.V. KALININ, R.K. VASUDEVAN, and N. BASSIRI-GHARB, *Piezoelectric response enhancement in the proximity of grain boundaries*, Appl. Phys. Lett. 108, 242908 (2016).

118. E. STRELCOV, S.M. YANG, S. JESSE, N. BALKE, R.K. VASUDEVAN, and S.V. KALININ, *Solid-state electrochemistry on the nanometer and atomic scales: the scanning probe microscopy approach*, Nanoscale **8**, 13838 (2016).

119. L. COLLINS, A. BELIANINOV, T. ZUO, Y. ZANG, P.K. LIAW, S.V. KALININ, and S. JESSE, *G-Mode Magnetic Force Microscopy: Separating magnetic and electrostatic interactions using big data analytics*, Appl. Phys. Lett. **108**, 193103 (2016).

120. L. LI, Y. YANG, Z. LIU, S. JESSE, S.V. KALININ, and R.K. VASUDEVAN, *Correlation between piezoresponse nonlinearity and hysteresis in ferroelectric crystals at the nanoscale*, Appl. Phys. Lett. **108**, 172905 (2016).

121. A. TSELEV, R.K. VASUDEVAN, A.G. GIANFRANCESCO, L. QIAO, T.L. MEYER, H.N. LEE, M.D. BIEGALSKI, A.P. BADDORF, and S.V. KALININ, *Growth Mode Transition in Complex Oxide Heteroepitaxy: Atomically Resolved Studies*, Cryst. Growth and Design **16**, 2708 (2016).

122. A. BELIANINOV, V. IBERI, A. TSELEV, M. SUSNER, M. MCGUIRE, D. JOY, S. JESSE, A. RONDINONE, S.V. KALININ, and O. OVCHINNIKOVA, *Polarization control via* He-*ion beam induced nanofabrication in layered ferroelectric semiconductors*, ACS Appl. Mat. Int. **8**, 7349 (2016).

123. J. COME, Y. XIE, M. NAGUIB, S. JESSE, S.V. KALININ, Y. GOGOTSI, P.R.C. KENT, and N. BALKE, *Nanoscale elastic changes in* 2D $Ti_3C_2T_x$ (MXene) *pseudocapacitive electrodes*, Adv. Energy Mat. **6**, 1502290 (2016).

124. S. JESSE, M. CHI, A. BELIANINOV, C. BEEKMAN, S.V. KALININ, A.Y. BORISEVICH, and A.R. LUPINI, *Big Data Analytics for Scanning Transmission Electron Microscopy Ptychography*, Sci. Rep. **6**, 26348 (2016).

125. J. AGAR, A. DAMODARAN, M. OKATAN, J. KACHER, C. GAMMER, R. VASUDEVAN, S. PANDYA, L. DEDON, R. MANGALAM, G. VELARDE, S. JESSE, N. BALKE, A. MINOR, S.V. KALININ, and L. MARTIN, *Highly-Mobile Ferroelastic Domain Walls in Compositionally-Graded Ferroelectric Thin Films*, Nature Materials **15**, 549 (2016).

126. A.N. MOROZOVSKA, Y.M. VYSOCHANSKII, O.V. VARENYK, M.V. SILIBIN, S.V. KALININ, and E.A. ELISEEV, *Flexocoupling impact on the generalized susceptibility and soft phonon modes in the ordered phase of ferroics*, Phys. Rev. **B 92**, 094308 (2015).

127. V. IBERI, A. IEVLEV, I. VLASSIOUK, S. JESSE, S.V. KALININ, D. JOY, A. RONDINONE, A. BELIANINOV, and O. OVCHINNIKOVA, *Graphene Engineering by Neon Ion Beams: Functionality and Devices*, Nanotechnology **27**, 125302 (2016).

128. Y. CAO, Q. LI, L.Q, CHEN, and S.V. KALININ, *Coupling of electrical and mechanical switching in nanoscale ferroelectrics*, Appl. Phys. Lett. **107**, 202905 (2015).

129. Y. CAO, A.V. IEVLEV, A.N. MOROZOVSKA, L.Q. CHEN, S.V. KALININ, and P. MAKSYMOVYCH, *Intrinsic space charge layers and field enhancement in ferroelectric nanojunctions*, Appl. Phys. Lett. **107**, 022903 (2015).

130. R.R. UNOCIC, A.R. LUPINI, A.Y. BORISEVICH, D.A. CULLEN, S.V. KALININ, and S. JESSE, *Direct Write Liquid Phase Transformations with a Scanning Transmission Electron Microscope*, Nanoscale **8**, 15581 (2016).

131. N. BALKE, S. JESSE, P. YU, B. CARMICHAEL, M. B. OKATAN, I. I. KRAVCHENKO, S. V. KALININ, and A. TSELEV, *Quantification of surface displacements and electromechanical phenomena in dynamic atomic force microscopy*, Nanotechnology **27**, 425707 (2016).

132. S. SOMNATH, A. BELIANINOV, S.V. KALININ, and S. JESSE, *Full Information Acquisition in Piezoresponse Force Microscopy*, Appl. Phys. Lett. **107**, 263102 (2015).

133. A. TSELEV, P. YU, S.V. KALININ, and P. MAKSYMOVYCH, *Microwave ac conductivity of domain walls in ferroelectric thin films*, Nature Comm. **7**, 11630 (2016).

134. N. YANG, E. DI BARTOLOMEO, V. FOGLIETTI, C. CANTONI, A. BELIANINOV, A. TEBANO, S. LICOCCIA, T.L. LEE, C. SCHLUETER, S.V. KALININ, G. BALESTRINO, and C. ARUTA, *Microstructure and Compositional Defects Affects Proton Conductivity and Reactions in* Y-*doped* $BaZrO_3$ *Thin Films*, ECS Transactions **72**, 149 (2016).

135. A. TSELEV, J. VELMURUGAN, A.V. IEVLEV, S.V. KALININ, and A. KOLMAKOV, *Seeing through walls at the nanoscale: microwave microscopy of enclosed objects and processes in liquids*, ACS Nano **10**, 3562 (2016).

136. D.O. ALIKIN, A.V. IEVLEV, S. LUCHKIN, A.P. TURIGIN, V.YA. SHUR, S.V. KALININ, and A.L. KHOLKIN, *Characterization of* $LiMn_2O_4$ *cathodes by electrochemical strain microscopy*, Appl. Phys. Lett. **108**, 113106 (2016).

137. E. STRELCOV, A.V. IEVLEV, A. BELIANINOV, A. TSELEV, A. KOLMAKOV, and S.V. KALININ, L*ocal coexistence of* VO_2 *phases revealed by deep data analysis*, Sci. Rep. **6**, 29216 (2016)

138. V. IBERI, A.V. IEVLEV, I. VLASSIOUK, S. JESSE, S.V. KALININ, D.C. JOY, A.J. RONDINONE, and O.S. OVCHINNIKOVA, *Graphene engineering by neon ion beams*, Nanotechnology **27**, 125302 (2016).

139. A.N. MOROZOVSKA, A.V. IEVLEV, V.V. OBUKHOVSKII, Y. FOMICHOV, O.V. VARENYK, V.YA. SHUR, S.V. KALININ, and E.A. ELISEEV, *Self-consistent theory of nanodomain formation on non-polar surfaces of ferroelectrics*, Phys. Rev. **B 93**, 165439 (2016).

140. S.M. YANG, M. PARANTHAMAN, T.W. NOH, S.V. KALININ, and E. STRELCOV, *Nanoparticle Shape Evolution and Proximity Effects during Tip-Induced Electrochemical Processes*, ACS Nano **10**, 663 (2016).

141. L. COLLINS, A. BELIANINOV, S. SOMNATH, B.J. RODRIGUEZ, N. BALKE, S.V. KALININ, and S. JESSE, *Multifrequency spectrum analysis using fully digital G Mode-Kelvin probe force microscopy*, Nanotechnology **27**, 105706 (2016).

142. S.M NEUMAYER, E. STRELCOV, M. MANZO, K. GALLO, I.I. KRAVCHENKO, A.L. KHOLKIN, S.V. KALININ, and B.J. RODRIGUEZ, *Thickness, humidity, and polarization dependent ferroelectric switching and conductivity in* Mg *doped lithium niobate*, J. Appl. Phys. **118**, 244103 (2015).

143. D. GOBELJIC, V.V. SHVARTSMAN, A. BELIANINOV, B. OKATAN, S. JESSE, S. V. KALININ, C. GROH, J. RÖDEL, and D. C. LUPASCU, *Nanoscale Mapping of Heterogeneity of the Polarization Reversal in Lead-Free Relaxor-Ferroelectric Ceramic Composites*, Nanoscale **8**, 2168 (2016).

144. D. EDWARDS, S. BREWER, Y. CAO, S. JESSE, L.Q. CHEN, S.V. KALININ, A. KUMAR, and N. BASSIRI-GHARB, *Local probing of ferroelectric and ferroelastic switching through stress-mediated piezoelectric spectroscopy*, Advanced Materials Interfaces **2**, 1500470 (2016).

145. Y. WU, A.R. CHEW, G.A. ROJAS, G. SINI, G. HAUGSTAD, A. BELIANINOV, S.V. KALININ, H. LI, C. RISKO, J.L. BREDAS, A. SALLEO, and C.D. FRISBIE, *Strain Effects on the Work Function of an Organic Semiconductor*, Nat. Comm. **7**, 10270 (2016).

146. S.V. KALININ, E. STRELCOV, A. BELIANINOV, S. SOMNATH, R.K. VASUDEVAN, E.J. LINGERFELT, R.K. ARCHIBALD, C. CHEN, R. PROKSCH, N. LAANAIT, and S. JESSE, *Big, Deep, and Smart Data in Scanning Probe Microscopy*, ACS Nano **10**, 9068 (2016).

147. A. IEVLEV, S. JESSE, T.J. COCHELL, R.R. UNOCIC, V.A. PROTOPOPESCU, and SERGEI V. KALININ, *Quantitative Description of Crystal Nucleation and Growth from* in Situ *Scanning Transmission Electron Microscopy*, ACS Nano **9**, 11784 (2015).

148. A. IEVLEV, M. SUSNER, M. MCGUIRE, P. MAKSYMOVYCH, and S.V. KALININ, *Quantitative analysis of the local phase transitions induced by laser heating*, ACS Nano **9**, 12442 (2015).

149. R.K. VASUDEVAN, H. KHASSAF, Y. CAO, S. ZHANG, A. TSELEV, B. CARMICHAEL, M.B. OKATAN, S. JESSE, L.Q. CHEN, S.P. ALPAY, S.V. KALININ, and N. BASSIRI-GHARB, *Acoustic Detection of Phase Transitions at the Nanoscale*, Adv. Func. Mat. **26**, 478 (2016).

150. A.B. PAPANDREW, Q. LI, M.B. OKATAN, S. JESSE, C. HARTNETT, S.V. KALININ, and R.K. VASUDEVAN, *Electrocatalysis Induced Elasticity Modulation in a Superionic Proton Conductor Probed by Band-Excitation Atomic Force Microscopy*, Nanoscale **7**, 20089 (2015).

151. J. COME, J.M. BLACK, M.R. LUKATSKAYA, M. NAGUIB, M. BEIDAGHI, A.J. RONDINONE, S.V. KALININ, D.J. WESOLOWSKI, Y. GOGOTSI, and N. BALKE, *Controlling the actuation properties of MXene paper electrodes upon cation intercalation*, Nano Energy **17**, 27 (2015).

152. N. YANG, E. STRELCOV, A. BELIANINOV, A. TEBANO, V. FOGLIETTI, C. SCHLUETER, T.L. LEE, S. JESSE, S.V. KALININ, G. BALESTRINO, and C. ARUTA, *Effect of Water Adsorption on Conductivity in Epitaxial* $Sm_{0.1}Ce_{0.9}O_{2-\delta}$ *Thin Film for Micro Solid Oxide Fuel Cells Applications*, ECS Transactions **69**, 39 (2015).

153. M.A. FRECHERO, M. ROCCI, G. SÁNCHEZ-SANTOLINO, A. KUMAR, J. SALAFRANCA, R. SCHMIDT, M.R. DÍAZ-GUILLÉN, O.J. DURÁ, A. RIVERA-CALZADA, R. MISHRA, S. JESSE, S.T. PANTELIDES, S.V. KALININ, M. VARELA, S.J. PENNYCOOK, J. SANTAMARIA, and C. LEON, *Paving the way to nanoionics: atomic origin of barriers for ionic transport through interfaces*, Sci. Rep., in print

154. (**perspective**) B.G. SUMPTER, R.K. VASUDEVAN, T. POTOK, and S.V. KALININ, *A Bridge for Accelerating Materials by Design*, NPJ Comp Mat. **1**, 15008 (2015).

155. (**editorial**) L.Q. CHEN, L. CHEN, S.V. KALININ, G. KLIMECK, S. KUMAR, J. NEUGEBAUER, and I. TERASAKI, *Design and Discovery of Materials Guided by Theory and Computation*, NPJ Comp Mat. **1**, 15007 (2015).

156. Q. LI, Y. CAO, P. YU, R.K. VASUDEVAN, N. LAANAIT, A. TSELEV, F. XUE, L.Q. CHEN, P. MAKSYMOVYCH, S.V. KALININ, and N. BALKE, *Giant elastic tunability in strained* $BiFeO_3$ *near an electrically induced phase transition*, Nat. Comm. **6**, 8985 (2015).

157. A. GIANFRANCESCO, A. TSELEV, A.P. BADDORF, S.V. KALININ, and R.K. VASUDEVAN, *The Ehrlich-Schwoebel Barrier on an oxide surface: A combined Monte-Carlo and* in-situ *scanning tunneling microscopy approach*, Nanotechnology **26**, 455705 (2015).

158. Q. HE, A. BELIANINOV, A. DZIAUGYS, P. MAKSYMOVYCH, Y. VYSOCHANSKII, S.V. KALININ, and A. Y. BORISEVICH, *Antisite Defects in Layered Multiferroic* $CuCr_{0.9}In_{0.1}P_2S_6$, Nanoscale **7**, 18579 (2015).

159. SERGEI V. KALININ, BOBBY G. SUMPTER, and RICHARD K. ARCHIBALD, *Big-deep-smart data in imaging for guiding materials design*, Nature Materials **14**, 973 (2015).

160. S. JESSE, Q. HE, A.R. LUPINI, D.N. LEONARD, M.P. OXLEY, O. OVCHINNIKOV, R. UNOCIC, A. TSELEV, M. FUENTES-CABRERA, B.G. SUMPTER, S.J. PENNYCOOK, S.V. KALININ, and A.Y. BORISEVICH, *Atomic-level sculpting of crystalline oxides: towards bulk nanofabrication with single atomic plane precision*, Small **11**, 5895 (2015).

161. S.M. YANG, S. LEE, J. JIAN, W. ZHANG, P. LU, Q. JIA, H. WANG, T.W. NOH, S.V. KALININ, and J. MACMANUS-DRISCOLL, *Strongly enhanced oxygen ion transport through samarium-doped* CeO2 *nanopillars in nanocomposite films*, Nature Comm. **6**, 8588 (2015).

162. E. STRELCOV, A. BELIANINOV, Y.H. HSIEH, Y.H. CHU, and S.V. KALININ, *Constraining data mining with physical models: voltage- and oxygen pressure-dependent transport in multiferroic nanostructures*, Nano Lett. **15**, 6650 (2015).

163. (opinion) SERGEI V. KALININ and ANNA N. MOROZOVSKA, *Focusing light on flexoelectricity*, Nature Nano. **10**, 916 (2015).

164. B. WINCHESTER, N. BALKE. X.X. CHENG, A.N. MOROZOVSKA, S.V. KALININ, and L.Q. CHEN, *Electroelastic fields in artificially created vortex cores in epitaxial* $BiFeO_3$ *thin films*, Appl. Phys. Lett. **107**, 052903 (2015).

165. N. BALKE, S. JESSE, Q. LI, P. MAKSYMOVYCH, M.B. OKATAN, E. STRELCOV, A. TSELEV, and S.V. KALININ, *Surface and Charge Modified Hysteresis Loops in Ferroelectric Thin Films*, J. Appl. Phys. **118**, 072013 (2015).

166. A. TSELEV, A. KLEIN, J. GASSMANN, S. JESSE, Q. LI , S.V. KALININ, and N. BALKE, *Quantitative Nanometer-Scale Mapping of Dielectric Tunability*, Adv. Mater. Interfaces 2, 500088 (2015).

167. R.K. VASUDEVAN, S. ZHANG, M.B. OKATAN, S. JESSE, S.V. KALININ, and N. BASSIRI-GHARB, *Multidimensional dynamic piezoresponse measurements: Unraveling local relaxation behavior in relaxor-ferroelectrics via big data*, J. Appl. Phys. **118**, 072003 (2015).

168. V.A. BOROVIKOV, S.V. KALININ, YU. KHAVIN, B. MIRMAN, and E. KARAPETIAN, *Point force and point electric charge applied to the boundary of three-dimensional anisotropic piezoelectric solid*, J. Appl. Phys. **118**, 072009 (2015).

169. O.V. VARENYK, M.V. SILIBIN, D.A. KISELEV, E.A. ELISEEV, S.V. KALININ, and A.N. MOROZOVSKA, *Self-consistent modelling of electrochemical strain microscopy in mixed ionic-electronic conductors: Nonlinear and dynamic regimes*, J. Appl. Phys. **118**, 072015 (2015).

170. L. COLLINS, S. JESSE, N. BALKE, B.J. RODRIGUEZ, S.V. KALININ, and Q. LI, *Band excitation Kelvin probe force microscopy utilizing photothermal excitation*, Appl. Phys. Lett. **106**, 104102 (2015).

171. J.M. BLACK, M.B. OKATANA, G. FENG, P.T. CUMMINGS, S.V. KALININ, and N. BALKE, *Topological defects in electric double layers of ionic liquids at carbon interfaces*, Nano Energy **15**, 737 (2015).

172. N. BALKE, P. MAKSYMOVYCH, S. JESSE, A. HERKLOTZ, A. TSELEV, C.B. EOM, I.I. KRAVCHENKO, P. YU, and S.V. KALININ, *Differentiating Ferroelectric and Nonferroelectric Electromechanical Effects with Scanning Probe Microscopy*, ACS Nano **9**, 6484 (2015).

173. F. LAVINI, N. YANG, R.K. VASUDEVAN, E. STRELCOV, S. JESSE, M.B. OKATAN, I. KRAVCHENKO, D. DI CASTRO, S.V. KALININ, G. BALESTRINO, C. ARUTA, and V. FOGLIETTI, *Bias assisted SPM direct write lithography enables local oxygen enrichment of Lanthanum Cuprates thin films*, Nanotechnology **26**, 325302 (2015).

174. A. BELIANINOV, Q. HE, M. KRAVCHENKO, S. JESSE, A. BORISEVICH, and S.V. KALININ, *Identification of phases, symmetries, and defects through local crystallography*, Nat. Comm. **6**, 7801 (2015).

175. D.M. MARINCEL, S. JESSE, A. BELIANINOV, M.B. OKATAN, S.V. KALININ, T.N. JACKSON, C.A. RANDALL, and S. TROLIER-MCKINSTRY, A-*site stoichiometry and piezoelectric response in thin film* $PbZr_{1-x}Ti_xO_3$, J. Appl. Phys. **117**, 204104 (2015).

176. A.V. IEVLEV, A.N. MOROZOVSKA, V.YA. SHUR, and S.V. KALININ, *Ferroelectric switching by the grounded scanning probe microscopy tip*, Phys. Rev. **B 91**, 214109 (2015).

177. A. IEVLEV and S.V. KALININ, *Data encoding based on the shape of the ferroelectric domains produced by the a scanning probe microscopy tip*, Nanoscale **7**, 11040 (2015).

178. A.N. MOROZOVSKA, A.S. PUSENKOVA, O.V. VARENYK, M. STRIKHA, S.V. KALININ, and E.A. ELISEEV, *Finite size effects of hysteretic dynamics in multi-layer graphene on ferroelectric*, Phys. Rev. **B 91**, 235312 (2015).

179. A. BELIANINOV, Q. HE, A. DZIAUGYS, P. MAKSYMOVYCH, E. ELISEEV, A. BORISEVICH, A. MOROZOVSKA, J. BANYS, Y. VYSOCHANSKII, and S.V. KALININ, $CuInP_2S_6$ - *Room Temperature Layered Ferroelectric*, Nano Lett. **15**, 3808 (2015).

180. R.K. VASUDEVAN, S. ZHANG, M.B. OKATAN, S. JESSE, S.V. KALININ, and N. BASSIRI-GHARB, *Mesoscopic Harmonic Mapping of Electromechanical Response in a Relaxor Ferroelectric*, Appl. Phys. Lett. 106, 222901 (2015).

181. J. DING, E. STRELCOV, S.V. KALININ, and N. BASSIRI-GHARB, *Spatially resolved probing of electrochemical reactions via energy discovery platforms*, Nano Lett. **15**, 3669 (2015).

182. N. BALKE, P. MAKSYMOVYCH, S. JESSE, I.I. KRAVCHENKO, Q. LI, and S.V. KALININ, *Exploring Local Electrostatic Effects with Scanning Probe Microscopy: Implications for Piezoresponse Force Microscopy and Triboelectricity*, ACS Nano **8**, 10229 (2014).

183. L. MAZET, S.M. YANG, S.V. KALININ, S. SCHAMM-CHARDON, and C. DUBOURDIEU, *A review of molecular beam epitaxy of ferroelectric* $BaTiO_3$ *films on* Si, Ge *and* GaAs *substrates and their applications*, STAM **16**, 036005 (2015).

184. D.O. ALIKIN, A.V. IEVLEV, A.P. TURYGIN, A.I. LOBOV, S.V. KALININ, and V.YA. SHUR, *Tip-induced domain growth on the non-polar cuts of lithium niobate single-crystals*, Appl. Phys. Lett. **106**, 182902 (2015).

185. A. BELIANINOV, R.K VASUDEVAN, E. STRELCOV, C. STEED, S.M. YANG, A. TSELEV, S. JESSE, M. BIEGALSKI, G. SHIPMAN, C. SYMONS, A. BORISEVICH, R. ARCHIBALD, and S.V. KALININ, *Big Data and Deep data in scanning and electron microscopies: deriving functionality from multidimensional data sets*, Advanced Structural and Chemical Imaging **1**, 1 (2015).

186. W. LIN, P. GANESH, A. GIANFRANCESCO, J. WANG, T. BERLIJN, T.A. MAIER, S.V. KALININ, B.C. SALES, and M. PAN, *Role of chalcogen vapor annealing in inducing bulk superconductivity in* $Fe_{1+y}Te_{1-x}Se_x$, Phys. Rev. **B 91**, 060513(R) (2015).

187. D.M. MARINCEL, H.R. ZHANG, J. BRITSON, A. BELIANINOV, M.B. OKATAN, S. JESSE, S.V. KALININ, L.Q. CHEN, W.M. RAINFORTH, I.M. REANEY, C. RANDALL, and S. TROLIER-MCKINSTRY, *Domain pinning near a single grain boundary in tetragonal and rhombohedral lead zirconate titanate films*, Phys. Rev. **B 91**, 134113 (2015).

188. R.K. VASUDEVAN, A. TSELEV, A.G. GIANFRANCESCO, A.P. BADDORF, and S.V. KALININ, *Atomic-scale electrochemistry on the surface of a manganite by scanning tunneling microscopy*, Appl. Phys. Lett. **106**, 143107 (2015).

189. R.K. VASUDEVAN, A. BELIANINOV, A.G. GIANFRANCESCO, A.P. BADDORF, A. TSELEV, S.V. KALININ, and S. JESSE, *Big data in reciprocal space: Sliding fast Fourier transforms for determining periodicity*, Appl. Phys. Lett. **106**, 091601 (2015).

190. N. YANG, C. CANTONI, V. FOGLIETTI, A. TEBANO, A. BELIANINOV, E. STRELCOV, S. JESSE, D. DI CASTRO, DANIELE; E. DI BARTOLOMEO, S. LICOCCIA, S.V. KALININ, G. BALESTRINO, and C. ARUTA, *Defective interfaces in Yttrium-doped Barium Zirconate films and consequences on proton conduction*, Nano Lett. **15**, 2343 (2015).

191. A. TSELEV, R.K. VASUDEVAN, A.G. GIANFRANCESCO, L. QIAO, P. GANESH, T.L. MEYER, H.N. LEE, M.D. BIEGALSKI, A.P. BADDORF, and S.V. KALININ, *Surface Control of Epitaxial Manganite Films via Oxygen Pressure*, ACS Nano **9**, 4316 (2015).

192. T. FARROW, N. YANG, S. DORIA, A. BELIANINOV, S. JESSE, T.M. ARRUDA, G. BALESTRINO, S.V. KALININ, and A. KUMAR, *Sub-nA spatially resolved conductivity profiling of surface and interface defects in ceria films*, APL Materials **3**, 036106 (2015);

193. L. COLLINS, M.B. OKATAN, Q. LI, I. KRAVCHENKO, N. LAVRIK, S.V. KALININ, B. RODRIGUEZ, and S. JESSE, *Quantitative* 3D KPFM *imaging with simultaneous electrostatic force and force gradient detection*, Nanotechnology **26**, 175707 (2015).

194. A. BELIANINOV, S.V. KALININ, and S. JESSE, *Complete information acquisition in scanning probe microscopy*, Nat. Comm. **6**, 6550 (2015).

195. S.M. YANG, E. STRELCOV, M. PARANTHAMAN, A. TSELEV, T.W. NOH, and S.V. KALININ, *Humidity Effect on Nanoscale Electrochemistry in Solid Silver Ion Conductors and the Dual Nature of Its Locality*, Nano Lett. **15**, 1062 (2015).

196. E.A. ELISEEV, S.V. KALININ, and A.N. MOROZOVSKA, *Finite size effects in ferroelectric-semiconductor thin films under open-circuit electric boundary conditions*, J. Appl. Phys. **117**, 034102 (2015).

197. E. STRELCOV, R. KUMAR, V. BOCHAROVA, B.G. SUMPTER, A. TSELEV, and S.V. KALININ, *Nanoscale Lubrication of Ionic Surfaces Controlled via Strong Electric Field*, Sci. Rep. **5**, 8049 (2015).

198. F. XUE, L.Y. LIANG, Y.J. GU, I. TAKEUCHI, S.V. KALININ, and L.Q. CHEN, *Composition- and pressure-induced ferroelectric to antiferroelectric phase transitions in* Sm-*doped* $BiFeO_3$ *system*, Appl. Phys. Lett. **106**, 012903 (2015).

199. A.V. IEVLEV, D.O. ALIKIN, A.N. MOROZOVSKA, O.V. VARENYK, E.A. ELISEEV, A.L. KHOLKIN, V.Y. SHUR, and S.V. KALININ, *Symmetry Breaking and Electrical Frustration during Tip-Induced Polarization Switching in the Nonpolar Cut of Lithium Niobate Single Crystals*, ACS Nano **9**, 769 (2015).

200. (**perspective**) S.J. PENNYCOOK and S.V. KALININ, *Hasten high resolution*, Nature **515**, 487 (2014).

201. L. COLLINS, S. JESSE, J.I. KILPATRICK, A. TSELEV, M.B. OKATAN, S.V. KALININ, and B.J. RODRIGUEZ, *Kelvin probe force microscopy in liquid using electrochemical force microscopy*, Belstein Journal of Nanotechnology **6**, 201 (2015).

202. Q. LI, W. LIN, J. YAN, X. CHEN, A.G. GIANFRANCESCO, D.J. SINGH, D. MANDRUS, S.V. KALININ, and M. PAN, *Bond competition and phase evolution on the* $IrTe_2$ *surface*, Nature Comm. **5**, 5358 (2014).

203. S.J KELLY, Y. KIM, E. ELISEEV, A.N. MOROZOVSKA, S. JESSE, M.D. BIEGALSKI, J.F. MITCHELL, H. ZHENG, J. AARTS, I. HWANG, S. OH, J.S. CHOI, T. CHOI, B.H PARK, S.V KALININ, and P. MAKSYMOVYCH, *Controlled mechanical modification of manganite surface with nanoscale resolution*, Nanotechnology **25**, 475302 (2014).

204. R.K. VASUDEVAN, A. TSELEV, A.P. BADDORF, and S.V. KALININ, *Big-Data Reflection High Energy Electron Diffraction Analysis for Understanding Epitaxial Film Growth Processes*, ACS Nano **8**, 10899 (2014).

205. P. PONATH, K. FREDRICKSON, A.B. POSADAS, Y. REN, X. WU , R.K. VASUDEVAN, M.B. OKATAN, S. JESSE, T. AOKI, M.R. MCCARTNEY, D.J. SMITH, S.V. KALININ, K. LAI, and A.A. DEMKOV, *Carrier Density Modulation in* Ge *Heterostructure by Ferroelectric Switching*, Nat. Comm. **6**, 6067 (2015).

206. N. YANG, A. BELIANINOV, E. STRELCOV, A. TEBANO, V. FOGLIETTI, D. DI CASTRO, C. SCHLUETER, T.L. LEE, A. BADDORF, N. BALKE, S. JESSE, S.V. KALININ, G. BALESTRINO, and C. ARUTA, *Effect of Doping on Surface Reactivity and Conduction Mechanism in Samarium-Doped Ceria Thin Films*, ACS Nano **8**, 12494 (2014).

207. V. BOCHAROVA, A.L. AGAPOV, A. TSELEV, L. COLLINS, R. KUMAR, S. BERDZINSKI, V. STREHMEL, A. KISLIUK, I.I. KRAVCHENKO, B.G. SUMPTER, A.P. SOKOLOV, S.V. KALININ, and E. STRELCOV, *Controlled Nanopatterning of a Polymerized Ionic Liquid in a Strong Electric Field*, Adv. Func. Mat. **25**, 805 (2015).

208. Q. LI, S. JESSE, A. TSELEV, L. COLLINS, P. YU, I. KRAVCHENKO, S.V. KALININ, and N. BALKE, *Probing Local Bias-Induced Transitions Using Photothermal Excitation Contact Resonance Atomic Force Microscopy and Voltage Spectroscopy*, ACS Nano **9**, 1848 (2015).

209. A. BELIANINOV, P. GANESH, W. LIN, B.C. SALES, A.S. SEFAT, S. JESSE, M. PAN, and S.V. KALININ, *Spatially-resolved mapping of electronic structure on atomic level by multivariate statistical analysis*, APL Materials **2**, 120701 (2014).

210. S.M. YANG, M.B. OKATAN, M.P. PARANTHAMAN, S. JESSE, T.W. NOH, and S.V. KALININ, *Second harmonic detection in the electrochemical strain microscopy of* Ag-*ion conducting glass*, Appl. Phys. Lett. **105**, 193106 (2014).

211. R. KUMAR, V. BOCHAROVA, E. STRELCOV, A. TSELEV, I.I. KRAVCHENKO, S. BERDZINSKI, V. STREHMEL, O.S. OVCHINNIKOVA, J.A. MINUTOLO, J.R. SANGORO, A.L. AGAPOV, A.P. SOKOLOV, S.V. KALININ, and B.G. SUMPTER, *Ion transport and softening in a polymerized ionic liquid*, Nanoscale **7**, 947 (2015).

212. D. MARTIN, J. MÜLLER, T. SCHENK, T.M. ARRUDA, A. KUMAR, E. STRELCOV, E. YURCHUK, S. MÜLLER, D. POHL, U. SCHRÖDER, S.V. KALININ and T. MIKOLAJICK, *Ferroelectricity in* Si-*doped* HfO_2 *Revealed: A Binary Lead-free Ferroelectric*, Adv. Mat. **26**, 8198 (2014).

213. L. COLLINS, A. TSELEV, S. JESSE, M.B. OKATAN, R. PROKSCH, J.P. MATHEWS, G.D. MITCHELL, B.J. RODRIGUEZ, S.V. KALININ, and I. IVANOV, *Breaking the limits of structural and mechanical imaging of the heterogeneous structure of coal macerals*, Nanotechnology **25**, 435402 (2014).

214. A.N. MOROZOVSKA, E.A. ELISEEV, O.V. VARENIK, Y. KIM, E. STRELCOV, A. TSELEV, N.V. MOROZOVSKY, and S.V. KALININ, *Nonlinear space charge dynamics in mixed ionic-electronic conductors: Resistive switching and ferroelectric-like hysteresis of electromechanical response*, J. Appl. Phys. **116**, 066808 (2014).

215. E. STRELCOV, A. BELIANINOV, B.G. SUMPTER, and S.V. KALININ, *Extracting physics through deep data analysis*, Materials Today **17**, 416 (2014).

216. A.N. MOROZOVSKA, E.A. ELISEEV, A.V. IEVLEV, O.V. VARENYK, A.S. PUSENKOVA, Y.H. CHU, V.YA. SHUR, M.V. STRIKHA, and S.V. KALININ, *Ferroelectric domain triggers the charge modulation in semiconductors* (invited), J. Appl. Phys. **116**, 066817 (2014).

217. A. TSELEV, R.K. VASUDEVAN, S.V. KALININ, and A.P. BADDORF, *Effect of silver doping on the surface of* $La_{5/8}Ca_{3/8}MnO_3$ *epitaxial films*, Appl. Phys. Lett. **105**, 101602 (2014).

218. R.K. VASUDEVAN, Y. MATSUMOTO, X. CHENG, A. IMAI, S. MARUYAMA, M.B. OKATAN, S. JESSE, S.V. KALININ, and V. NAGARAJAN, *Deterministic Arbitrary Switching of Polarization in a Ferroelectric Thin Film*, Nat. Comm. **5**, 4971 (2014).

219. A.V. IEVLEV, A.N. MOROZOVSKA, E.A. ELISEEV, V.Y. SHUR, and S.V. KALININ, *Ionic field effect and memristive phenomena in single-point ferroelectric domain switching*, Nat. Comm. **5**, 4545 (2014).

220. Y.M. KIM, A. MOROZOVSKA, E. ELISEEV, M.P. OXLEY, R. MISHRA, S.T. PANTELIDES, S.M. SELBACH, T. GRANDE, S.V. KALININ, and A.Y. BORISEVICH, *Direct observation of ferroelectric field effect and vacancy-controlled screening at the* $BiFeO_3$-$La_xSr_{1-x}MnO_3$ *interface*, Nature Materials **13**, 1019 (2014).

221. I. SUGIYAMA, Y. KIM, S. JESSE, E. STRELCOV, A. KUMAR, A. TSELEV, E.K. RAHANI, V.B. SHENOY, T. YAMAMOTO, N. SHIBATA, Y. IKUHARA, and S.V. KALININ, *Spatially-resolved mapping of history-dependent coupled electrochemical and electronical behaviors of electroresistive* NiO, Sci. Rep. **4**, 6725 (2014).

222. E.A. ELISEEV, A.N. MOROZOVSKA, A.V. IEVLEV, N. BALKE, P. MAKSYMOVYCH, A. TSELEV, and S.V. KALININ, *Electrostrictive and electrostatic responses in contact mode voltage modulated scanning probe microscopies*, Appl. Phys. Lett. **104**, 232901 (2014).

223. Z. GAI, W. LIN, J.D. BURTON, K. FUCHIGAMI, P.C. SNIJDERS, T.Z. WARD, E.Y. TSYMBAL, J. SHEN, ST. JESSE, S.V. KALININ, and A.P. BADDORF, *Chemically-induced Jahn-Teller ordering on manganite surfaces*, Nat. Comm. 5, 4528 (2014).

224. E. STRELCOV, A. BELIANINOV, Y.H. HSIEH, S. JESSE, A.P. BADDORF, Y.H. CHU, and S.V. KALININ, *Deep Data Analysis of Conductive Phenomena on Complex Oxide Interfaces: Physics from Data Mining*, ACS Nano **8**, 6449 (2014).

225. S. GUPTA, A. BELIANINOV, M.B. OKATAN, S. JESSE, S.V. KALININ, and S. PRIYA, *Fundamental limitation to the magnitude of piezoelectric response of* <001> (pc) *textured* $K_{0.5}Na_{0.5}NbO_3$ *ceramic*, Appl. Phys. Lett. **104**, 172902 (2014).

226. M.D. BIEGALSKI, E. CRUMLIN, A. BELIANINOV, E. MUTORO, Y. SHAO-HORN, and S.V. KALININ, In-situ *examination of oxygen non-stoichiometry in* $La_{0.80}Sr_{0.20}CoO_{3\text{-delta}}$ *thin films at intermediate and low temperatures by x-ray diffraction*, Appl. Phys. Lett. **104**, 161910 (2014).

227. L. COLLINS, J.L. KILPATRICK, I.V. VLASSIOUK, A. TSELEV, S.A.L. WEBER, S. JESSE, S.V. KALININ, and B.J. RODRIGUEZ, *Dual harmonic Kelvin probe force microscopy at the graphene-liquid interface*, Appl. Phys. Lett. **104**, 133103 (2014).

228. L. COLLINS, S. JESSE, J.I. KILPATRICK, A. TSELEV, O. VARENYK, M.B. OKATAN, S.A.L. WEBER, A. KUMAR, N. BALKE, S.V. KALININ, and B.J. RODRIGUEZ, *Probing charge screening dynamics and electrochemical processes at the solid-liquid interface with electrochemical force microscopy*, Nat. Comm. **5**, 3871 (2014).

229. A.V. IEVLEV, A.N. MOROZOVSKA, V.Y. SHUR, and S.V. KALININ, *Humidity effects on tip-induced polarization switching in lithium niobate*, Appl. Phys. Lett. **104**, 092908 (2014).

230. N. YANG, S. DORIA, A. KUMAR, J.H. JANG, T.M. ARRUDA, A. TEBANO, S. JESSE, I.N. IVANOV, A.P. BADDORF, E. STRELCOV, S. LICOCCIA, A.Y. BORISEVICH, G. BALESTRINO, and S.V. KALININ, *Water-mediated electrochemical nano-writing on thin ceria films*, Nanotechnology **25**, 075701 (2014).

231. U. SCHROEDER, E. YURCHUK, J. MULLER, D. MARTIN, T. SCHENK, P. POLAKOWSKI, C. ADELMANN, M.I. POPOVICI, S.V. KALININ, and T. MIKOLAJICK, *Impact of different dompants on the switching properties of ferroelectric hafniumoxide*, Jap. J. Appl. Phys. **53**, 85 (2014).

232. A.N. MOROZOVSKA, E.A. ELISEEV, P.S.S.R. KRISHNAN, A. TSELEV, E. STRELKOV, A. BORISEVICH, O.V. VARENYK, N.V. MOROZOVSKY, P. MUNROE, S.V. KALININ, and V. NAGARAJAN, *Defect thermodynamics and kinetics in thin strained ferroelectric films: The interplay of possible mechanisms*, Phys. Rev. **B 89**, 054102 (2014).

233. M.D. BIEGALSKI, Y. TAKAMURA, A. MEHTA, Z. GAI, S.V. KALININ, H. AMBAYE, V. LAUTER, D. FONG, J. HE, S.T. PANTELIDES, Y. M. KIM, A. BORISEVICH, W. SIEMONS and H.M. CHRISTEN, *Interrelation between Structure –Magnetic Properties in* $La_{0.5}Sr_{0.5}CoO_3$, Adv. Mat. Interfaces **1**, 1400203 (2014).

234. A. TSELEV, I.N. IVANOV, N.V. LAVRIK, A. BELIANINOV, S. JESSE, J.P. MATHEWS, G.D. MITCHELL, and S.V. KALININ, *Mapping internal structure of coal by confocal micro-Raman spectroscopy and scanning microwave microscopy*, Fuel **126**, 32 (2014).

235. A. TSELEV, A.N. MOROZOVSKA, A. UDOD, E.A. ELISEEV, and S.V. KALININ, *Self-consistent modeling of electrochemical strain microscopy of solid electrolytes*, Nanotechnology **24**, 445701 (2014).

236. Y. KIM, S. JESSE, A. MORELLI, S.V. KALININ, and I. VREJOIU, *Influence of interfacing with electrically inhomogeneous bottom electrode on the ferroelectric properties of epitaxial* $PbTiO_3$, Appl. Phys. Lett. **103**, 192901 (2013).

237. J. SEIDEL, M. TRASSIN, Y. ZHANG , P. MAKSYMOVYCH, T. UHLIG, P. MILDE, D. KÖHLER, A.P. BADDORF, S.V. KALININ, L.M. ENG, X. PAN, and R. RAMESH, *Electronic Properties of Isosymmetric Phase Boundaries in Highly Strained* Ca-Doped $BiFeO_3$, Adv. Mat. **26**, 4376 (2014).

238. S.M. LEI, E.A. ELISEEV, A.N. MOROZOVSKA, R.C. HAISLMAIER, T.T. LUMMEN, W. CAO, S.V. KALININ, and V. GOPALAN, *Comment on 'Origin of piezoelectric response under a biased scanning probe microscopy tip across a 180 degrees ferroelectric domain wall' Reply*, Phys. Rev. **B 89**, 226102 (2012).

239. E.A. ELISEEV, S.V. KALININ, Y. GU, M.D. GLINCHUK, V. KHIST, A. BORISEVICH, V. GOPALAN, L.Q. CHEN, and A. MOROZOVSKA, *Universal Emergence of Spatially Modulated Structures Induced by Flexoantiferrodistortive Coupling in Multiferroics*, Phys. Rev. **B 88**, 224105 (2013).

240. Y. KIM, S.J. KELLY, A. MOROZOVSKA, E.K. RAHANI, E. STRELCOV, E. ELISEEV, S. JESSE, M.D. BIEGALSKI, N. BALKE, N. BENEDEK, D. STRUKOV, J. AARTS, I. HWANG, S. OH, J.S. CHOI, T. CHOI, B.H. PARK, V.B. SHENOY, P. MAKSYMOVYCH, and S.V. KALININ, *Mechanical Control of Electroresistive Switching*, Nano Lett. **13**, 4068 (2013).

241. K. SEAL, B.J. RODRIGUEZ, I.N. IVANOV, and S.V. KALININ, *Anomalous Photodeposition of Ag on Ferroelectric Surfaces with Below Bandgap Excitation*, Adv. Opt. Mat. **2**, 292 (2014).

242. S. JESSE, R.K. VASUDEVAN, L. COLLINS, E. STRELCOV, M.B. OKATAN, A. BELIANINOV, A.P. BADDORF, R. PROKSCH, and S.V. KALININ, *Band excitation in scanning probe microscopy: recognition and functional imaging*, Annu. Rev. Phys. Chem. **65**, 519 (2014).

243. T.A. LUMMEN, Y. GU, J. WANG, S. LEI, F. XUE, A. KUMAR, A.T. BARNES, E. BARNES, S. DENEV, A. BELIANINOV, M. HOLT, A.N. MOROZOVSKA, S.V. KALININ, L.Q. CHEN, and V. GOPALAN, *Thermotropic Phase Boundaries in Classic Ferroelectrics*, Nat. Comm. **5**, 3172 (2014).

244. A.V. IEVLEV, S. JESSE, A.N. MOROZOVSKA, E. STRELCOV, E.A. ELISEEV, Y.V. PERSHIN, A. KUMAR, V. YA. SHUR, and S.V. KALININ, *Intermittency, quasiperiodicity, and chaos in probe-induced ferroelectric domain switching*, Nature Physics **10**, 59 (2014).

245. J.M. BLACK, D. WALTERS, A. LABUDA, G. FENG, P.C. HILLESHEIM, S. DAI, P. CUMMINGS, S.V. KALININ, R. PROKSCH, and N. BALKE, *Bias-dependent molecular-level structure of electrical double layer in ionic liquid on graphite*, Nano Lett. **13**, 5954 (2013).

246. J. LU, W.S. CHOI, H.J. JEEN, S. DONG, Y. KIM, M.G. HAN, Y. ZHU, S.V. KALININ, E. DAGOTTO, T. EGAMI, and H.N. LEE, *Tunneling Electroresistance Induced by Interfacial Phase Transitions in Ultrathin Oxide Heterostructures*, Nano Lett. **13**, 5837 (2013).

247. A. IMAI, X. CHENG, E.A. ELISEEV, A.N. MOROZOVSKA, S.V. KALININ, R. TAKAHASHI, M. LIPPMAA, V. NAGARAJAN, and Y. MATSUMOTO, *Epitaxial* $Bi_5Ti_3FeO_{15}$-$CoFe_2O_4$ *pillar-matrix multiferroic nanostructures*, ACS Nano **7**, 11079 (2013).

248. N. BASSIRI-GHARB, S.V. KALININ, and V. NAGARAJAN, *Preface to Special Topic: Piezoresponse Force Microscopy and Nanoscale Phenomena in Polar Materials*, J. Appl. Phys. **116**, 066701 (2014).

249. T.M. ARRUDA, J.S. LAWTON, A. KUMAR, R.R. UNOCIC, I.I. KRAVCHENKO, T.A. ZAWODZINSKI, S. JESSE, S.V. KALININ, and N. BALKE, In-situ *formation of micron-scale* Li-*metal anodes with high cyclability*, ECS Electrochemistry Lett. **3**, A4 (2014).

250. L. COLLINS, J.I. KILPATRICK, S.A.L. WEBER, A. TSELEV, I.V. VLASSIOUK, I.N. IVANOV, S. JESSE, S.V. KALININ, and B.J. RODRIGUEZ, *Open loop Kelvin probe force microscopy with single and multi-frequency excitation*, Nanotechnology **24**, 475702 (2013).

251. J.C. AGAR, R.V.K. MANGALAM, A.R. DAMODARAN, G. VELARDE, J. KARTHIK, M.B. OKATAN, Z.H. CHEN, S. JESSE, N. BALKE, S.V. KALININ, and L.W. MARTIN, *Tuning Susceptibility via Misfit Strain in Relaxed Morphotropic Phase Boundary* $PbZr_{1-x}Ti_xO_3$ *Epitaxial Thin Films*, Adv. Mat. Interfaces **1**, 1400098 (2014).

252. A. SHKABKO, M.H. AGUIRRE, A. KUMAR, Y. KIM, S. JESSE, R. WASER, S.V. KALININ, and A. WEIDENKAFF, *Surface deformations as a necessary requirement for resistance switching at the surface of* $SrTiO_3$:N, Nanotechnology **24**, 475701 (2013).

253. S. DORIA, N. YANG, A. KUMAR, S. JESSE, A. TEBANO, C. ARUTA, E. DI BARTOLOMEO, T.M. ARRUDA, S.V. KALININ, S. LICOCCIA, and G. BALESTRINO, *Nanoscale mapping of oxygen vacancy kinetics in nanocrystalline Samarium doped Ceria thin films*, Appl. Phys. Lett. **103**, 171605 (2013).

254. A. KUMAR, C. CHEN, T.M. ARRUDA, S. JESSE, F. CIUCCI, and S.V. KALININ, *Frequency Spectroscopy of Irreversible Electrochemical Nucleation Kinetics on the nanoscale*, Nanoscale **5**, 11964 (2013).

255. W. LIN, Q. LI, A. BELIANINOV, B.C. SALES, A. SEFAT, Z. GAI, A.P. BADDORF, M. PAN, S. JESSE, and S.V. KALININ, *Local crystallography analysis for atomically resolved scanning tunneling microscopy images*, Nanotechnology **24**, 415707 (2013).

256. Y. KIM, E. STRELCOV, I.R. HWANG, T. CHOI, B.H. PARK, S. JESSE, and S.V. KALININ, *Correlative Multimodal Probing of Ionically-Mediated Electromechanical Phenomena in Simple Oxides*, Science Reports **3**, 2924 (2013).

257. D. MARINCEL, H. R. ZHANG, A. KUMAR, S. JESSE, S. V. KALININ, W. M. RAINFORTH, I. M. REANEY, C. A. RANDALL, and S. TROLIER-MCKINSTRY, *Influence of a Single Grain Boundary on Domain Wall Motion in Ferroelectrics*, Adv. Func. Mat. **24**, 1409 (2014).

258. E. STRELCOV, A. IEVLEV, S. JESSE, I.I. KRAVCHENKO, V.YA. SHUR, and S.V. KALININ, *Direct Probing of Charge Injection and Polarization-Controlled Ionic Mobility on Ferroelectric* $LiNbO_3$ *Surfaces*, Adv. Mat. **26**, 958 (2014).

259. J.M. BLACK, G. FENG, P.F. FULVIO, P. C. HILLESHEIM, S. DAI, Y. GOGOTSI, P. CUMMINGS, S.V. KALININ, and N. BALKE, *Strain-based* in-situ *study of anion and cation insertion into porous carbon electrodes with different pore sizes*, Adv. Energy Mat. **4**, 1300683(2014)

260. S.V. KALININ and A.N. MOROZOVSKA, *Electrochemical strain microscopy of local electrochemical processes in solids: mechanism of imaging and spectroscopy in the diffusion limit*, J. Electrocer. **32**, 51 (2014).

261. Y.H. HSIEH, E. STRELCOV, J.M. LIOU, C.Y. SHEN, Y.C. CHEN, S.V. KALININ, and Y.H. CHU, *Electrical Modulation of the Local Conduction at Oxide Tubular Interfaces*, ACS Nano **7**, 8627 (2013).

262. T. ARRUDA, A. KUMAR, S. JESSE, G. VEITH, A. TSELEV, A. BADDORF, N. BALKE, and SERGEI V. KALININ, *Towards quantitative electrochemical measurements on the nanoscale by scanning probe microscopy: environmental and current spreading effects*, ACS Nano **7**, 8175 (2013).

263. (**perspective**) SERGEI V. KALININ and N.A. SPALDIN, *Functional Ion Defects in Transition Metal Oxides*, Science **341**, 858 (2013).

264. C. DUBOURDIEU, J. BRULEY, T.M. ARRUDA, A. POSADAS, J. JORDAN-SWEET, M.M. FRANK, E. CARTIER, D.J. FRANK, S.V. KALININ, A. DEMKOV, and V. NARAYANAN, *Ferroelectric switching of epitaxial* $BaTiO_3$ *films on silicon without conducting bottom electrode*, Nature Nano. **8**, 748 (2013).

265. E. STRELCOV, Y. KIM, S. JESSE, Y. CAO, I. IVANOV, I. KRAVCHENKO, C.H. WANG, Y.C. TENG, L.Q. CHEN, Y.H. CHU, and S.V. KALININ, *Probing Local Ionic Dynamics in Functional Oxides at the Nanoscale*, Nano Lett. **13**, 3455 (2013).

266. E. STRELCOV, S. JESSE, Y.L. HUANG, Y.C. TENG, I. KRAVCHENKO, Y.H. CHU, and S.V. KALININ, *Space- and Time-Resolved Mapping of Ionic Dynamic and Electroresistive Phenomena in Lateral Devices*, ACS Nano **7**, 6806 (2013).

267. A. TSELEV, V.K. SANGWAN, D. JARIWALA, T.J. MARKS, L.J. LAUHON, M.C. HERSAM, and S.V. KALININ, *Near-field microwave microscopy of high-kappa oxides grown on graphene with an organic seeding layer*, Appl. Phys. Lett. **103**, 243105 (2013).

268. (essay) SERGEI V. KALININ, *Scanning Probe Microscopy in US Department of Energy Nanoscale Science Research Centers: Status, Perspectives, and Opportunities*, Adv. Func. Mat. 23, 2468 (2013).

269. A.N. MOROZOVSKA, E.A. ELISEEV, G.S. SVECHNIKOV, and SERGEI V. KALININ, *Mesoscopic mechanisms of the domain wall interaction with elastic defects in uniaxial ferroelectrics*, J. Appl. Phys. **113**, 187203 (2013).

270. J. LI, SERGEI V. KALININ, and A. KHOLKIN, *Preface to Special Topic: Selected Papers from the Piezoresponse Force Microscopy Workshop Series: Part of the Joint ISAF-ECAPD-PFM 2012 Conference*, J. Appl. Phys. **113**, 187101 (2013).

271. A. TSELEV, P. GANESH, L. QIAO, W. SIEMONS, Z. GAI, M. BIEGALSKI, A.P. BADDORF, and SERGEI V. KALININ, *Oxygen Control of Atomic Structure and Physical Properties of* $SrRuO_3$ *Surfaces*, ACS Nano **7**, 4403 (2013).

272. A.N. MOROZOVSKA, E.A. ELISEEV, O.V. VARENYK, and S.V. KALININ, *Effective piezoelectric response of twin walls in ferroelectrics*, J. Appl. Phys. **113**, 187222 (2013).

273. A. KUMAR, D. LEONARD, S. JESSE, F. CIUCCI, E.A. ELISEEV, A.N. MOROZOVSKA, M. BIEGALSKI, H. CHRISTEN, A. TSELEV, E. MUTORO, E. CRUMLIN, D. MORGAN, Y. SHAO-HORN, A. BORISEVICH, and S.V. KALININ, *Spatially resolved mapping of oxygen reduction/evolution reaction on solid-oxide fuel cell cathodes with sub*-10 nm *resolution*, ACS Nano **7**, 3808 (2013).

274. A. KUMAR, T.M. ARRUDA, A. TSELEV, I.N. IVANOV, J.S. LAWTON, T.A. ZAWODZINSKI, O. BUTYAEV, S. ZAYATS, S. JESSE, and S.V. KALININ, *Nanometer-scale mapping of irreversible electrochemical nucleation processes on solid* Li-*ion electrolytes*, Sci. Rep. **3**, 1621 (2013).

275. A. KUMAR, F. CIUCCI, D. LEONARD, S. JESSE, M. BIEGALSKI, H. CHRISTEN, E. MUTORO, E. CRUMLIN, Y. SHAO-HORN, A. BORISEVICH, AND S.V. KALININ, *Probing bias-dependent electrochemical gas-solid reactions in* $(La_xSr_{1-x})CoO_{3-\delta}$ *cathode materials,* Adv. Func. Mat. **23**, 5027 (2013).

276. A. KUMAR, S. JESSE, A. MOROZOVSKA, E. ELISEEV, A. TEBANO, N. YANG and S.V. KALININ, *Variable Temperature Electrochemical Strain Microscopy of* Sm-*doped Ceria*, Nanotechnology **24**, 145401 (2013).

277. R.K. VASUDEVAN, M.B. OKATAN, I. RAJAPAKSA, Y. KIM, D. MARINCEL, S. TROLIER-MCKINSTRY, S. JESSE, N. VALANOOR, S.V. KALININ, *Higher order harmonic detection for exploring nonlinear interactions with nanoscale resolution*, Sci. Rep. **3**, 2677 (2013).

278. W. LIN, Q. LI, B.C. SALES, S. JESSE, A.S. SEFAT, S.V. KALININ, and M. PAN, *Direct Probe of Interplay between Local Structure and Superconductivity in* $FeTe_{0.55}Se_{0.45}$, ACS Nano **7**, 2634 (2013).

279. A. TSELEV, N.V. LAVRIK, A. KOLMAKOV, and S.V. KALININ, *Scanning Near-Field Microwave Microscopy of* VO_2 *and CVD Graphene*, Adv. Func. Mat. **23**, 2635 (2013).

280. E.A. ELISEEV, P.V. YUDIN, S.V. KALININ, N. SETTER, A.K. TAGANTSEV and A.N. MOROZOVSKA, *Structural phase transitions and electronic phenomena at* 180 *degree domain walls in rhombohedral* $BaTiO_3$, Phys. Rev. **B 87**, 054111 (2013).

281. Y. KIM, X. LU, S. JESSE, D. HESSE, M. ALEXE, and S.V. KALININ, *Universality of Polarization Switching Dynamics in Ferroelectric Capacitors Revealed by* 5D *Piezoresponse Force Microscopy*, Adv. Func. Mat. **23**, 3971 (2013).

282. S.W. HONG, T. CHOI, J.H. JEON, Y. KIM, H. LEE, H.Y. JOO, I. HWANG, S.O. KANG, S.V. KALININ and B.H. PARK, *Large resistive switching in ferroelectric* $BiFeO_3$ *nanoisland based switchable diodes*, Adv. Mat. **25**, 2339 (2013).

283. E. KARAPETIAND AND S.V. KALININ, *Indentation of a punch with chemical or heat distribution at its base into transversely isotropic half-space: application to local thermal and electrochemical probes*, J. Appl. Phys. **113**, 187201 (2013).

284. R.K. VASUDEVAN, W. WU, J. R. GUEST, A.P. BADDORF, A.N. MOROZOVSKA, E.A. ELISEEV, N. BALKE, V. NAGARAJAN, P. MAKSYMOVYCH, and S.V. KALININ, *Domain wall conduction and polarization-mediated transport in ferroelectrics*, Adv. Func. Mat. **23**, 2592 (2013).

285. R.K. VASUDEVAN, D. MARINCEL, S. JESSE, Y. KIM, A. KUMAR, S.V. KALININ, and S. TROLIER-MCKINSTRY, *Polarization dynamics in ferroelectric capacitors: local perspective on emergent collective behaviors and memory effects*, Adv. Func. Mat. **23**, 2490 (2013).

286. Z. GAI, S.V. KALININ, A.P. LI, J. SHEN, and A.P. BADDORF, In-situ *observations and tuning of physical and chemical phenomena on the surfaces of strongly correlated oxides*, Adv. Func. Mat. **23**, 2477 (2013).

287. Y. KIM, J.H. JANG, S.J. PARK, S. JESSE, L. DONOVAN, A.Y. BORISEVICH, W. LEE, and S.V. KALININ, *Local Probing of Electrochemically Induced Negative Differential Resistance in* TiO2 *Memristive Materials*, Nanotechnology **24**, 085702 (2013).

288. Y.M. KIM, A. KUMAR, A. HATT, ANNA MOROZOVSKA, A. TSELEV, M. BIEGALSKI, I. IVANOV, E. ELISEEV, S.J. PENNYCOOK, J.M. RONDINELLI, S.V. KALININ, and A.Y. BORISEVICH, *Interplay of octahedral tilts and polar order in* $BiFeO_3$ *films*, Adv. Mat. **25**, 2497 (2013).

289. D.N. LEONARD, A. KUMAR, S. JESSE, M. BIEGALSKI, H. CHRISTEN, E. MUTORO, E. CRUMLIN, Y. SHAO HORN, S.V. KALININ, and A. BORISEVICH, *Nanoscale probing of voltage activated oxygen reduction/evolution reactions in nanopatterned* $(La_xSr_{1-x})CoO_{3-\delta}$ *cathodes*, Adv. Energy Mat. **3**, 788 (2013).

290. R.K. VASUDEVAN, M.B. OKATAN, Y.Y. LIU, S. JESSE, J.C. YANG, W.I. LIANG, Y.H. CHU, J.Y. LI, S.V. KALININ, and V. NAGARAJAN, *Unraveling the origins of electromechanical response in mixed-phase bismuth ferrite*, Phys. Rev. **B 86**, 020402 (2013).

291. G.L. THOMPSON, V.V. REUKOV, M.P. NIKIFOROV, S. JESSE, S.V. KALININ, and A.A. VERTEGEL, *Electromechanical and elastic probing of bacteria in a cell culture medium*, Nanotechnology **23**, 245705 (2012).

292. S.V. KALININ, A.Y. BORISEVICH, and D. FONG, *Beyond Condensed Matter Physics on the Nanoscale: The Role of Ionic and Electrochemical Phenomena in the Physical Functionalities of Oxide Materials*, ACS Nano **6**, 10423 (2012).

293. G.S. ROHRER, M. AFFATIGATO, M. BACKHAUS, R.K. BORDIA, H.M. CHAN, S. CURTAROLO, A. DEMKOV, J.N. ECKSTEIN, K.T. FABER, J.E. GARAY, Y. GOGOTSI, L.P. HUANG, L.E. JONES, S.V. KALININ, R.J. LAD, C.G. LEVI, J. LEVY, J.P. MARIA, L. MATTOS, A. NAVROTSKY, N. ORLOVSKAYA, C. PANTANO, J.F. STEBBINS, T.S. SUDARSHAN, T. TANI, and K.S. WEIL, *Challenges in Ceramic Science: A Report from the Workshop on Emerging Research Areas in Ceramic Science*, J. Am. Ceram. Soc. **95**, 3699 (2012)

294. E. STRELCOV, A. TSELEV, I. IVANOV, J. BUDAI, J. ZHANG, J. TISCHLER, I. KRAVCHENKO, S.V. KALININ, and A. KOLMAKOV, *Doping-Based Stabilization of the M2 Phase in Free-Standing* VO2 *Nanostructures at Room Temperature*, Nano Lett. **12**, 6198 (2012).

295. E. STRELCOV, Y. KIM, J.C. YANG, Y.H. CHU, P.YU, X. LU, S. JESSE, and S.V. KALININ, *Role of measurement voltage on hysteresis loop shape in piezoresponse force microscopy*, Appl. Phys. Lett. **101**, 192902 (2012).

296. S.M. LEI, E.A. ELISEEV, A.N. MOROZOVSKA, R.C. HAISLMAIER, T.T. LUMMEN, W. CAO, S.V. KALININ, and V. GOPALAN, *Origin of piezoelectric response under a biased scanning probe microscopy tip across a* 180 *degrees ferroelectric domain wall*, Phys. Rev. **B 86**, 134115 (2012).

297. A.N. MOROZOVSKA, E.A. ELISEEV, M.D. GLINCHUK, L.Q. CHEN, S.V. KALININ, and V. GOPALAN, *Impact of Free Charges on Polarization and Pyroelectricity in Antiferrodistortive Structures and Surfaces Induced by a Flexoelectric Effect*, Ferroelectrics **438**, 32 (2012).

298. T.M. ARRUDA, M. HEON, V. PRESSER, P.C. HILLESHEIM, S. DAI, Y. GOGOTSI, S.V. KALININ, and N. BALKE, In-situ *tracking of the nanoscale expansion of porous carbon electrodes*, Energy and Environmental Science **6**, 225 (2013).

299. N. BALKE, A. TSELEV, T.M. ARRUDA , S. JESSE, Y.H. CHU, and S.V. KALININ, *Probing Local Electromechanical Effects in Highly Conductive Electrolytes*, ACS Nano **6**, 10139 (2012)

300. N. BALKE, S. JESSE, Y.H. CHU, and S.V. KALININ, *High-Frequency Electromechanical Imaging of Ferroelectrics in a Liquid Environment*, ACS Nano **6**, 5559(2012)

301. J.E. MITCHELL, B. SAPAROV, W. LIN, S. CALDER, Q. LI, S.V. KALININ, M. PAN, A.D. CHRISTIANSON, and A.S. SEFAT, *Temperature-composition phase diagrams for* Ba1-xSrxFe2As2 and Ba0.5Sr0.5(Fe1-yCoy)2As2, Phys. Rev. **B 86**, 174511 (2012).

302. A.Y. BORISEVICH, A.R. LUPINI, J. HE, E.A. ELISEEV, A.N. MOROZOVSKA, G.S. SVECHNIKOV, P. YU, Y.H. CHU, R. RAMESH, S.T. PANTELIDES, S.V. KALININ, and S.J. PENNYCOOK, *Interface dipole between two metallic oxides caused by localized oxygen vacancies*, Phys. Rev. **B 86**, 140102 (2012).

303. R. VASUDEVAN, A. MOROZOVSKA, E. ELISEEV, J. BRITSON, J.C. YANG, Y.H. CHU, P. MAKSYMOVYCH, L.Q. CHEN, N. VALANOOR, and S.V. KALININ, *Domain wall geometry controls conduction in ferroelectrics*, Nano Lett. **12**, 5524 (2012).

304. T.M. ARRUDA, A. KUMAR, S.V. KALININ, and S. JESSE, *The partially reversible formation of Li-metal particles on a solid Li electrolyte: applications toward nanobatteries*, Nanotechnology **23**, 325402 (2012).

305. Y.M. KIM, J. HE, M.D. BIEGALSKI, H. AMBAYE, V. LAUTER, H.M. CHRISTEN, S.T. PANTELIDES, S.J. PENNYCOOK, S.V. KALININ, and A.Y. BORISEVICH, *Probing Oxygen Vacancy Concentration and Homogeneity in Solid Oxide Fuel Cell Cathode Materials on the (sub) Unit Cell Level*, Nature Materials **11**, 888 (2012)

306. D.A. BONNELL, D.N. BASOV, M. BODE, U. DIEBOLD, S.V. KALININ, V, MADHAVAN, L. NOVOTNY, M. SALMERON, U.D. SCHWARZ, and P.S. WEISS, *Imaging physical phenomena with local probes: From electrons to photons*, Rev. Mod. Phys. **84**, 1343 (2012).

307. A. TSELEV, N.V. LAVRIK, I. VLASSIOUK, D.P. BRIGGS, M. RUTGERS, R. PROKSCH, and S.V. KALININ, *Near-field microwave scanning probe imaging of conductivity inhomogeneities in CVD graphene*, Nanotechnology **23**, 385706 (2012).

308. A.N. MOROZOVSKA, E.A. ELISEEV, S.L. BRAVINA, A.Y. BORISEVICH, and S.V. KALININ, *Roto-flexoelectric coupling impact on the phase diagrams and pyroelectricity of thin* $SrTiO_3$ *films*, J. Appl. Phys. **112**, 064111 (2012).

309. A.N. MOROZOVSKA, R.K. VASUDEVAN, P. MAKSYMOVYCH, S.V. KALININ, and E.A. ELISEEV, *Anisotropic conductivity of uncharged domain walls in* $BiFeO_3$, Phys. Rev. **B 86**, 085315 (2012)

310. Y. KIM, A. MOROZOVSKA, A. KUMAR, S. JESSE, E. ELISEEV, F. ALIBART, D. STRUKOV, and S.V. KALININ, *Ionically-Mediated Electromechanical Hysteresis in Transition Metal Oxides*, ACS Nano **6**, 7026 (2012).

311. N. BALKE, S. KALNAUS, N.J. DUDNEY, C. DANIEL, S. JESSE, and S.V. KALININ, *Local Detection of Activation Energy for Ionic Transport in Lithium Cobalt Oxide*, Nano Lett. **12**, 3399 (2012)

312. E.A. ELISEEV, A.N. MOROZOVSKA, Y. GU, A.Y. BORISEVICH, L.Q. CHEN, V. GOPALAN, and S.V. KALININ, *Conductivity of twin walls - surface junctions in ferroelastics: interplay of deformation potential, octahedral rotations, improper ferroelectricity and flexoelectric coupling*, Phys. Rev. **B 86**, 085416 (2012).

313. R.K. VASUDEVAN, M.B. OKATAN, C. DUAN, H. FUNAKUBO, A. KUMAR, S. JESSE, L.Q. CHEN, S.V. KALININ, and V. NAGARAJAN, *Nanoscale origins of nonlinear behavior in ferroic thin films*, Adv. Func. Mat. **23**, 81 (2013)

314. A.Y. BORISEVICH, A.N. MOROZOVSKA, Y.M. KIM, D. LEONARD, M.P. OXLEY, M.D. BIEGALSKI, E.A. ELISEEV, and S.V. KALININ, *Exploring mesoscopic physics of vacancy-ordered systems through atomic scale observations of topological defects*, Phys. Rev. Lett. **109**, 065702 (2012).

315. A. KUMAR, T.M. ARRUDA, Y. KIM, I.N. IVANOV, S. JESSE, C.W. BARK, N.C. BRISTOWE, E. ARTACHO, P.B. LITTLEWOOD, C.B. EOM, and S.V. KALININ, *Probing bulk and surface electrochemical processes on the* $LaAlO_3$-$SrTiO_3$ *interface,* ACS Nano 5, 3841 (2012).

316. R. DITTMER, W. JO, J. RÖDEL, S.V. KALININ and N. BALKE, *Nanoscale insight into lead-free* BNT-BT-xKNN, Adv. Func. Mat. **22**, 4208 (2012).

317. V. SHELKE, D. MAZUMDAR, S. JESSE, S.V. KALININ, A. BADDORF, and A. GUPTA, *Ferroelectric domain scaling and switching in ultrathin* $BiFeO_3$ *films deposited on vicinal substrates*, New J. of Physics **14**, 053040 (2012).

318. Y.C. CHEN, Q. HE, F.N. CHU, Y.C. HUANG, J.W. CHEN, W.I. LIANG, R.K. VASUDEVAN, V. NAGARAJAN, E. ARENHOLZ, S.V. KALININ, and Y.H. CHU, *Electrical Control of Multiferroic Orderings in Mixed-Phase* BiFeO3 *Films*, Adv. Mat. **24**, 3070 (2012)

319. A.N. MOROZOVSKA, E.A. ELISEEV, S.V. KALININ, L.Q. CHEN and V. GOPALAN, *Surface polar states and pyroelectricity in ferroelastics induced by roto-flexo field*, Appl. Phys. Lett. **100**, 142902 (2012).

320. P. MAKSYMOVYCH, M. HUIJBEN, M. PAN, S. JESSE, N. BALKE, Y.H. CHU, H.J. CHUNG, A.Y. BORISEVICH, A.P. BADDORF, G. RIJNDERS, D.H.A. BLANK, R. RAMESH, and S.V. KALININ, *Ultrathin Limit and Dead-layer Effects in Local Polarization Switching of* $BiFeO_3$, Phys. Rev. **B 85**, 014119 (2012).

321. A.Y. BORISEVICH, E.A. ELISEEV, A.N. MOROZOVSKA, C.J. CHENG, J.Y. LIN, Y.H. CHU, D. KAN, I. TAKEUCHI, V. NAGARAJAN, and S.V. KALININ, *Atomic-scale evolution of modulated phases at the ferroelectric-antiferroelectric morphotropic phase boundary controlled by flexoelectric interaction*, Nature Communications **3**, 775 (2012)

322. C. W. BARK, P. SHARMA, S.H. BEAK, S. LEE, S. RYU, C. M. FOLKMAN, A. KUMAR, S.V. KALININ, E. Y. TSYMBAL, M. S. RZCHOWSKI, A. GRUVERMAN, and C.B. EOM, *Switchable induced polarization in* $LaAlO_3/SrTiO_3$ *heterostructures*, Nano Lett. **12**, 1765 (2012).

323. F. GRIGGIO, S. JESSE, A. KUMAR, O. OVCHINNIKOV, H. KIM, T.N. JACKSON, D. DAMJANOVIC, S.V. KALININ, and S. TROLIER-MCKINSTRY, *Substrate Clamping Effects on Irreversible Domain Wall Dynamics in Lead Zirconate Titanate Thin Films*, Phys. Rev. Lett. **108**, 157604 (2012).

324. N.A. ROBERTS, J.H. NOH, M.G. LASSITER, S. GUO, S.V. KALININ, and P.D. RACK, *Synthesis and electroplating of high resolution insulated carbon nanotube scanning probes for imaging in liquid solutions*, Nanotechnology 23, 145301 (2012).

325. S. GUO, S.V. KALININ, and S. JESSE, *Open loop band excitation Kelvin Probe Force Microscopy*, Nanotechnology **23**, 125704 (2012).

326. S. GUO, S.V. KALININ, and S. JESSE, *Half-harmonic Kelvin probe force microscopy with transfer function correction*, Appl. Phys. Lett. **100**, 063118 (2012).

327. (invited review) R.K. VASUDEVAN, S. JESSE, Y. KIM, A. KUMAR, and S.V. KALININ, *Spectroscopic imaging in piezoresponse force microscopy: New opportunities for studying polarization dynamics in ferroelectrics and multiferroics*, MRS Comm. **2**, 61 (2012).

328. N. BALKE, E.A. ELISEEV, S. JESSE, S. KALNAUS, C. DANIEL, N.J. DUDNEY, A.N. MOROZOVSKA, and S.V. KALININ, *Three-dimensional vector electrochemical strain microscopy*, J. Appl. Phys. **112**, 052020 (2012).

329. S.V. KALININ, Z.G. YE, and A.L. KHOLKIN, *Preface to Special Topic: Piezoresponse Force Microscopy and Nanoscale Phenomena in Polar Materials*, J. Appl. Phys. **112**, 051901 (2012).

330. A. KUMAR, Y. EHARA, A. WADA, H. FUNAKUBO, F. GRIGGIO, S. TROLIER-MCKINSTRY, S. JESSE, and S.V. KALININ, *Dynamic piezoresponse force microscopy: Spatially resolved probing of polarization dynamics in time and voltage domains*, J. Appl. Phys. 112, 052021 (2012).

331. A. HEREDIA, V. MEUNIER, I.K. BDIKIN, J. GRACIO, N. BALKE, S. JESSE, A. TSELEV, P. AGARWAL, B.G. SUMPTER, and S.V. KALININ, A. L. KHOLKIN, *Nanoscale ferroelectricity in crystalline gamma glycine*, Adv. Func. Mat. **22**, 2996 (2012)

332. P. MAKSYMOVYCH, A.N. MOROZOVSKA, P. YU, E.A. ELISEEV, Y.H. CHU, R. RAMESH, A.P. BADDORF, and S.V. KALININ, *Tunable metallic conductance in ferroelectric nanodomains*, Nano Lett. **12**, 209 (2012).

333. A.N. MOROZOVSKA, E.A. ELISEEV, and S.V. KALININ, *Electrochemical strain microscopy with blocking electrodes: the role of electromigration and diffusion*, J. Appl. Phys. **111**, 014114 (2012).

334. S. GUO, S.D. SOLARES, V. MOCHALIN, I. NEITZEL, Y. GOGOTSI, S.V. KALININ, and S. JESSE, *Multifrequency imaging in the intermittent contact mode of atomic force microscopy: beyond phase imaging*, Small **8**, 1264 (2012).

335. A.N. MOROZOVSKA, E.A. ELISEEV, S.L. BRAVINA, F. CIUCCI, G.S. SVECHNIKOV, L.Q. CHEN, and S.V. KALININ, *Frequency Dependent Dynamical Electromechanical Response of Mixed Ionic-Electronic Conductors*, J. Appl. Phys. **111**, 014107 (2012).

336. E.A. ELISEEV, A.N. MOROZOVSKA, G.S. SVECHNIKOV, P. MAKSYMOVYCH and S.V. KALININ, *Domain wall conduction in multiaxial ferroelectrics*, Phys. Rev. **B 85**, 045312 (2012).

337. Y. KIM, A. KUMAR, O. OVCHINNIKOV, S. JESSE, H. HAN, D. PANTEL, I. VREJOIU, W LEE, D. HESSE, M. ALEXE, and S.V. KALININ, *First-Order Reversal Curve Probing of Spatially Resolved Polarization Dynamics in Ferroelectric Nanocapacitors*, ACS Nano **6**, 491 (2012).

338. S. JESSE, N. BALKE, E. ELISEEV, A. TSELEV, N. DUDNEY, A.N. MOROZOVSKA, and S.V. KALININ, *Direct mapping of ionic transport in* Si*-anode on the nanoscale: time domain electrochemical strain spectroscopy study*, ACS Nano **5**, 9682 (2011).

339. N. BALKE, B. WINCHESTER, W. REN, Y.H. CHU, A.N. MOROZOVSKA, E.A. ELISEEV, M. HUIJBEN, R.K. VASUDEVAN, P. MAKSYMOVYCH, J. BRITSON, S. JESSE, I. KORNEV, R. RAMESH, L.

BELLAICHE, L.Q. CHEN, and S. V. KALININ, *Enhanced electric conductivity at ferroelectric vortex cores in* $BiFeO_3$, Nature Physics **8**, 81 (2012).

340. I. STOLICHNOV, P. MAKSYMOVYCH, E. MIKHEEV, S.V. KALININ, A. TAGANTSEV, and N. SETTER, *Cold-field switching in* PVDF-TrFE *ferroelectric polymer nanomesas*, Phys. Rev. Lett. **108**, 027603 (2012).

341. SERGEI V. KALININ, N. BALKE, S. JESSE, A. TSELEV, A. KUMAR, T.M. ARRUDA, S. GUO, and R. PROKSCH, Li-*ion dynamics and reactivity on the nanoscale*, Materials Today **14**, 548 (2011).

342. Y. KIM, A. KUMAR, A. TSELEV, I. KRAVCHENKO, H. HAN, I. VREJOIU, W. LEE, D. HESSE, M. ALEXE, S. KALININ, and S. JESSE, *Non-Linear Phenomena in Multiferroic Nanocapacitors: Joule Heating and Electromechanical Effects*, ACS Nano **5**, 9104 (2011).

343. T.M. ARRUDA, A. KUMAR, S.V. KALININ, and S. JESSE, *Mapping Irreversible Electrochemical Processes on the Nanoscale: Ionic Phenomena in* Li-*ion Conductive Glass Ceramics*, Nano Lett. **11**, 4161 (2011).

344. F. GRIGGIO, S. JESSE, W. QU, A. KUMAR, O. OVCHINNIKOV, D.S. TINBERG, S.V. KALININ, and S. TROLIER-MCKINSTRY, *Composition dependence of local piezoelectric nonlinearity in* $(0.3)Pb(Ni_{0.33}Nb_{0.67})O_3$-$(0.7)Pb(Zr_xTi_{1-x})O_3$ *films*, J. Appl. Phys. **110**, 044109 (2011).

345. F. GRIGGIO, S. JESSE, A. KUMAR, D. MARINCEL, D. TINBERG, S.V. KALININ, and S. TROLIER-MCKINSTRY, *Mapping piezoelectric nonlinearity in the Rayleigh regime using band excitation piezoresponse force microscopy*, Appl. Phys. Lett. **98**, 212901 (2011).

346. D.W. CHUNG, N. BALKE, S.V. KALININ, and R.E. GARCIA, *Virtual Electrochemical Strain Microscopy of Polycrystalline* $LiCoO_2$ *films*, J. Electrochem. Soc. **158,** A1083 (2011).

347. A. TSELEV, J. BUDAI, E. STRELCOV, J. TISCHLER, A. KOLMAKOV, and SERGEI V. KALININ, *Electromechanical actuation and current-induced metastable states in suspended single-crystalline* VO_2 *nanoplatelets*, Nano Lett. **11**, 3065 (2011).

348. A. KUMAR, F. CIUCCI, A.N. MOROZOVSKA, S.V. KALININ, and S. JESSE, *Measuring oxygen reduction/evolution reactions on the nanoscale*, Nature Chem. **3**, 707 (2011).

349. A. KUMAR, O. OVCHINNIKOV, S. GUO, F. GRIGGIO, S. JESSE, S. TROLIER-MCKINSTRY, and S.V. KALININ, *Spatially Resolved Mapping of Disorder Type and Distribution in Random Systems using Artificial Neural Network Recognition*, Phys. Rev. **B 84**, 024203 (2011).

350. R. VASUDEVAN, Y. LIU, J. LI, W.I. LIANG, A. KUMAR, S. JESSE, Y.C. CHEN, Y.H. CHU, N. VALANOOR, and S.V. KALININ, *Nanoscale-control of phase-variants in strain-engineered* $BiFeO_3$, Nano Lett. **11**, 3346 (2011)

351. S. GUO, S. JESSE, S. KALNAUS, N. BALKE, C. DANIEL, and S.V. KALININ, *Direct mapping of ion diffusion times on* $LiCoO_2$ *surfaces with nanometer resolution*, J. Electrochem. Soc. **158**, A982 (2011).

352. J.Y. JO, P. CHEN, R.J. SICHEL, R.T. SMITH, N. BALKE, S.V. KALININ, M.V. HOLT, J. MASER, K. EVANS-LUTTERODT, C.B. EOM, and P.G. EVANS, *Structural consequences of ferroelectric nanolithography*, Nano Lett. **11**, 3080 (2011).

353. A.N. MOROZOVSKA, E.A. ELISEEV, S.L. BRAVINA, and S.V. KALININ, *Landau-Ginzburg-Devonshire theory for electromechanical hysteresis loop formation in piezoresponse force microscopy of thin films*, J. Appl. Phys. **110**, 052011 (2011).

354. S.V. KALININ and A.L. KHOLKIN, *Preface to special topic: Piezoresponse force microscopy and nanoscale phenomena in polar materials,* J. Appl. Phys. **110**, 052014 (2011).

355. H.J. CHANG, S.V. KALININ, S. YANG, P. YU, S. BHATTACHARYA, P.P. WU, N. BALKE, S. JESSE, L.Q. CHEN, R. RAMESH, S.J. PENNYCOOK, and A.Y. BORISEVICH, *Watching domains grow: In-situ studies of polarization switching by combined scanning probe and scanning transmission electron microscopy*, J. Appl. Phys. **110**, 052014 (2011).

356. E. KARAPETIAN and S.V. KALININ, *Point force and generalized point source on the surface of semi-infinite transversely isotropic material*, J. Appl. Phys. **110**, 052020 (2011).

357. (invited review) S. JESSE and S.V. KALININ, *Band Excitation in Scanning Probe Microscopy: Sines of Change*, J. Phys. **D 44**, 464006 (2011).

358. S.V. KALININ, S. JESSE, A. TSELEV, A.P. BADDORF, and N. BALKE, *The role of electrochemical phenomena in scanning probe microscopy of ferroelectric thin films*, ACS Nano **5**, 5683 (2011).

359. (**editorial**) S.V. KALININ, J. JOSHUA YANG, and A. DEMMING, *Non-volatile memory based on nanostructures*, Nanotechnology **22**, 250201 (2011).

360. A. KUMAR, O. S. OVCHINNIKOV, H. FUNAKUBO, S. JESSE, and S.V. KALININ, *Real-space mapping of dynamic phenomena during hysteresis loop measurements: Dynamic Switching Spectroscopy Piezoresponse Force Microscopy,* Appl. Phys. Lett. **98**, 202903 (2011).

361. P. MAKSYMOVYCH, M. PAN, P. YU, R. RAMESH, A.P. BADDORF, and S.V. KALININ, *Scaling and disorder analysis of local I-V curves from ferroelectric thin films of lead-zirconate titanate*, Nanotechnology **22**, 254031 (2011).

362. A.N. MOROZOVSKA, E.A. ELISEEV, G.S. SVECHNIKOV, and S.V. KALININ, *Nanoscale Electromechanics of Paraelectric Materials with Mobile Charges: Size effects and Nonlinearity of Electromechanical Response of* $SrTiO_3$ *Films*, Phys. Rev. **B 84**, 045402 (2011).

363. S. TROLIER-MCKINSTRY, F. GRIGGIO, C. YAEGER, P. JOUSSE, D. ZHAO, S.S.N. BHARADWAJA, T.N. JACKSON, S. JESSE, S.V. KALININ, and K. WASA, *Designing piezoelectric films for microelectromehcnical systems (MEMS)*, IEEE TUFFC **58**, 1782 (2011).

364. P. MAKSYMOVYCH, J. SEIDEL, Y.H. CHU, P.P. WU, A. BADDORF, L. CHEN, S.V. KALININ, AND R. RAMESH, *Dynamic conductivity of ferroelectric domain walls in* $BiFeO_3$, Nano Lett. **11**, 1906 (2011).

365. A.N. MOROZOVSKA, E.A. ELISEEV, A.K. TAGANTSEV, S. BRAVINA, L.Q. CHEN, and S.V. KALININ, *Thermodynamics of electromechanically coupled mixed ionic-electronic conductors: Deformation potential, Vegard strains, and flexoelectric effect*, Phys. Rev. **B 83**, 195313 (2011).

366. H.J. CHANG, S.V. KALININ, A.N. MOROZOVSKA, M. HUIJBEN, Y.H. CHU, P. YU, R. RAMESH, E.A. ELISEEV, G.S. SVECHNIKOV, S.J. PENNYCOOK and A. BORISEVICH, *Atomically-resolved mapping of polarization and electric fields across ferroelectric-oxide interfaces by Z-contrast imaging*, Adv. Mat. **23**, 2474 (2011).

367. A.A. BOKOV, B.J. RODRIGUEZ, Z. ZHAO, J.H. KO, S. JESSE, X. LONG, W. QU, T.H. KIM, J.D. BUDAI, A.N. MOROZOVSKA, S. KOJIMA, X. TAN, S.V. KALININ, and Z.G. YE, *Compositional disorder, polar nanoregions and dipole dynamics in* $Pb(Mg_{1/3}Nb_{2/3})O_3$*-based relaxor ferroelectrics*, Z. Kristallogr. **226**, 99 (2011).

368. A.L. KHOLKIN A.N. MOROZOVSKA, D. A. KISELEV, I.K. BDIKIN, B.J. RODRIGUEZ, P. WU, A.A. BOKOV, Z.G. YE, B. DKHIL, L.Q. CHEN, M. KOSEC, and S.V. KALININ, *Surface domain structures and mesoscopic phase transition in relaxor ferroelectrics*, Adv. Func. Mat. **21**, 1977 (2011).

369. R. VASUDEVAN, Y.C. CHEN, H.H. TAI, N. BALKE, P.P. WU, S. BHATTACHARYA, L.Q. CHEN, Y.H. CHU, I.N. LIN, S.V. KALININ, and N. VALANOOR, *Exploring topological defects in epitaxial* $BiFeO_3$ *thin films*, ACS Nano **5**, 879 (2011).

370. M.A. MCLACHLAN, D.W. MCCOMB, M.P. RYAN, A.N MOROZOVSKA, E. ELISEEV, A. PAYZANT, S. JESSE, K. SEAL, and S.V KALININ, *Probing local and global ferroelectric phase stability and polarization switching in ordered PZT nanosponges*, Adv. Func. Mat. **21**, 941 (2011).

371. V. SHELKE, D. MAZUMDAR, G. SRINIVASAN, S. JESSE, S. KALININ, A. BADDORF, and A. GUPTA, *Reduced Coercive Field in* $BiFeO_3$ *Thin Films through Domain Engineering*, Adv. Mat., in print

372. N. BALKE, S. JESSE, Y. KIM, L. ADAMCZYK, I.N. IVANOV, N.J. DUDNEY, and S.V. KALININ, *Decoupling electrochemical reaction and diffusion processes in ionically-conductive solids on the nanometer scale*, ACS Nano **4**, 7349 (2010).

373. M.P. NIKIFOROV, S. HOHLBAUCH, W.P. KING, K. VOITCHOVSKY, S.A. CONTERA, S. JESSE, S.V. KALININ, and R. PROKSCH, *Temperature-dependent phase transitions in zeptoliter volumes of a complex biological membrane*, Nanotechnology **22**, 055709 (2011).

374. A.L. KHOLKIN, D.A. KISELEV, I.K BDIKIN, A. STERNBERG, B. DKHIL, S. JESSE, O. OVCHINNIKOV AND S.V, KALININ, *Mapping Disorder in Polycrystalline Relaxors: A Piezoresponse Force Microscopy Approach*, Materials **3**, 4860 (2010).

375. N. BALKE, M. GAJEK, A.K. TAGANTSEV, L.W. MARTIN, Y.H. CHU, R. RAMESH, and S.V. KALININ, *Direct observations of capacitor switching using planar electrodes*, Adv. Func. Mat. **20**, 3466 (2010).

376. A. TSELEV, I.A. LUK'YANCHUK, I.N. IVANOV, J.D. BUDAI, J.Z. TISCHLER, E. STRELCOV, A. KOLMAKOV, and S.V. KALININ, *Symmetry Relationship and Strain-Induced Transitions between Insulating* M1 *and* M2 *and Metallic* R *Phases of Vanadium Dioxide*, Nano Lett. **10**, 4409 (2010).

377. J. HE, A. BORISEVICH, S.V. KALININ, S.J. PENNYCOOK, and S.T. PANTELIDES, *Control of octahedral tilts and magnetic properties of perovskites oxide heterostructures by substrate symmetry*, Phys. Rev. Lett. **105**, 227203 (2010).

378. J. SEIDEL, P. MAKSYMOVYCH, Y. BATRA, A. KATAN, S.Y. YANG, Q. HE, A.P. BADDORF, S.V. KALININ, C.H. YANG, J.C. YANG, Y.H. CHU, E.K.H. SALJE, H. WORMEESTER, M. SALMERON, and R. RAMESH, *Domain Wall Conductivity in* La-*doped* $BiFeO_3$, Phys. Rev. Lett. **105**, 197603 (2010).

379. R. PROKSCH and S.V. KALININ, *Energy dissipation measurements in frequency modulated scanning probe microscopy*, Nanotechnology **21**, 455705 (2010).

380. S. GUO, O. OVCHINNIKOV, M.E. CURTIS, M.B. JOHNSON, S. JESSE, and S.V. KALININ, *Spatially resolved probing of Preisach density in polycrystalline ferroelectric thin films*, J. Appl. Phys. **108**, 084103 (2010).

381. A. BORISEVICH, O. OVCHINNIKOV, H.J. CHANG, M. OXLEY, P. YU, J. SEIDEL, E. ELISEEV, A. MOROZOVSKA, R. RAMESH, S. PENNYCOOK, and S.V. KALININ, *Mapping octahedral tilts and polarization across a domain wall in* $BiFeO_3$ *from Z-contrast STEM image atomic column shape analysis*, ACS Nano **4**, 6071 (2010).

382. S.V. KALININ, N. SETTER, and A.L. KHOLKIN, *Invited Papers from the International Symposium on Piezoresponse Force Microscopy and Nanoscale Phenomena in Polar Materials, Aveiro, Portugal*, 2009, J. Appl. Phys. **108**, 041901 (2010).

383. B.J. RODRIGUEZ, S. JESSE, A.N. MOROZOVSKA, S.V. SVECHNIKOV, D.A. KISELEV, A.L. KHOLKIN, A.A. BOKOV, Z.G. YE, and S.V. KALININ, *Real space mapping of polarization dynamics and hysteresis loop formation in relaxor-ferroelectric* $PbMg_{1/3}Nb_{2/3}O_3$–$PbTiO_3$ *solid solutions*, J. Appl. Phys. **108**, 042006 (2010).

384. A.N. MOROZOVSKA, E.A. ELISEEV, G.S. SVECHNIKOV, and S.V. KALININ, *Pyroelectric response of ferroelectric nanowires: size effect and electric energy harvesting*, J. Appl. Phys. **108**, 042009 (2010).

385. (**invited review**) R.H. FRENCH, V.A. PARSEGIAN, R. PODGORNIK, R.F. RAJTER, A. JAGOTA, J. LUO, D. ASTHAGIRI, M.K. CHAUDHURY, Y.M. CHIANG, S. GRANICK, SERGEI V. KALININ, M. KARDAR, R. KJELLANDER, D.C. LANGRETH, J. LEWIS, S. LUSTIG, D. WESOLOWSKI, J. WETTLAUFER, W.Y. CHING, M. FINNIS, F. HOULIHAN, O.A. VON LILIENFELD, C.J. VAN OSS, T. ZEMB, *Long Range Interactions In Nanoscale Science*, Rev. Mod. Phys. **82**, 1887 (2010).

386. S. JESSE, S. GUO, A. KUMAR, B.J. RODRIGUEZ, R. PROKSCH and S.V. KALININ, *Resolution theory and static- and frequency dependent cross-talk in piezoresponse force microscopy*, Nanotechnology **21**, 405703 (2010).

387. N. BALKE, S. JESSE, Y. KIM, L. ADAMCZYK, A. TSELEV, I.N. IVANOV, N. J. DUDNEY, and S.V. KALININ, *Real Space Mapping of Li-Ion Transport in Amorphous Si Anodes with Nanometer Resolution*, Nano Lett. **10**, 3420 (2010).

388. J.H NOH, M. NIKIFOROV, S.V. KALININ, A.A. VERTEGEL, and P.D. RACK, *Nanofabrication of insulated scanning probes for electromechanical imaging in liquid solutions*, Nanotechnology **21**, 365302 (2010).

389. A.Y. BORISEVICH, H.J. CHANG, M. HUIJBEN, M.P. OXLEY, S. OKAMOTO, M.K. NIRANJAN, J.D. BURTON, E.Y. TSYMBAL, Y.H. CHU, P. YU, R. RAMESH, S.V. KALININ, and S.J. PENNYCOOK, *Suppression of Octahedral Tilts and Associated Changes in Electronic Properties at Epitaxial Oxide Heterostructure Interfaces*, Phys. Rev. Lett. **105**, 087204 (2010).

390. M. NIKIFOROV, S. GAM, S. JESSE, R. COMPOSTO, and S.V. KALININ, *Morphology Mapping of Phase Separated Polymer Films using Nano-Thermal analysis*, Macromolecules **43**, 6724 (2010).

391. A. TSELEV, V. MEUNIER, E. STRELKOV, W. SHELTON, I. LUKYANCHUK, K. JONES, R. PROKSCH, A. KOLMAKOV, AND S.V. KALININ, *Mesoscopic Metal-Insulator Transition at Ferroelastic Domain Walls in* VO_2, ACS Nano **4**, 4412 (2010).

392. SERGEI V. KALININ and N. BALKE, *Local electrochemical functionality in energy storage materials and devices by scanning probe microscopies: status and perspectives*, Adv. Mat. **22**, E193 (2010).

393. D. MAZUMDAR, V. SHELKE, M. ILIEV, S. JESSE, A. KUMAR, S.V. KALININ, A.P. BADDORF, and A. GUPTA, *Nanoscale switching characteristics of nearly tetragonal* $BiFeO_3$ *thin films*, Nano Lett. **10**, 2555 (2010).

394. J. SHIN, A.Y. BORISEVICH, J. ZHOU, V. MEUNIER, E.W. PLUMMER, S.V. KALININ, and A.P. BADDORF, *An oxygen-induced surface reconstruction of* $SrRuO_3$ *and its effect on the* $BaTiO_3$ *interface*, ACS Nano **4**, 4190 (2010).

395. A. VASUDEVARAO, A.N. MOROZOVSKA, Y. LI, S. JESSE, S. CHOUDHURY, K. SEAL, E.A. ELISEEV, S.V. SVECHNIKOV, D. LEE, S. R. PHILLPOT, L.Q. CHEN, V. GOPALAN, and S.V. KALININ *Correlated polarization switching in the proximity of a* 180° *domain wall*, Phys. Rev. **B 82**, 024111 (2010).

396. A. MOROZOVSKA, E. ELISEEV, N. BALKE, and S.V. KALININ, *Local probing of ionic diffusion by electrochemical strain microscopy: spatial resolution and signal formation mechanisms*, J. Appl. Phys. **108**, 053712 (2010).

397. V. ANBUSATHAIAH, S. JESSE, M.A. ARREDONDO, F.C. KARTAWIDJAJA, O.S. OVCHINNIKOV, J. WANG, V. NAGARAJAN and SERGEI V. KALININ, *Ferroelastic domain wall dynamics in ferroelectric bilayers*, Acta Mat. **58**, 5316 (2010).

398. A. MOROZOVSKA, E. ELISEEV, AND S.V. KALININ, *Electromechanical Probing of Ionic Currents in Energy Storage Materials*, Appl. Phys. Lett. **96**, 222906 (2010).

399. N. BALKE, S. JESSE, A.N. MOROZOVSKA, E. ELISEEV, D.W. CHUNG, Y. KIM, L. ADAMCZYK, R.E. GARCIA, N. DUDNEY, and S.V. KALININ, *Nanometer-scale electrochemical intercalation and diffusion mapping of Li-ion battery materials*, Nature Nanotechnology **5**, 749 (2010).

400. H.W. JANG, A. KUMAR, S. DENEV, M.D. BIEGALSKI, P. MAKSYMOVYCH, C.W. BARK, C.T. NELSON, C.M. FOLKMAN, S.H. BAEK, N. BALKE, C.M. BROOKS, D.A. TENNE, D.G. SCHLOM, L.Q. CHEN, X.Q. PAN, S.V. KALININ, V. GOPALAN, and C.B. EOM, *Ferroelectricity in strain-free* $SrTiO_3$ *films*, Phys. Rev. Lett. **104**, 197601 (2010).

401. A. TSELEV, E. STRELCOV, I.A. LUKYANCHUK, J.D. BUDAI, J.Z. TISCHLER, I.N. IVANOV, K. JONES, R. PROKSCH, S.V. KALININ, and A. KOLMAKOV, *Interplay between Ferroelastic and Metal-Insulator Phase Transitions in Strained quasi-2D VO2 Nanoplatelets*, Nano Lett. **10**, 2003 (2010).

402. A.N. MOROZOVSKA, E.A. ELISEEV, S.V. SVECHNIKOV, V.Y. SHUR, A.Y. BORISEVICH, P. MAKSYMOVYCH, and S.V. KALININ, *Finite size and intrinsic field effect on the polar-active properties of the ferroelectric-semiconductor heterostructures*, Phys. Rev. **B 81**, 205308 (2010).

403. (**review**) S.V. KALININ, A.N. MOROZOVSKA, L.Q. CHEN, and B.J. RODRIGUEZ, *Local Polarization Dynamics in Ferroelectric Materials*, Rev. Prog. Phys. **73**, 056502 (2010).

404. O. OVCHINNIKOV, S. JESSE, S. GUO, K. SEAL, P. BINTACHITT, I. FUJII, S. TROLIER-MCKINSTRY, and S.V. KALININ, *Local measurements of Preisach density in polycrystalline ferroelectric capacitors using piezoresponse force microscopy*, Appl. Phys. Lett. **96**, 112906 (2010).

405. P. BINTACHITT, S. JESSE, D. DAMJANOVICH, S. TROLIER-MCKINSTRY, and S.V. KALININ, *Collective dynamics underpins Rayleigh behavior in disordered polycrystalline ferroelectrics*, PNAS **107**, 7219 (2010).

406. M.P. NIKIFOROV, G.L. THOMPSON, V.V. REUKOV, S. JESSE, S. GUO, B.J. RODRIGUEZ, K. SEAL, A.A. VERTEGEL, and S.V. KALININ, *Double-layer Mediated Electromechanical Response of Amyloid Fibrils in Liquid Environmen*t, ACS Nano **4**, 689 (2010).

407. S.V. KALININ, B.J. RODRIGUEZ, J.D. BUDAI, S. JESSE, A.N. MOROZOVSKA A.A. BOKOV and Z.-G. YE, *Direct Evidence of Mesoscopic Dynamic Heterogeneities at the Surfaces of Ergodic Ferroelectric Relaxor*, Phys. Rev. **B 81**, 064107 (2010).

408. A.N. MOROZOVSKA, E.A. ELISEEV, Y. LI, S.V. SVECHNIKOV, P. MAKSYMOVYCH, V. GOPALAN, L.Q. CHEN, and S.V. KALININ, *Thermodynamics of nanodomain formation and breakdown in Scanning Probe Microscopy: Landau-Ginzburg-Devonshire approach*, Phys. Rev. **B 80**, 214110 (2009).

409. J. WADDELL, R. OU, C.J. CAPOZZI, S. GUPTA, C.A. PARKER, R.A. GERHARDT, K. SEAL, S.V. KALININ, and A.P. BADDORF, *Detection of percolating paths in polyhedral segregated network composites using electrostatic force microscopy and conductive atomic force microscopy*, Appl. Phys. Lett. **95**, 233122 (2009).

410. S.V. KALININ, B.J. RODRIGUEZ, S. JESSE, A.N. MOROZOVSKA, A.A. BOKOV and Z.-G. YE, *Spatial distribution of relaxation behavior on the surface of a ferroelectric relaxor in the ergodic phase*, Appl. Phys. Lett. **95**, 142902 (2009).

411. J. SHIN, V.B. NASCIMENTO, G. GENESTE, J. RUNDGREN, E.W. PLUMMER, B. DKHIL, S.V. KALININ, and A.P. BADDORF, *Atomistic screening mechanism of ferroelectric surfaces: An in situ study of the polar phase in ultra-thin* $BaTiO_3$ *films exposed to* H_2O, Nano Lett. **9**, 3720 (2009).

412. O.S. OVCHINNIKOV, S. JESSE, P. BINTACCHIT, S. TROLIERMCKINSTRY, and S.V. KALININ, *Disorder identification in hysteresis data: recognition analysis of random-bond random-field Ising model*, Phys. Rev. Lett. **103**, 157203 (2009).

413. N. BALKE, S. CHOUDHURY, S. JESSE, M. HUIJBEN, Y.H. CHU, A.P. BADDORF, L.Q. CHEN, R. RAMESH, and S.V. KALININ, *Deterministic control of ferroelastic switching in multiferroic materials*, Nature Nanotechnology **4**, 868 (2009).

414. E.A. ELISEEV, A.N. MOROZOVSKA, S.V. KALININ, Y.L. LI, J. SHEN, M.D. GLINCHUK, L.Q. CHEN, and V. GOPALAN, *Surface Effect on Domain Wall Width in Ferroelectrics*, J. Appl. Phys. **106**, 084102 (2009).

415. S.V. KALININ, B.J. RODRIGUEZ, S. JESSE, A.N. MOROZOVSKA, A.A. BOKOV and Z.-G. YE, *Mapping of Local Polarization Bias-Induced Phase Stability and Random Fields in Relaxor Ferroelectrics Using Piezoresponse Force Microscopy*, Appl. Phys. Lett. **95**, 092904 (2009).

416. S. WICKS, K. SEAL, S. JESSE, V. ANBUSATHAIAH, S. LEACH, R. EDWIN GARCIA, S.V. KALININ and V. NAGARAJAN, *Collective dynamics in nanostructured polycrystalline ferroelectric thin films using local time resolved measurements and switching spectroscopy*, Acta Mat. **58**, 67 (2010).

417. M.P. NIKIFOROV, A.A. VERTEGEL, V.V. REUKOV, G.L. THOMPSON, S.V. KALININ, and S. JESSE, *Functional recognition imaging using artificial neural networks: Applications to rapid cellular identification by broadband electromechanical response*, Nanotechnology **20**, 405708 (2009).

418. M. NIKIFOROV, S. JESSE, A.N. MOROZOVSKA, E.A. ELISEEV, L.T. GERMINARIO, and S.V. KALININ, *Probing the temperature dependence of the mechanical properties of the polymers at the nanoscale with band excitation thermal scanning probe microscopy*, Nanotechnology **20**, 395709 (2009).

419. N. BALKE, I. BDIKIN, S.V. KALININ, and A.L. KHOLKIN, *Electromechanical imaging and spectroscopy of ferroelectric and piezoelectric materials: state of the art and prospects for the future*, J. Am. Ceram. Soc. **92** 1629 (2009).

420. J. SHIN, S.V. KALININ, E.W. PLUMMER, and A.P. BADDORF, *Electronic transport through in situ grown ultra-thin* $BaTiO_3$ *films*, Appl. Phys. Lett. **95**, 032903 (2009).

421. K. SEAL, S. JESSE AND S.V. KALININ, I. FUJII, P. BINTACHITT, and S. TROLIER-MCKINSTRY, *Spatially Resolved Spectroscopic Mapping of Polarization Reversal in Polycrystalline Ferroelectric Films: Crossing the Resolution Barrier*, Phys. Rev. Lett. **103**, 057601 (2009).

422. P. MAKSYMOVYCH, N. BALKE, S. JESSE, A.P. BADDORF, and S.V. KALININ, *Defect-induced asymmetry of local hysteresis loops on* $BiFeO_3$ *Surfaces*, J. Mat. Sci. **44**, 5095 (2009).

423. (**invited review**) S.V. KALININ, B.J. RODRIGUEZ, A.P. BADDORF, N. BALKE, A.Y. BORISEVICH, H.J. CHANG, L.Q. CHEN, S. CHOUDHURY, S. JESSE, P. MAKSYMOVYCH, M.P. NIKIFOROV, and S.J. PENNYCOOK, *Defect-mediated polarization switching in ferroelectrics and related materials: from mesoscopic mechanisms to atomistic control*, Adv. Mat. **22**, 314 (2010).

424. P. MAKSYMOVYCH, S. JESSE, P. YU, R. RAMESH, A.P. BADDORF, and S.V. KALININ, *Polarization Control of Electron Tunneling into Ferroelectric Surfaces*, Science **324**, 1421 (2009).

425. O.S. OVCHINNIKOV, S. JESSE, and S.V. KALININ, *Adaptive probe trajectory scanning probe microscopy for multiresolution measurements of interface geometry*, Nanotechnology **20**, 255701 (2009).

426. B.J. RODRIGUEZ, S. JESSE, K. SEAL, A.P. BADDORF, S. HABELITZ, and S.V. KALININ, *Intermittent-contact mode piezoresponse force microscopy in liquid environment*, Nanotechnology **20**, 195701 (2009).

427. C.H. YANG, J. SEIDEL, S.Y. KIM, P. ROSSEN, P. YU, M. GAJEK, Y.H. CHU, L.W. MARTIN, M.B. HOLCOMB, Q. HE, P. MAKSYMOVYCH, N. BALKE, S.V. KALININ, A. P. BADDORF, S.R. BASU, M.L. SCULLIN, AND R. RAMESH, *Electric modulation of conduction in multiferroic* Ca-*doped* BiFeO3 *films*, Nature Materials **8**, 485 (2009).

428. BRIAN J. RODRIGUEZ, SAMRAT CHOUDHURY, Y.H. CHU, ABHISHEK BHATTACHARYYA, STEPHEN JESSE, KATYAYANI SEAL, ARTHUR P. BADDORF, R. RAMESH, LONG-QINQ CHEN, and SERGEI V. KALININ, *Spatially Resolved Polarization Switching at an Engineered Defect: Bicrystal Grain Boundary in Bismuth Ferrite*, Adv. Func. Mat. **19**, 1 (2009)

429. S. JESSE and S.V. KALININ, *Principal component and spatial correlation analysis of spectroscopic imaging data in scanning probe microscopy*, Nanotechnology **20**, 085714 (2009).

430. J. SEIDEL, L. W. MARTIN, Q. HE, Q. ZHAN, Y.-H. CHU, A. ROTHER, M. HAWKRIDGE, P. MAKSYMOVYCH, S. KALININ, S. GEMMING, H. LICHTE, P. YU, F. WANG, G. CATALAN, J. F. SCOTT, N. A. SPALDIN, J. ORENSTEIN, and R. RAMESH, *Conduction at domain walls in oxide multiferroics*, Nature Materials **8**, 229 (2009).

431. A. MAKAGON, M. KACHANOV, E. KARAPETIAN, and SERGEI V. KALININ, *Piezoelectric indentation of a flat circular punch accompanied by frictional sliding and applications to scanning probe microscopy*, Int. J. Eng. Sci. **47**, 221 (2009).

432. P. BINTACHITT, S. TROLIER-MCKINSTRY, K. SEAL, S. JESSE, and S.V. KALININ, *Switching Spectroscopy Piezoresponse Force Microscopy of Polycrystalline Capacitor Structures*, Applied. Phys. Lett. **94**, 042906 (2009).

433. E. KARAPETIAN, M. KACHANOV, and S.V. KALININ, *Stiffness relations for piezoelectric indentation of flat and non-flat punches of arbitrary planform: Applications to probing nanoelectromechanical properties of materials*, J. Mechanics and Physics of Solids 57, 673 (2009).

434. (**invited review**) S.V. KALININ, B.J. RODRIGUEZ, S. JESSE, P. MAKSYMOVYCH, K. SEAL, M. NIKIFOROV, A.P. BADDORF, A.L. KHOLKIN, and R. PROKSCH, *Local Bias-Induced Phase Transitions*, Materials Today **11**, 16 (2008).

435. S. CHOUDHURY, Y. LI, N. ODAGAWA, A. VASUDEVARAO, L. TIAN, P. CAPEK, V. DIEROLF, A.N. MOROZOVSKA, E.A. ELISEEV, S. KALININ, Y. CHO, L.QI. CHEN, and VENKATRAMAN GOPALAN, *The influence of 180° ferroelectric domain wall width on the threshold field for wall motion*, J. Appl. Phys. **104**, 084107 (2008).

436. E.A. ELISEEV, A.N. MOROZOVSKA, G.S. SVECHNIKOV, E.I. SHISKIN, V.Y. SHUR, and S.V. KALININ, *Screening and retardation effect on* 180° *domain wall motion in ferroelectric: Wall velocity and nonlinear dynamics due to polarization-screening charge interactions*, Phys. Rev. **B 78**, 245409 (2008).

437. P. MAKSYMOVYCH, S. JESSE, M. HUIJBEN, R. RAMESH, A. MOROZOVSKA, S. CHOUDHURY, L.Q. CHEN, A.P. BADDORF and SERGEI V. KALININ, *Intrinsic Nucleation Mechanism and Disorder in Polarization Switching on Ferroelectric Surfaces*, Phys. Rev. Lett. **102**, 017601 (2009).

438. BRIAN J. RODRIGUEZ, Y.H. CHU R. RAMESH, and SERGEI V. KALININ, *Ferroelectric domain wall pinning at a bicrystal grain boundary in bismuth ferrite*, Appl. Phys. Lett. **93**, 142901 (2008).

439. SERGEI V. KALININ, S. JESSE, and R. PROKSCH, *Information Acquisition & Processing in Scanning Probe Microscopy*, R&D Mag. **50**, 20 (2008).

440. Z. TAN, A.L. ROYTBURD, I. LEVIN, K. SEAL, B.J. RODRIGUEZ, S. JESSE, S.V. KALININ, and A. BADDORF, *Piezoelectric response of nanoscale* $PbTiO_3$ *in composite* $PbTiO_3$–$CoFe_2O_4$ *epitaxial films*, Appl. Phys. Lett. **93**, 074101 (2008).

441. S. JESSE, M. NIKIFOROV, L. GERMINARIO, and SERGEI V. KALININ, *Local Thermomechanical Characterization of Phase Transitions in Polymers using Band Excitation Atomic Force Acoustic Microscopy with Heated Probe*, Appl. Phys. Lett. **93**, 073104 (2008).

442. S. JESSE, P. MAKSYMOVYCH, and SERGEI V. KALININ, *Rapid Multidimensional Data Acquisition in Scanning Probe Microscopy Applied to Local Polarization Dynamics and Voltage Dependent Contact Mechanics*, Appl. Phys. Lett. **93**, 112903 (2008).

443. A.N. MOROZOVSKA, SERGEI V. KALININ, E.A. ELISEEV, V. GOPALAN, S.V. SVECHNIKOV, *Interaction of a* 180° *ferroelectric domain wall with a biased scanning probe microscopy tip:*

Effective wall geometry and thermodynamics in Ginzburg-Landau-Devonshire theory, Phys. Rev. **B 78**, 125407 (2008).

444. S. CHOUDHURY, J.X. ZHANG, L.Q. CHEN, and S.V. KALININ, *Effect of ferroelastic twin walls on local polarization switching: Phase-field modeling*, Appl. Phys. Lett. **93**, 162901 (2008).

445. JUNSOO SHIN, V. B. NASCIMENTO, A.Y. BORISEVICH, E.W. PLUMMER, SERGEI V. KALININ, and A.P. BADDORF, *Polar distortion in ultra-thin* $BaTiO_3$ *films by in situ LEED-IV*, Phys. Rev. **B 77**, 245437 (2008).

446. A.N. MOROZOVSKA, S.V. SVECHNIKOV, E.A. ELISEEV, B.J. RODRIGUEZ, S. JESSE, and SERGEI V. KALININ, *Local polarization switching in the presence of surface-charged defects: Microscopic mechanisms and piezoresponse-force-spectroscopy observations*, Phys. Rev. **B 78**, 054101 (2008).

447. A.N. MOROZOVSKA, E.A. ELISEEV, S.V. SVECHNIKOV, V. GOPALAN, and SERGEI V. KALININ, *Effect of the intrinsic width on the piezoelectric force microscopy of a single ferroelectric domain wall*, J. Appl. Phys. **103**, 124110 (2008)

448. BRIAN J. RODRIGUEZ, STEPHEN JESSE, JIHEE KIM, STEPHEN DUCHARME, and SERGEI V. KALININ, *Local probing of relaxation time distributions in ferroelectric polymer nanomesas: Time-resolved piezoresponse force spectroscopy and spectroscopic imaging*, Appl. Phys. Lett. **92**, 232903 (2008).

449. L. TIAN, A. VASUDEVARAO, A.N. MOROZOVSKA, E.A. ELISEEV, S.V. KALININ, and V. GOPALAN, *Nanoscale Polarization Profile across a* 180° *Ferroelectric Domain Wall Extracted by Quantitative Piezoelectric Force Microscopy*, J. Appl. Phys. **104**, 074110 (2008).

450. I. BDIKIN, A. KHOLKIN, A.N. MOROZOVSKA, S.V. SVECHNIKOV, S.H. KIM, and SERGEI V. KALININ, *Domain Dynamics in Piezoresponse Force Microscopy: Quantitative Deconvolution and Hysteresis Loop Fine Structure*, Appl. Phys. Lett. **92**, 182909 (2008).

451. (**invited**) S.R. COHEN, N. APTER, S. JESSE, S.V. KALININ, D. BARLAM, A.I. PERETZ, D. ZISKIND, and H.D. WAGNER, *AFM Investigation of mechanical properties of dentin*, Israel Journal of Chemistry **48**, 65 (2008).

452. SERGEI V. KALININ, B.J. RODRIGUEZ, S.H. KIM, S.K. HONG, A. GRUVERMAN, and E.A. ELISEEV *Imaging Mechanism of Piezoresponse Force Microscopy in Capacitor Structures*, Appl. Phys. Lett. **92**, 152906 (2008).

453. SERGEI V. KALININ, S. JESSE, B.J. RODRIGUEZ, Y.H. CHU, R. RAMESH, E.A. ELISEEV and A.N. MOROZOVSKA, *Probing the role of single defects on the thermodynamics of electric-field induced phase transitions*, Phys. Rev. Lett. **100**, 155703 (2008).

454. STEPHEN JESSE, B.J. RODRIGUEZ, A.P. BADDORF, I. VREJOIU, D. HESSE, M. ALEXE, E.A. ELISEEV, A.N. MOROZOVSKA, and SERGEI V. KALININ, *Direct imaging of Spatial and Energy distribution of Nucleation Centers in Ferroelectric Materials*, Nature Materials **7**, 209 (2008).

455. B.J. RODRIGUEZ, S. JESSE, M. ALEXE, and SERGEI V. KALININ, *Spatially Resolved Mapping of Polarization Switching Behavior in Nanoscale Ferroelectrics*, Adv. Mat. **20**, 109 (2008).

456. B.J. RODRIGUEZ, S. JESSE, K. SEAL, A.P. BADDORF, and S.V. KALININ, *Direct Measurement of Periodic Electric Forces in Liquids*, J. Appl. Phys. **103**, 014306 (2008).

457. SERGEI V. KALININ and V. MEUNIER, *Electronic Flexoelectricity in Low Dimensional Structures*, Phys. Rev. **B 77**, 033403 (2008).

458. B. MIRMAN and S.V. KALININ, *Resonance Frequency Analysis for Surface-Coupled AFM Cantilever in Ambient and Liquid Environments*, Appl. Phys. Lett. **92**, 083102 (2008)

459. B.J. RODRIGUEZ, R. PROKSCH, S. JESSE, and S.V. KALININ, *Nanoelectromechanics of Inorganic and Biological Systems: From Structural Imaging to Local Functionalities*, Microscopy Today, in print

460. SERGEI V. KALININ, E. KARAPETIAN, and B. MIRMAN, *Reciprocity between Direct and Converse Piezoelectric Effect in a Nanoscale Electromechanical Contact*, Phys. Rev. **B 76**, 212102 (2007).

461. K. SEAL, B. J. RODRIGUEZ, S. JESSE, A. P. BADDORF, and S.V. KALININ, *High Frequency Piezoresponse Force Microscopy in the 1-10 MHz Regime*, Appl. Phys. Lett. **91**, 232904 (2007).

462. SERGEI V. KALININ, B.J. RODRIGUEZ, S. JESSE, and R. PROKSCH, *A Biased View on the Nanoworld: Electromechanical Imaging By Scanning Probe Microscopy*, R&D Magazine **49**, 34 (2007).

463. A.N. MOROZOVSKA, S. SVECHNIKOV, E.A. ELISEEV, B.J. Rodriguez, S. JESSE, and SERGEI V. KALININ, *Piezoresponse Force Spectroscopy of Ferroelectric-Semiconductor Materials*, J. Appl. Phys. **102**, 114108 (2007).

464. SERGEI V. KALININ, B.J. RODRIGUEZ, S. JESSE, Y.H. CHU, T. ZHAO, R. RAMESH, E.A. ELISEEV, and A.N. MOROZOVSKA, *Intrinsic Single Domain Switching in Ferroelectric Materials on a Nearly-Ideal Surface*, PNAS **104**, 20204 (2007).

465. B.J. RODRIGUEZ, C. CALLAHAN, S.V. KALININ, and R. PROKSCH, *Dual-Frequency Resonance-Tracking Atomic Force Microscopy*, Nanotechnology **18**, 475504 (2007).

466. JUNSOO SHIN, SERGEI V. KALININ, A.Y. BORISEVICH, E.W. PLUMMER, and A.P. BADDORF, *Layer-by-layer and Pseudo-2D growth modes for heteroepitaxial $BaTiO_3$ films: exploiting kinetic limitations and dislocation networks*, Appl. Phys. Lett. **91**, 202901 (2007).

467. A.N. MOROZOVSKA, E.A. ELISEEV, and SERGEI V. KALININ, *The Piezoresponse Force Microscopy of surface layers and thin films: effective response and resolution function*, J. Appl. Phys. **102**, 074105 (2007).

468. B.J. RODRIGUEZ, S. JESSE, K. SEAL, A.P. BADDORF, S.V. KALININ, and P.D. RACK, *Fabrication, Dynamics, and Electrical Properties of Insulated SPM Probes for Electrical and Electromechanical Imaging in Liquids*, Appl. Phys. Lett. **91**, 093130 (2007).

469. STEPHEN JESSE, SERGEI V. KALININ, R. PROKSCH, A.P. BADDORF, and B.J. RODRIGUEZ, *The band excitation method in scanning probe microscopy for rapid mapping of energy dissipation on the nanoscale*, Nanotechnology **18**, 435503 (2007).

470. B.J. RODRIGUEZ, S. JESSE, A.P. BADDORF, T. ZHAO, Y.H. CHU, R. RAMESH, and SERGEI V. KALININ, *Spatially resolved mapping of ferroelectric switching behavior in self-assembled multiferroic nanostructures: strain, size, and interface effects*, Nanotechnology **18**, 405701 (2007).

471. A.N. MOROZOVSKA, S.V. SVECHNIKOV, E.A. ELISEEV, and SERGEI V. KALININ, *Extrinsic Size Effect in Piezoresponse Force Microscopy of Thin Films*, Phys. Rev. **B 76**, 054123 (2007).

472. A. MAKAGON, M. KACHANOV, SERGEI V. KALININ, and E. KARAPETIAN, *Indentation of Spherical and Conical Punches into Piezoelectric Half-Space with Frictional Sliding: Applications to Scanning Probe Microscopy*, Phys. Rev. **B 76**, 064115 (2007).

473. S. HABELITZ, B.J. RODRIGUEZ, S.J. MARSHALL, G.W. MARSHALL, S.V. KALININ, and A. GRUVERMAN, *Peritubular Dentin Lacks Piezoelectricity*, J. Dent. Res. **86**, 908 (2007).

474. B.J. RODRIGUEZ, S.JESSE, A.P. BADDORF, S.H. KIM, and SERGEI V. KALININ, *Controlling Polarization Dynamics in a Liquid Environment: from Localized to Macroscopic Switching*, Phys. Rev. Lett. **98**, 247603 (2007).

475. (**invited**) SERGEI V. KALININ, B.J. RODRIGUEZ, S. JESSE, K. SEAL, ROGER PROKSCH, SOPHIA HOHLBAUCH, IRENE REVENKO, G.L. THOMPSON, and A.A. VERTEGEL, *Towards local electromechanical probing of cellular and biomolecular systems in a liquid environment*, Nanotechnology **18**, 424020 (2007).

476. E.A. ELISEEV, SERGEI V. KALININ, S. JESSE, S.L. BRAVINA, and A.N. MOROZOVSKA, *Electromechanical Detection in Scanning Probe Microscopy: Tip Models and Materials Contrast*, J. Appl. Phys. **102**, 014109 (2007).

477. A.N. MOROZOVSKA, S.L. BRAVINA, E.A. ELISEEV, and SERGEI V. KALININ, *Resolution-function theory in piezoresponse force microscopy: Wall imaging, spectroscopy, and lateral resolution*, Phys. Rev. **B 75**, 174109 (2007)

478. SERGEI V. KALININ, S. JESSE, B.J. RODRIGUEZ, E.A. ELISEEV and A.N. MOROZOVSKA, *Quantitative Determination of Tip Parameters in Piezoresponse Force Microscopy*, Appl. Phys. Lett. **90**, 212905 (2007)

479. (**invited**) A.N. MOROZOVSKA, S.V. KALININ, E.A. ELISEEV, and S.V. SVECHNIKOV, *Local Polarization Switching in Piezoresponse Force Microscopy*, Ferroelectrics **354**, 198 (2007)

480. (**invited review**) SERGEI V. KALININ, S. JESSE, B.J. RODRIGUEZ, K. SEAL, A.P. BADDORF, T. ZHAO, Y.H. CHU, R. RAMESH, E.A. ELISEEV, A.N. MOROZOVSKA, B. MIRMAN, and E. KARAPETIAN, *Recent Advances in Electromechanical Imaging on the Nanometer Scale: Polarization Dynamics in Ferroelectrics, Biopolymers, and Liquid Imaging*, Jap. J. Appl. Phys. **46**, 5674 (2007).

481. B.J. RODRIGUEZ, S. JESSE, S.V. KALININ, J. KIM, S. DUCHARME, and V.M. FRIDKIN, *Nanoscale polarization manipulation and imaging in ferroelectric Langmuir-Blodgett polymer films*, Appl. Phys. Lett. **90**, 122904 (2007).

482. V. MEUNIER, SERGEI V. KALININ, and B.G. SUMPTER, *Nonvolatile memory elements based on the intercalation of organic molecules inside carbon nanotubes,* Phys. Rev. Lett. **98**, 056401 (2007).

483. (**Invited Review**) SERGEI V. KALININ, B.J. RODRIGUEZ, S. JESSE, B. MIRMAN, E. KARAPETIAN, E.A. ELISEEV, and A.N. MOROZOVSKA, *Nanoscale Electromechanics of Ferroelectric and biological Systems,* Annu. Rev. Mat. Sci. **37**, 189 (2007).

484. A. GRUVERMAN, B.J. RODRIGUEZ, and SERGEI V. KALININ, *Nanoscale Electromechanical and Mechanical Imaging of Butterfly Wings by Scanning Probe Microscopy*, Journal of Scanning Probe Microscopy **1**, 1 (2006).

485. A. GRUVERMAN, D. WU, B.J. RODRIGUEZ, SERGEI V. KALININ, and S. HABELITZ, *High-Resolution Imaging of Proteins in Human Teeth by Scanning Probe Microscopy,* Biochemical and Biophysical Research Communications **352**, 142 (2007).

486. A.N. MOROZOVSKA, E.A. ELISEEV, and SERGEI V. KALININ, *Domain Nucleation and Hysteresis Loop Shape in Piezoresponse Force Spectroscopy,* Appl. Phys. Lett. **89**, 192901 (2006).

487. J. ZHOU, S. DAG, S. D. SENANAYAKE, B. C. HATHORN, S. V. KALININ, V. MEUNIER, D. R. MULLINS, S. H. OVERBURY and A. P. BADDORF, "*Adsorption, Desorption and Dissociation of Benzene on* TiO_2(110) *and* Pd/TiO_2(110): Experimental Characterization and First-Principles Calculations", Phys. Rev. **B 74**, 125318 (2006).

488. R.C. TIRUVALAM, A. KUNDU, A. SOUKHOZHAK, S. JESSE, and SERGEI V. KALININ, *Observing the Superparaelectric Limit of Relaxor* $(Na_{1/2}Bi_{1/2})_{1-x}Ba_xTiO_3$ *Nanocrystals,* Appl. Phys. Lett. **89**, 112901 (2006).

489. T.F. JULIANO, Y.G. GOGOTSI, T.E. BUCHHEIT, C.S. WATSON, S.V. KALININ, J. SHIN, and A.P. BADDORF, 95/5 *Lead Zirconate Titanate Microscale Behavior Using Depth-Sensing Indentation, Raman Spectroscopy, and Piezoresponse Force Microscopy*, J. Am. Ceram. Soc. **89**, 3557 (2006).

490. A. KOLMAKOV, U. LANKE, R. KARAM, J. SHIN, S. JESSE and S.V. KALININ, *Application of spectromicroscopy tools to explore local origins of sensor activity in quasi-1D oxide nanostructures,* Nanotechnology **17**, 4014 (2006).

491. S. JESSE, B. MIRMAN, and SERGEI V. KALININ, *Resonance Enhancement in Piezoresponse Force Microscopy: Mapping Electromechanical Activity, Contact Stiffness, and Q-factor*, Appl. Phys. Lett. **89**, 022906 (2006).

492. (**invited review**) SERGEI V. KALININ, A. RAR, and S. JESSE, *A Decade of Piezoresponse Force Microscopy: Progress, Challenges, and Opportunities*, IEEE Transactions on Ultrasonics and Ferroelectric Materials **53**, 2226 (2006).

493. B.J. RODRIGUEZ, S. JESSE, and SERGEI V. KALININ, *Electromechanical Imaging in Liquid Environment*, Phys. Rev. Lett. **96**, 237602 (2006).

494. S. JESSE, H.N. LEE, and SERGEI V. KALININ, *Quantitative Mapping of Switching Behavior in Piezoresponse Force Microscopy,* Rev. Sci. Instr. **77**, 073702 (2006).

495. SERGEI V. KALININ, E.A. ELISEEV, and A.N. MOROZOVSKA, *Materials Contrast in Piezoresponse Force Microscopy*, Appl. Phys. Lett. **88**, 232904 (2006).

496. S. V. KALININ, S. JESSE, J. SHIN, A.P. BADDORF, H.N. LEE, A. BORISEVICH, and S.J. PENNYCOOK, *Resolution, Information Limit, and Contrast Transfer in Piezoresponse Force Microscopy*, Nanotechnology, **17**, 3400 (2006).

497. B.J. RODRIGUEZ, S. JESSE, V. MEUNIER, and SERGEI V. KALININ, *Scanning Frequency Mixing Microscopy*, Appl. Phys. Lett. **88**, 143128 (2006).

498. S. JESSE, A.P. BADDORF, and SERGEI V. KALININ, *Switching Spectroscopy Mapping in Piezoresponse Force Microscopy*, Appl. Phys. Lett. **88**, 062908 (2006).

499. SERGEI V. KALININ, S. JESSE, W. LIU, and A. BALANDIN, *Possible Flexoelectricity in Tobacco Mosaic Virus*, Appl. Phys. Lett. **88**, 153902 (2006).

500. S. JESSE, A.P. BADDORF, and SERGEI V. KALININ, *Dynamic Effects in Electromechanical Scanning Probe Microscopies,* Nanotechnology **17**, 1615 (2006).

501. B.J. RODRIGUEZ, SERGEI V. KALININ, J. SHIN, S. JESSE, V. GRICHKO, T. THUNDAT, A.P. BADDORF, and A. GRUVERMAN, *Electromechanical Imaging of Biomaterials by Scanning Probe Microscopy,* J. Struct. Biol. **153**, 151 (2006).

502. A. RAR, G.M. PHARR, W.C. OLIVER, E. KARAPETIAN, and SERGEI V. KALININ, *Piezoelectric Nanoindentation,* J. Mat. Res. **21**, 552 (2006).

503. SERGEI V. KALININ, B.J. RODRIGUEZ, J. SHIN, S. JESSE, V. GRICHKO, T. THUNDAT, A.P. BADDORF, and A. GRUVERMAN, *Bioelectromechanical Imaging by Scanning Probe Microscopy: Galvani's Experiment at the Nanoscale,* Ultramicroscopy **106**, 334 (2006).

504. SERGEI V. KALININ, B.J. RODRIGUEZ, S. JESSE, J. SHIN, A.P. BADDORF, P. GUPTA, H. JAIN, D.B. WILLIAMS, and A. GRUVERMAN, *Vector Piezoresponse Force Microscopy,* Microscopy and Microanalysis **12**, 206 (2006).

505. P. GUPTA, H. JAIN, D.B. WILLIAMS, J. SHIN, A.P. BADDORF, and S.V. KALININ, *Observation of ferroelectricity in a confined crystallite using electron-backscattered diffraction and piezoresponse force microscopy,* Appl. Phys. Lett. **87**, 172903 (2005).

506. SERGEI V. KALININ, J. SHIN, S. JESSE, D. GEOHEGAN, A.P. BADDORF, Y. LILACH, M. MOSKOVITS, and A. KOLMAKOV, *Electronic Transport Imaging in* SnO_2 *Nanobelt Sensor in the Presence of Local Electroactive Elements*, J. Appl. Phys. **98**, 044503 (2005).

507. J. SHIN, B.J. RODRIGUEZ, A.P. BADDORF, T. THUNDAT, E. KARAPETIAN, M. KACHANOV, A. GRUVERMAN, and S.V. KALININ, *Simultaneous Elastic and Electromechanical Imaging by Scanning Probe Microscopy: Theory and Applications to Ferroelectric and Biological Materials*, J. Vac. Sci. Technol. **B 23**, 2102 (2005).

508. SERGEI V. KALININ, B.J. RODRIGUEZ, S. JESSE, T. THUNDAT, and A. GRUVERMAN, *Electromechanical Imaging of Biological Systems with sub-10 nm Resolution,* Appl. Phys. Lett. **87**, 053901 (2005), also cond-mat/0504232

509. **(invited review)** A. GRUVERMAN and SERGEI V. KALININ, *Piezoresponse Force Microscopy and Recent Advances in Nanoscale Studies of Ferroelectrics*, J. Mat. Sci. **41**, 107 (2006).

510. **(feature article)** SERGEI V. KALININ, RUI SHAO, and DAWN A. BONNELL, *Local Phenomena in Oxides by Advanced Scanning Probe Microscopy,* J. Am. Ceram. Soc. **88**, 1077 (2005).

511. S.V. KALININ, J. SHIN, G.M. VEITH, A.P. BADDORF, M.V. LOBANOV, H. RUNGE, and M. GREENBLATT, *Real Space Imaging of the Microscopic Origins of the Ultrahigh Dielectric Constant in Polycrystalline* $CaCu_3Ti_4O_{12}$, Appl. Phys. Lett. **86**, 102902 (2005), also cond-mat/0407608

512. J. SHIN, S.V. KALININ, H.N. LEE, H.M. CHRISTEN, R.G. MOORE, E.W. PLUMMER, and A.P. BADDORF, *Surface Stability of Epitaxial* $SrRuO_3$ *Thin Films,* Surf. Sci. **581**, 118 (2005).

513. SERGEI V. KALININ, A.L. GRUVERMAN, J. SHIN, A.P. BADDORF, E. KARAPETIAN, and M. KACHANOV, *Nanoelectromechanics of Polarization Switching by Piezoresponse Force Microscopy,* J. Appl. Phys. **97**, 074305 (2005), also cond-mat/0406383

514. E. KARAPETIAN, M. KACHANOV, and S.V. KALININ, *Nanoelectromechanics of Piezoelectric Indentation and Applications to Scanning Probe Microscopies of Ferroelectric Materials*, Phil. Mag. **85**, 1017 (2005).

515. B.J. RODRIGUEZ, R.J. NEMANICH, A. KINGON, A. GRUVERMAN, S.V. KALININ, K. TERABE, X.Y. LIU and K. KITAMURA, *Domain growth kinetics in lithium niobate single crystals studied by piezoresponse force microscopy*, Appl. Phys. Lett. **86**, 012906 (2005).

516. V. MEUNIER, S.V. KALININ, J. SHIN, A.P. BADDORF, and R.J. HARRISON, *Quantitative Analysis of Electronic Properties of Carbon Nanotubes by Scanning Probe Microscopy: from Atomic to Mesoscopic Length Scales*, Phys. Rev. Lett. **93**, 246801 (2004).

517. H. CUI, S.V. KALININ, X. YANG, and D.H. LOWNDES, *Growth of vertically aligned carbon nanofibers on cantilevers for scanning probe microscopy*, Nano Lett. **4**, 2157 (2004).

518. J. SHIN, S.V. KALININ, H.N. LEE, H.M. CHRISTEN, R.G. MOORE, E.W. PLUMMER, and A.P. BADDORF, *Surface Properties and Thermal Behavior of Epitaxial* $SrRuO_3$ *Thin Films*, J. Mat. Res. **19**, 3447 (2004).

519. SERGEI V. KALININ and DAWN A. BONNELL, *Local Electronic Transport at Grain Boundaries in* Nb-*doped* $SrTiO_3$, Phys. Rev. **B 70**, 235304 (2004).

520. J. SHIN, V. MEUNIER, A.P. BADDORF, and S.V. KALININ, *Non-linear Transport Imaging by Scanning Impedance Microscopy,* Appl. Phys. Lett. **85**, 4240 (2004).

521. S.V. KALININ, A.L. GRUVERMAN, and D.A. BONNELL, *Quantitative Analysis of Nanoscale Switching in* $SrBi_2Ta_2O_9$ *Thin Films by Piezoresponse Force Microscopy*, Appl. Phys. Lett. **85**, 795 (2004).

522. R.G. MOORE, J. ZHANG, S.V. KALININ, ISMAIL, A.P. BADDORF, R. JIN, D.G. MANDRUS, and E.W. PLUMMER, *Surface Mott Transition in the Layered Ruthenate* $Ca_{1.9}Sr_{0.1}RuO_4$, Phys. Stat. Sol. **241**, 2363 (2004).

523. SERGEI V. KALININ, E. KARAPETIAN, and M. KACHANOV, *Nanoelectromechanics of Piezoresponse Force Microscopy*, Phys. Rev. **B 70**, 184101 (2004), also cond-mat/0408223

524. I. OKUBO, H.M. CHRISTEN, S.V. KALININ, G.E. JELLISON, Jr., C.M. ROULEAU and D.H. LOWNDES, *High throughput growth temperature optimization of ferroelectric* $Sr_xBa_{1-x}Nb_2O_6$ *epitaxial thin films using a temperature gradient method*, Appl. Phys. Lett. **84**, 1350 (2004).

525. SERGEI V. KALININ, S. JESSE, J. SHIN, A.P. BADDORF, M. GUILLORN, and D.B. GEOHEGAN, *Frequency Dependent Transport Imaging in Nanotube Networks*, Nanotechnology **15**, 907 (2004).

526. F. FELTEN, G.A. SCHNEIDER, J. MUNOZ SALDANA, and S.V. KALININ, *Modeling and Measurement of Surface Displacements in* $BaTiO_3$ *Bulk Material in Piezoresponse Force Microscopy* (*PFM*), J. Appl. Phys. **96**, 563 (2004).

527. S.V. KALININ, D.A. BONNELL, T. ALVAREZ, X. LEI, Z. HU, R. SHAO, and J.H. FERRIS, *Ferroelectric Lithography of Multi Component Nanostructures*, Adv. Mat. **16**, 795 (2004), featured in **Science 304**, 415 (2004).

528. SERGEI V. KALININ and DAWN A. BONNELL, Potential Screening on Oxide Surfaces and Implications for Local Electrostatic and Transport Measurements, Nano Letters **4**, 555 (2004).

529. J. H. FERRIS, D. LI, S.V. KALININ, and D.A. BONNELL, Nanoscale Domain Patterning of Ferroelectric Materials Using Electron Beams, Appl. Phys. Lett. **84**, 774 (2004).

530. DAWN A. BONNELL and SERGEI V. KALININ, *Non-linear Dielectric Properties at Oxide Grain Boundaries*, Z. Metallkd. **94**, 188 (2003).

531. R. SHAO, S.V. KALININ, and D.A. BONNELL, *Nanoimpedance Microscopy and Spectroscopy of Local Transport Properties in Polycrystalline* ZnO, Appl. Phys. Lett. **82**, 1869 (2003).

532. A.T. JOHNSON, M. FREITAG, M. RADOSAVLJEVIC, S.V. KALININ, and D.A. BONNELL, *Role of defects in carbon nanotube circuits*, International Journal of Nanoscience **1**, 247 - 254 (2002).

533. SERGEI V. KALININ, *Nanoscale Electric Phenomena at Oxide Surfaces and Interfaces by Scanning Probe Microscopy*, Ph.D. Thesis, University of Pennsylvania (2002), cond-mat/0209599

534. S.V. KALININ, M.R. SUCHOMEL, P.K. DAVIES, and D.A. BONNELL, *Potential and impedance imaging of polycrystalline $BiFeO_3$ ceramics*, J. Am. Ceram. Soc. **85,** 3011 (2002).

535. SERGEI V. KALININ, DAWN A. BONNELL, M. FREITAG, and A.T. JOHNSON, *Tip-Gating Effect in Scanning Impedance Imaging of Nanoelectronic Devices*, Appl. Phys. Lett. **81**, 5219-5221 (2002), cond-mat/0210474

536. M. FREITAG, SERGEI V. KALININ, DAWN A. BONNELL, and A.T. JOHNSON, *Role of defects in electronic transport through semiconducting single-wall carbon nanotubes*, Phys Rev. Lett. **89**, 216801 (2002), cond-mat/0209105

537. SERGEI V. KALININ, M. FREITAG, A.T. JOHNSON, and DAWN A. BONNELL, *Carbon nanotubes as a tip calibration standard in electrostatic scanning probe microscopies*, Appl. Phys. Lett. **81**(4), 754-756 (2002), cond-mat/0206454

538. SERGEI V. KALININ and DAWN A. BONNELL, *Contrast mechanism maps for piezoresponse force microscopy*, J. Mat. Res. **17**(5), 936-939 (2002).

539. SERGEI V. KALININ, DAWN A. BONNELL, T. ALVAREZ, X. LEI, Z. HU, J.H. FERRIS, Q. ZHANG, and S. DUNN, *Atomic Polarization, Charge Compensation and Local Reactivity on Ferroelectric Surfaces: a new route toward complex nanostructures*, Nano Letters **2**(6), 589-593 (2002).

540. SERGEI V. KALININ and DAWN A. BONNELL, *Imaging mechanism of piezoresponse force microscopy of ferroelectric surfaces*, Phys. Rev. **B 65**(12), 125408 (2002).

541. SERGEI V. KALININ, C.Y. JOHNSON, and DAWN A. BONNELL, *Domain polarity and temperature induced potential inversion on $BaTiO_3$ (100) surface*, J. Appl. Phys. **91**(6), 3816 (2002).

542. G. POPOV, S.V. KALININ, T. ALVAREZ, T.J. EMGE, M. GREENBLATT, and D.A. BONNELL, *Micromagnetic and magnetoresistance studies of ferromagnetic* $La_{0.83}Sr_{0.13}MnO_{2.98}$ *crystals*, Phys. Rev. **B 65**(6), 064426 (2002).

543. SERGEI V. KALININ and DAWN A. BONNELL, *Scanning impedance microscopy: from impedance spectra to impedance images*, Microscopy Today **2**(1), 22 (2002).

544. SERGEI V. KALININ and DAWN A. BONNELL, *Scanning Impedance Microscopy of an active Schottky barrier diode*, J. Appl. Phys. **91**(2), 832-839 (2002).

545. SERGEI V. KALININ and DAWN A. BONNELL, *Local potential and polarization screening on ferroelectric surfaces*, Phys. Rev. B **63**(12), 125411/1-125411/13, (2001).

546. SERGEI V. KALININ and DAWN A. BONNELL, *Scanning impedance microscopy of electroactive interfaces*, Appl. Phys. Lett. **78**(9), 1306-1308 (2001).

547. SERGEI V. KALININ and DAWN A. BONNELL, *Temperature dependence of polarization and charge dynamics on the* $BaTiO_3$ (100) *surface by scanning probe microscopy*, Appl. Phys. Lett. **78**(8), 1116-1118 (2001).

548. TONY ALVAREZ, SERGEI V. KALININ, and DAWN A. BONNELL, *Magnetic-field measurements of current-carrying devices by force-sensitive magnetic-force microscopy with potential correction*, Appl. Phys. Lett. **78**(7), 1005-1007 (2001).

549. ALBINA Y. BORISEVICH, SERGEI V. KALININ, DAWN A. BONNELL, and PETER K. DAVIES, *Analysis of phase distributions in the* Li_2O-Nb_2O_5-TiO_2 *system by piezoresponse imaging*, J. Mater. Res. **16**(2), 329-332 (2001).

550. A.V. LUKASHIN, A.A. ELISEEV, N.G. ZHURAVLEVA, S.V. KALININ, A.A. VERTEGEL, YU.D. TRET'YAKOV, *Synthesis of PbS/S Nanostructures through Chemical Modification of Layered Double Hydroxides*, Doklady Chemistry (Translation of the chemistry section of Doklady Akademii Nauk) **383**(4-6), 93-96 (2002).

551. SERGEI V. KALININ and DAWN A. BONNELL, *Surface potential above grain boundary-surface junctions in* $SrTiO_3$ *bicrystals*, Phys. Rev. B **62**(15), 10419-10430 (2000).

552. SERGEI V. KALININ and DAWN A. BONNELL, *Effect of phase transition on the surface potential of the* $BaTiO_3$ (100) *surface by variable temperature scanning surface potential microscopy*, J. Appl. Phys. **87**(8), 3950-3957 (2000).

553. SERGEI V. KALININ and DAWN A. BONNELL, *Dynamic behavior of domain-related topography and surface potential on the* $BaTiO_3$ (100) *surface by variable temperature scanning surface potential microscopy*, Z. Metallkd. **90**(12), 983-989 (1999).

554. A.V. LUKASHIN, S.V. KALININ, A.A. VERTEGEL, and YU.D. TRETYAKOV, *Chemical modification of layered double hydroxides as a new route to prepare functional nanocomposite materials*, Dokl. Akad. Nauk **369**(6), 781-783 (1999).

555. S.V. KALININ, D.L. GORBACHEV, A. YU. BORISEVICH, K.V. TOMASHEVICH, A.A. VERTEGEL, A.J. MARKWORTH, and YU. D. TRETYAKOV, *Evolution of fractal particles in systems with conserved order parameter*, Phys. Rev. **E 61**(2), 1189-1194 (2000).

556. A. ELISEEV, S.V. KALININ, V.I. PRIVALOV, A.A. VERTEGEL, and YU.D. TRETYAKOV, *The Effect of Copolymerization of tetraethylorthosilicate and aluminum hydroxonitrates*, J. Solid State Chem. **147**(1), 304-308 (1999).

557. S.V. KALININ, L.I. KHEIFETS, A.I. MAMCHIK, A.G. KNOT'KO, and A.A. VERTEGEL, *Influence of the drying technique on the structure of silica gels*, J. Sol-Gel Sci. Technol. **15**(1), 31-35 (1999).

558. S.V. KALININ, A.V. LUKASHIN, M.P. NIKIFOROV, A.A. ELISEEV, A.A. VERTEGEL, and YU.D. TRETYAKOV, *Use of hydrolytic polycondensation processes for the preparation of superparamagnetic nanocomposites***.** Dokl. Akad. Nauk **363**(6), 777-779 (1998).

559. S.V. KALININ, A.V. LUKASHIN, K.V. TOMASHEVICH, A.V. KNOT'KO, M.P. NIKIFOROV, S.YU. STEFANOVICH, A.A. VERTEGEL, and YU.D. TRETYAKOV, *Preparation of* MS/SiO_2 (M = Pb, Cd, Zn) *nanocomposites using cryo-chemical immobilization*, Dokl. Akad. Nauk **364**(2), 207-209 (1999).

560. A.V. LUKASHIN, S.V. KALININ, M.P. NIKIFOROV, V.I. PRIVALOV, A.A. ELISEEV, A.A. VERTEGEL, and YU.D. TRETYAKOV, *Effect of preparation conditions on the structure of layered double hydroxides*, Dokl. Akad. Nauk **364**(1), 77-79 (1999).

561. S.V. KALININ, D.L. GORBACHEV, K.V. TOMASHEVICH, A.YU. BORISEVICH, A.A. VERTEGEL, and YU.D. TRETYAKOV, *Modeling of evolution processes of fractal particles in systems with conserved order parameter*, Russian Materials Science Transactions **12**, 2-12 (1998)

562. S.V. KALININ, A.A. VERTEGEL, N.N. OLEYNIKOV, and YU.D. TRETYAKOV, *Kinetics of solid state reactions with fractal reagent*, J. Mater. Synth. Process **6**(5), 305-309 (1998).

563. K.V. TOMASHEVITCH, S.V. KALININ, A.A. VERTEGEL, N.N. OLEINIKOV, V.A. KETSKO, and YU.D. TRETYAKOV, *Application of non-linear heating regime for the determination of activation energy and kinetic parameters of solid-state reactions*, Thermochim. Acta **323**(1-2), 101-107 (1998).

564. A.I. MAMCHIK, S.V. KALININ, and A.A. VERTEGEL, *Cryosol synthesis of nanocrystalline alumina*, Chem. Mater. **10**(11), 3548-3554 (1998).

565. A.A. VERTEGEL, S.V. KALININ, N.N. OLEYNIKOV, YU.G. METLIN, and YU.D. TRETYAKOV, *Cryosol method: a novel powder processing technique based on ion-exchange phenomena*, J. Mater. Res. **13**(4), 901-904 (1998)

566. S.M. KUDRYAVTSEVA, A.A. VERTEGEL, S.V. KALININ, N.N. OLEYNIKOV, L.I. RYABOVA, L.L. MESHKOV, S.N. NESTERENKO, M.N. RUMYANTSEVA, and A.M. GASKOV, *Effect of microstructure on the stability of nanocrystalline tin dioxide ceramics*, J. Mater. Chem. **7**(11), 2269-2272 (1997).

567. S.V. KALININ, A.A. VERTEGEL, N.N. OLEYNIKOV, and YU.D. TRETYAKOV, *The influence of fractal dimension of iron (III) hydroxonitrate particle on the kinetics of solid state reactions with its participation*, Russian Materials Science Transactions **6-7**, 59 (1997).

568. A.A. VERTEGEL, S.V. KALININ, N.N. OLEYNIKOV, and YU.D. TRETYAKOV, *Visible spectra of fractal particles in colloidal solutions*, Chem. Phys. Lett. **262**(3,4), 455-459 (1996).

569. A.A. VERTEGEL, S.V. KALININ, N.N. OLEYNIKOV, and YU.D. TRETYAKOV, *The fractal particles of iron (III) hydroxonitrate: from solution to solid state*, J. Non-Cryst. Solids **181**(1,2), 146-50 (1995).

570. YU.I. ALEKSEEVA, T.S. SOLOV'EVA, I.A. TUTORSKII, S.V. KALININ, and A.V. CHEL'TSOV, *Characteristics of binary aqueous solutions of the type polysaccharide-surfactant*, Kolloidn. Zh. **54**(2), 9-13 (1992).

Patents

1. RUI SHAO, SERGEI V. KALININ and DAWN A. BONNELL, *Scanning probe microscopy apparatus and techniques,* Patent Application **20050262930**

2. D.A. BONNELL, A.T. JOHNSON S.V. KALININ, M. FREITAG, and, *Carbon Nanotube Calibration Standard for Electrostatic Scanning Probe Microscopies*, US Patent **6,720,553**

3. D.A. BONNELL, R.A. ALVAREZ, and S.V. KALININ, *Directed Assembly of Nanometer Scale Molecular Devices*, US Patent **6,982,174**

4. D.A. BONNELL, S.V. KALININ, and R.A. ALVAREZ, *Spatially resolved electromagnetic property measurement,* US Patent **6,873,163**,
5. D.A. BONNELL, S.V. KALININ, and R.A. ALVAREZ, *Spatially resolved electromagnetic property measurement,* US Patent **7,078,896**.
6. S.V. KALININ, A. GRUVERMAN, J. SHIN, H.N. LEE, H.M. CHRISTEN, A.P. BADDORF, E. KARAPETIAN, and M. KACHANOV, *Ultra High Density Ferroelectric Storage and Lithography by Second Order Ferroelectroelastic Switching*, U.S. Patent No. **7,292,768**
7. S.V. KALININ, H.M. CHRISTEN, A.P. BADDORF, and V. MEUNIER, *Asymmetric Ferroelectric Tunneling Element* (AFTE) *and Applications for Non-volatile Random Access Memory*, U.S> Patent 7,759,713 B2, filed March 6, 2006, issued Jul. 20, 2010
8. **(R&D100 Award, three patents)** S. JESSE and S.V. KALININ, *Adaptive Band Excitation Method in Scanning Probe Microscopy*, **licensed by Asylum Research Corporation,** US9097738 B2 (Aug 4, 2015), US7775086 (Aug 17, 2010), US8448502 (Jun 2, 2010)
9. S. JESSE, S.V. KALININ, A.P. BADDORF, K. SEAL, B.J. RODRIGUEZ, A. GANNEPALLI and R. PROKSCH, *Harmonic Balance Method in Scanning Probe Microscopy*, patent disclosure submitted
10. S.V. KALININ, S. JESSE, P. MAKSYMOVYCH, M. NIKIFOROV, and A.P. BADDORF, *Rapid Functional Recognition in Scanning Probe Microscopy*, patent disclosure submitted
11. M. NIKIFOROV, S.V. KALININ, S. JESSE, *Spatially Resolved Quantitative Mapping of Thermomechanical Properties and Phase Transition Temperatures Using Scanning Probe Microscopy*, patent disclosure submitted
12. S.V. KALININ, N. BALKE, A. KUMA, N.J. DUDNEY, and S. JESSE, *Real Space Mapping of Ionic Diffusion and Electrochemical Activity in Energy Storage and Conversion Materials*, US Patent 8,719,961 B2, granted May 6, 2014
13. SERGEI V. KALININ, N. BALKE, A. BORISEVICH S. JESSE, P. MAKSYMOVYCH, Y. KIM, and E. STRELCOV, *Real space mapping of oxygen vacancy diffusion and electrochemical transformations by hysteretic current reversal curve measurements*, US Patent, 8,752,211
14. H.N. LEE, S.V. KALININ, H.J. JEEN, W.S. CHOI, L. JIANG, S. DONG, Y. KIM, M.G. HAN, Y. ZHU, E. DAGOTTO, and T. EGAMI, *Colossal Tunneling Electroresistance Induced by Interfacial Phase Transitions in Ultrathin Oxide Heterostructures*, patent disclosure submitted
15. S.V. KALININ, S. JESSE, L. COLLINS, and B. RODRIGUEZ, *Electrochemical Force Microscopy*, US Patent 20,160,025,773
16. S. JESSE, A. BELIANINOV, S.V. KALININ, and S. SOMNATH, *Full Information Acquisition in Scanning Probe Microscopy*, US Patent 9,612,257,2017
17. S.V. KALININ, P. MAKSYMOVYCH, and A. TSELEV, *Methods for Detection and Quantification of Conductance and Dielectric Permittivity*, 201503548, DOE 138,181
18. P. MAKSYMOVYCH, A. TSELEV, and S.V. KALININ, *Microwave AC conductivity of domain walls*, US Patent 20,170,099,055, 2017
19. S. JESSE, A.Y. BORISEVICH, Q. HE, S.V. KALININ, A.R. LUPINI, and R.R. UNOCIC, *Bulk Nanofabrication with Single Atomic Plane Precision via Atomic-Level Sculpting of Crystalline Oxides*, 201503502, DOE S-138,134

20. S. JESSE, O. DYCK, B. Sumpter, and S.V. KALININ, *Atom Assembly Device*, IDSA submitted S-138,604

21. O. DYCK, S. JESSE, S.V. KALININ, A.Y. BORISEVICH, and R. UNOCIC, *Atomic-Scale E-Beam Sculpter*, IDSA S-138,605

22. L. COLLINS, S. JESSE, S.V. KALININ, *Fast free force recovery (F3R) for ultrafast force reconstruction in SPM*, ID 3971,

Invited talks - conferences

1. (**invited**) S.V. KALININ, *Imaging in information dimension: from materials design to atomic fabrication*, US-Cz conference on chemistry and nanoscience

2. (**invited**) S.V. KALININ, *Electrochemistry on Nano- and Aotmic scale: challenges and opportunities*, MIT Conference 2017

3. (**invited**) S.V. KALININ, *Atomic fabrication by electron beams*, MRS Fall 2017

4. (**invited**) S.V. KALININ, *Atomic fabrication by electron beams*, Singapore Nano, 2017

5. (**invited**) S.V. KALININ, *Imaging in information dimension: from materials design to atomic fabrication*, Kanazawa AFM, 2017

6. (**keynote**) S.V. KALININ, *Ferroionic states in ferroelectric films*, International Meeting on Ferroelectricity, San Antonio, September 2017

7. (**plenary**) S.V. KALININ, *Big, deep, and smart data in atomically resolved imaging: From better materials towards Atom by Atom fabrication*, Electron Microscopy Society of India, July 2017

8. (**plenary**) S.V. KALININ, *Big, Deep, and Smart Data in Imaging: from Full Information Capture to Atomic Manipulation*, FRIMACHAT, Limerick, Ireland, July 2017

9. S.V. KALININ, *Ferroionic states: coupling between surface electrochemical and bulk ferroelectric functionalities on the nanoscale*, APS March meeting, New Orleans 2017

10. (**Keynote**) S.V. KALININ, *Full information acquisition and chemical imaging in scanning probe microscopy: what happens on the tip surface junction*?, STLE, Atlanta, May 2017

11. S.V. KALININ, *Big, Deep, and Smart Data in Imaging: Atomic View and Control of Materials Structure and Functionalities*, Materials Research Society Fall Meeting, Boston MA, USA, November 28 - December 2, 2016,

12. S.V. KALININ, *Direct mining of structure-property relationships from atomic and mesoscopic imaging data*, Materials Research Society Fall Meeting, Boston MA, USA, November 28 - December 2, 2016

13. S.V. KALININ, *Coupled ferroelectric and metal-insulator transitions in Oxides*, DOE Contractor meeting, Gatesburg, October 2016

14. (**plenary**) S.V. KALININ, *Chemical boundary conditions and emergence of coupled electrochemical-ferroelectric states on the nanoscale*, 13th International Symposium on Ferroic Domains & Micro- to Nano-scopic Structures (ISFD-13), Vancouver, Canada, October 2-6, 2016

15. S.V. KALININ, *Atomic Forge: Building Matter atom by Atom in 3D*, Foresight institute meeting October 1, 2016.
16. S.V. KALININ, *Big, Deep, and Smart Data in Imaging: Accelerating Materials by Design*, Quantum Materials Synthesis, New York, September 1, 2016
17. S.V. KALININ, *Big, Deep, and Smart Data in Imaging: Accelerating Materials by Design*, Blavatnik symposium, July 2016
18. S.V. KALININ, *Big, Deep, and Smart Data in Imaging: Atomic View on Chemical Bonding*, International Conference on Chemical Bonding, Lihue, Hawaii, July 2016
19. S.V. KALININ, *Big, Deep, and Smart Data in Imaging: Towards Nanoscience 2.0*, OLCF User meeting, ORNL 2016
20. S.V. KALININ, *Big, Deep, and Smart Data in Atomic Imaging: Mining Local Structure-Property Relationships*, Data Science and Optimal Learning for Materials Discovery and Design, Santa Fe, May 2016
21. S.V. KALININ, *Big Data for materials*, ORAU meeting, March 2016
22. S.V. KALININ, *Scanning Probe Microscopy: The Information Dimension*, MultiFrequency conference, Madrid, April 2016
23. S.V. KALININ, *Electrochemistry on Nano- and Atomic Levels: Scanning Probe Microscopy Meets Deep Data*, SKKU Oxide Conference, February 2016 2016
24. S.V. KALININ, *Big, Deep, and Smart Data in Energy Materials Research: Atomic View on Materials Functionalities*, Materials Research Meeting, Boston, December 2015
25. S.V. KALININ *Electrochemistry on Nano- and Atomic Levels: Scanning Probe Microscopy Meets Deep Data*, Materials Research Meeting, Boston, December 2015
26. S.V. KALININ, *Big, Deep, and Smart Data in Energy Materials Research: Atomic View on Materials Functionalities*, Microscopy and Microanalysis Conference, Manchester, UK
27. S.V. KALININ, *Big, Deep, and Smart Data in Energy Materials Research: Atomic View on Materials Functionalities*, MRS Spring meeting, San Francisco, CA
28. S.V. KALININ *Deep Data in Nanoscience: Exploring Local Structure-Property Relationships by Scanning Probe Microscopy*, MRS Fall meeting, Boston, MA
29. S.V. KALININ *Electrochemistry on Nano- and Atomic Levels: Scanning Probe Microscopy Meets Deep Data*, International Materials Research Council Meeting, Cancun, Mexico, August 2014
30. S.V. KALININ *Atomic View at Oxide Surfaces: Physics and Electrochemistry*, International Conference on Physics of Semiconductors, Austin, TX, August 2014
31. S.V. KALININ *Mapping Oxygen Vacancy Dynamics and Reactivity in Solids at the Nanometer and Atomic Scales*, Gordon's Research Conference on Solid State Studies in Ceramics, South Hadley, MA, July 2014
32. S.V. KALININ *Physical and Electrochemical Phenomena on Oxides Surfaces with Atomic Resolution: Merging In-Situ PLD-STM Studies with Deep Data*, Spring MRS Meeting, San Francisco, 2014

33. S.V. KALININ *Probing Local Ionic Dynamics in Functional Oxides: From Nanometer to Atomic Scale,* American Physical Society, Denver, March 2014

34. A.V. IEVLEV, E. STRELCOV, S. JESSE, A.N. MOROZOVSKA, E.A. ELISEEV, Y.V. PERSHIN, A. KUMAR, I.I. KRAVCHENKO, V.YA. SHUR AND S.V. KALININ, *Intermittency, quasiperiodicity, and chaos during ferroelectric domain switching,* Fundamental Physics of Ferroelectrics, Washington DC, February 2014

35. S.V. KALININ, "*Electrochemical Force and Strain Microscopies: Window in Nanoscale Electrochemistry*" Gordon Research Conference on Electrochemistry, Ventura, January 6 2014

36. S.V. KALININ, E. STRELCOV, A. BELIANINOV, and S. JESSE, *Big Data in Nanoscience: Exploring Dynamic Phenomena in Solids by Multidimensional Scanning Probe Microscopy*, MRS Fall Meeting 2014

37. S.V. KALININ, S. JESSE, and N. BALKE, *In-situ Electrochemistry at the End of the Tip,* MRS Fall Meeting 2014

38. S.V. KALININ, A. TSELEV, Z. GAI, R.K. VASUDEVAN, A. BELIANINOV, P. MAKSYMOVYCH, and A.P. BADDORF, *Atomic view on the surface electrochemistry of oxides*, MRS Fall Meeting 2014

39. S.V. KALININ, A. MOROZOVSKA, and V. SHUR, *Interplay of polarization dynamic and surface electrochemistry in ferroelectrics: from ionic transport to chaotic dynamics and fractal growth*, International Symposium on Applied Ferroelectrics, Prague, July 2013

40. (**keynote**) S.V. KALININ, *Imaging and spectroscopy in PFM*, 2013 International Tutorial Workshop on Piezoresponse Force Microscopy and Nanoscale Electromechanics of Polar Materials, July 6-8, 2013, Nanjing University, Nanjing, China

41. S.V. KALININ, A. TSELEV, Z. GAI, P. MAKSYMOVYCH, M. PAN, and A.P. BADDORF, *Probing coupled metal-insulator and ferroic transitions from atomistic to mesoscopic scales:* in-situ *PLD-STM study*, International Conference on Materials for Advanced Technologies, June 300-July 5, Singapore

42. (**keynote**) S.V. KALININ, *Surface electrochemical phenomena in oxide thin films: from ionic transport to chaotic dynamic in ferroelectric domain switching*, International Conference on Materials for Advanced Technologies, June 300-July 5, Singapore

43. S.V. KALININ, *Emergent mesoscopic lengthscales in disordered systems,* MRS Spring Meeting, San Francisco, April 2013

44. S.V. KALININ, *Mapping electrochemical functionality in oxides on mesoscopic and atomic scales,* Argonne January 2013

45. S.V. KALININ, *Static and dynamics conductance of topological defects in ferroelectrics,* MRS Fall 2012

46. S.V. KALININ, *Static and dynamics conductance of topological defects in ferroelectrics,* AVS Meeting, Tampa, FL

47. S.V. KALININ, *Band Excitation SPM,* Multifrequency conference, Madrid, Spain, October 2012

48. S.V. KALININ, L.Q. CHEN, A. MOROZOVSKA, AND A. BORISEVICH, *Linking Mesoscopic and Atomic Scale Behaviors in Disordered Ferroelectrics,* "International Workshop on Relaxor Ferroelectrics", Shloss Edesheim, Germany 2012

49. S.V. KALININ, *Emergent SPM Modes and their Application to Energy and Memory Materials*, SMASIS, September 2012

50. (DOE Contractor meeting), *Probing Coupled Metal-Insulator and Ferroic Transitions from the Atomistic to Mesoscopic Scales*, DOE Contractor Meeting, Gaitesburg, MD

51. (**plenary**) S.V. KALININ, *Static and dynamics conductance of topological defects in ferroelectrics,* ISAF-ECAPD 2012, Aveiro, Portugal

52. SERGEI V. KALININ, AMIT KUMAR, STEPHEN JESSE, and ALBINA BORISEVICH, *Electrochemical Strain Microscopy: Challenges and Opportunities in Probing Electrochemical Reactivity of Solids below* 10 nm *level*, Workshop on solid state ionics, Heidelberg, Germany July 2012

53. S.V. KALININ, *Probing bias-induced phase transitions and electrochemical reactions on a single defect level,* ASM Local, May 21, 2012

54. S.V. KALININ, *Electrochemical Strain microscopy: probing batteries and fuel cells on the nanoscale*, Gordon's research conference on batteries, 2012

55. S.V. KALININ, P. MAKSYMOVYCH, N. BALKE, A. BORISEVICH, L.Q. CHEN, and A.N. MOROZOVSKA, *Static and dynamics conductance of topological defects in ferroelectrics*, Fundamental Physics of Ferroelectrics, Argonne 2012

56. S.V. KALININ, *Probing local bias-induced transitions: the case for 6D SPM,* MRS Fall Meeting 2011

57. S.V. KALININ, S.V. Kalinin, S. Jesse, A. Kumar, D.N.Leonard, and A. Y. Borisevich *nome, Probing oxygen vacancy dynamics on the nanoscale – from fuel cells to ferroelectrics*, MRS Fall Meeting 2011

58. S.V. KALININ, *Role of ionic phenomena in electromechanical SPM of correlated oxides*, MRS Spring Meeting 2011.

59. S.V. KALININ, *Probing local ionic motion and conductivity phenomena in correlated oxides*, Heraus Seminar, Bad Honneff, Germany January 2011.

60. S.V. KALININ, *Probing and controlling bias-induced phase transitions on the nanoscale: from local Preisach densities to switching at a single defect*, EMA2011, January 2011.

61. S.V. KALININ, *Mapping Ionic dynamics and electrochemical reactivity on the nanometer scale*, MRS Fall, 2010

62. S.V. KALININ, *Mapping Ionic dynamics and electrochemical reactivity on the nanometer scale*, AVS 2010, Albuquerque, October 2010.

63. S.V. KALININ, *Recent Advanced in Piezoresponse Force Microscopy*, ESFD-PFM, Czech Republic, September 2010

64. (**plenary**) S.V. KALININ, *A Biased View on the Nanoworld: From Ferroelectrics and Multiferroics to Energy Storage Materials*, ISAF 2010, Edinburgh, Scotland

65. S.V. KALININ, *Artificial Intelligence Methods in Scanning Probe Microscopy*, MRS Spring, 2010

66. S.V. KALININ, *Nanoscale Electromechanics: from Ferroelectrics to Energy Storage Materials*, APS March Meeting, 2010

67. S.V. KALININ, *Electromechanics on a Nanoscale: Hidden Dimension(s) of Scanning Probe Microscopy*, MRS Fall, 2009

68. S.V. KALININ, *Probing Bias-Induced Phase Transitions in Ferroelectrics and Energy Storage Materials on a Single Defect Level*, MRS Fall, 2009

69. S.V. KALININ, *Spatially resolved spectroscopy of ferroelectric polarization switching on a single defect level*, ACerS 2009

70. S.V. KALININ, *Surface-and Temperature Induced Phase Transitions on Relaxor Surfaces by SPM*, IMF-ISAF 2008, Xi'an, China

71. S.V. KALININ, *Probing Local Bias-Induced Phase Transitions by SPM*, ISPM 2009, Madrid, Spain

72. S.V. KALININ, *Probing Thermodynamics and Kinetics of Phase Transitions and Order Parameter Dynamics in complex materials on a single defect level*, NSRC Contractors Meeting, Annapolis, MD June 2009

73. S.V. KALININ, *Probing the Role of Single Defects on Polarization Switching in Ferroelectric and Multiferroic Materials*, MST 2008, Pittsburg, PA

74. S.V. KALININ, *Multidimensional SPM of Phase Transitions and Order Parameter Dynamics in complex materials*, DOE Contractors Meeting, Warrenton, PA

75. (**Peter Mark award talk**) S.V. KALININ, *Probing the Order Parameter Dynamics and Energy Dissipation on a Single Defect Level: Hidden Dimensions of Scanning Probe Microscopy*, AVS Meeting, Boston, MA

76. S.V. KALININ, *Multidimensional SPM of Phase Transitions and Order Parameter Dynamics in complex materials*, BES DMSE Workshop Frontiers of Atomic-Scale Functionality Imaging, Annapolis, MD

77. S.V. KALININ, *Electromechanical Imaging of Biological Systems with Sub-10 nm Resolution*, ISE 14, September 2008, Tokyo, Japan

78. S.V. KALININ, *Electromechnics on the Nanoscale: A Hidden Dimension of Scanning Probe Microscopy*, PiezoSalon, September 2008, Tokyo, Japan

79. S.V. KALININ, *Nanoscale Electromechanics: Phenomena, Devices, and Applications*, Gordons Research Conference on Microfabrication, Tinton School, NH, July 12-16, 2008

80. S.V. KALININ, *PFM^2: Probing the Role of Single Defects on Polarization Switching in Ferroelectric and Multiferroic Materials*, ISAF 2008

81. S.V. KALININ, *Spectroscopic Studies of Defect-Mediated Polarization Dynamics on the Nanoscale: Intrinsic Switching, Landauer Centers, and Hysteresis Loop Fine Structure*, MRS Fall Meeting, 2007

82. S.V. KALININ, *Electromechanical and Energy Dissipation Imaging of Polarization Dynamics in Ferroelectric PVDF Films*, APS March Meeting, 2007

83. S.V. KALININ, *The Hunt for the Snark: Real Space Imaging of Microstructural Origins of Landauer Paradox*, International Conference for Young Scientists, NIMS, Japan, February 2007.

84. S.V. KALININ, *The Hunt for the Snark: Real Space Imaging of Spatial and Energy Distribution of Nucleation Centers in Ferroelectrics*, Fundamental Physics of Ferroelectrics 2007, Williamsburg, VA, February 2007.

85. S.V. KALININ, *Electromechanics on the nanoscale: A new dimension in Scanning Probe Microscopy*, International Symposium on Scanning Probe Microscopy 14, Japan 2006.

86. S.V. KALININ, *Electromechanics on the Nanoscale: Imaging, Spectroscopy, and Control of Ferroelectric Materials and Devices*, Mat Sci. Tech., Fall 2006, Cincinnatti, OH.

87. S.V. KALININ et al. *Interaction of Order Parameters and Energy Dissipation in Strongly Correlated Oxides by Scanning Probe Microscopy*, Surface and Interface Science at the Atomic Scale, DOE Program Meeting, Warrenton, VA October 29, 2006

88. S.V. KALININ, *Electromechanics on the Nanoscale: a New Dimension in Scanning Probe Microscopy*, UK SPM 2006, UK, June 2006

89. **(plenary talk)** S.V. KALININ, *Electromechanical Phenomena on the Nanoscale: polarization dynamics, patterning, and molecular orientation imaging*, 12th US-Japan Seminar on Dielectric and Piezoelectric Ceramics, Annapolis, MD, November 6–9, 2005.

90. (**press luncheon talk**) SERGEI KALININ, BRIAN RODRIGUEZ, and ALEXEI GRUVERMAN, *Recreating Galvani's Experiment at the Nanoscale*, AVS 52nd international symposium and exposition press luncheon, Monday October 31, 2005, Boston, MA.

91. SERGEI V. KALININ, *A Biased View on the Nanoworld: From Perovskites to Proteins*, AMS Meeting, Knoxville, TN June 2005

92. S.V. KALININ, *Electromechanical Phenomena on the Nanoscale: from Perovskites to Proteins*, American Ceramics Society Meeting, April 13, 2005

93. S.V. KALININ, J. SHIN, A.P. BADDORF, R.J. HARRISON and V. MEUNIER, *Transport imaging in* 1D *structures: from nanowires to nanotubes*, Materials Research Society Spring Meeting, March 2005.

94. S.V. KALININ, V. MEUNIER, S. JESSE, J. SHIN, A.P. BADDORF, R.J. HARRISON, and D.B. GEOHEGAN, *Electronic Transport in Individual Carbon Nanotubes and Nanotube Networks by Scanning Probe Microscopy*, Microscopy and Microanalysis 2004, Savannah, Georgia, August 1-5, 2004

95. S.V. KALININ, J. SHIN, A.P. BADDORF, V. MEUNIER, and R.J. HARRISON, *Electronic properties of individual defects in carbon nanotubes and semiconductor nanowires by Scanning Probe Microscopy*, American Ceramics Society Meeting April 2004, Indianapolis, IN

Invited talks – Workshops and Tutorials

96. S.V. KALININ, *Ionic phenomena in condensed matter physics*, ALS Workshop, Berkeley, CA January 2017

97. (**1 lecture, 50 min, workshop organizer**) S.V. KALININ, *Electrochemical Strain Microscopy*, ORNL ESM Workshop, September 2014

98. (**2 lectures, 50 min, workshop organizer**) S.V. KALININ, *Piezoresponse Force Microscopy: Imaging and Spectroscopic Modes*, ISAF-PFM School, March 2014

99. (**3 lectures, 50 min, workshop organizer**) S.V. KALININ, *Piezoresponse Force Microscopy: Theory, Instrumentation, and Applications*, ORNL PFM School, March 2013

100. (2 **tutorial**) S.V. KALININ, *Piezoresponse Force Microscopy and Spectroscopy*, MRS Fall Meeting, Boston November 2012

101. (**tutorial**) S.V. KALININ, *Emergent SPM Modes and their Application to Energy and Memory Materials*, ISAF-ECAPD, Aveiro July 2012

102. (**tutorial**) S.V. KALININ, *Piezoresponse Force Microscopy and Spectroscopy*, Nanomotion workshop at ISAF-ECAPD, Aveiro July 2012

103. (**tutorial**) S.V. KALININ, *Imaging energy materials by SPM*, ISAF meeting, Vancouver, July 2011.

104. (**tutorial**) S.V. KALININ, *Imaging energy materials by SPM*, MRS Spring meeting, 2011.

105. (**keynote**) S.V. KALININ, *Electrochemical Strain Microscopy – Probing Ionic Flows and Reactivity on the Nanoscale*, Vanderbilt University Nano day, October 27, 2010

106. S.V. KALININ, *Hidden Dimensions of Scanning Probe Microscopy*, AVS ASSD meeting, Albuquerque, October 2010

107. (**2 lectures, 50 min, workshop organizer**) S.V. KALININ, *Piezoresponse Force Microscopy: Theory, Instrumentation, and Applications*, 9th PFM workshop and ISFD conference, Prague, Czech Republic, September 2010

108. (**3 lectures, 40 min, workshop organizer**) S.V. KALININ, *Piezoresponse Force Microscopy: Theory, Instrumentation, and Applications*, 8th PFM workshop, Beijing, China, August 2010

109. S.V. KALININ, *Mapping defect dynamics by SPM*, Argonne workshop on defect control, July 2010

110. S.V. KALININ, *Spectroscopic Imaging of Polarization Dynamics in Ferroelectric Materials*, MRS 2009 Fall Meeting, Boston, MA

111. (**1 lectures, 1.5 hour, workshop organizer**) S.V. KALININ, *Piezoresponse Force Microscopy: Theory, Instrumentation, and Applications*, 6th PFM workshop, ORNL, September 2009

112. (**3 lectures, 1 hour each, workshop organizer**) S.V. KALININ, *Piezoresponse Force Microscopy: Theory, Instrumentation, and Applications*, 5th PFM workshop, NIMS, Japan, August 2009

113. (**3 lectures, 1 hour each, workshop organizer**) S.V. KALININ, *Piezoresponse Force Microscopy: Theory, Instrumentation, and Applications*, 4th PFM workshop and conference at Aveiro, Portugal, June 2009

114. S.V. KALININ, *Probing Thermodynamics and Kinetics of Phase Transitions and Order Parameter Dynamics in complex materials on a single defect level*, Stanford NSEC Workshop, April 2009

115. (**3 lectures, 1.5 hour each, workshop organizer**) S.V. KALININ, *Piezoresponse Force Microscopy: Theory, Instrumentation, and Applications*, Workshop at CNMS User meeting, Oak Ridge, September 2008

116. (**6 lectures, 45 min. each, workshop co-organizer with Nava Setter**) S.V. KALININ, *Piezoresponse Force Microscopy: Theory, Instrumentation, and Applications*, Workshop at EPFL, Switzerland, June 2008

117. S.V. KALININ, *Probing Electromechanical Energy Conversion on the Nanoscale – Recent Progress and Limitations*, DARPA MTO workshop, San Francisco, March 2008.

118. S.V. KALININ, *Piezoresponse Force Microscopy of Nanoscale Ferroelectrics: Imaging, Modification, and Spectroscopy*, MRS 2007 Fall Meeting, Boston, MA

119. (**3 lectures, 1.5 hour each, workshop organizer**) S.V. KALININ, *Piezoresponse Force Microscopy: Theory, Instrumentation, and Applications*, Workshop at CNMS User meeting, Oak Ridge, October 2007

120. (**10 hour workshop**) S.V. KALININ, *Piezoresponse Force Microscopy: Theory, Instrumentation, and Applications*, Intel Corporation, San Jose, CA, August 24, 2006.

121. (**1 hour workshop**) S.V. KALININ, *Nanoelectromechanics of Piezoresponse Force Microscopy: Application to Biological and Macromolecular Systems*, APS March Meeting, DPOLY, 2007

122. (**2 hour workshop**) S.V. KALININ, *Recent Advances in Local Studies of Low-Dimensional Ferroelectrics*, NIMS, Japan, February 2007.

123. S.V. KALININ, *Local Probing of Polarization Dynamics in Low-Dimensional Ferroelectrics*, Meeting of the International Technology Roadmap for Semiconductors of the Emerging Research Materials Work Group on Dynamic Properties of Correlated Electron State Materials, Stanford University, Palo Alto, CA, November 15.

124. *Scanning Probe Microscopy of Nanoscale Electrostatic Properties of Ceramics*, Seminar and Workshop on Electrical Characterization Techniques by Scanning Probe Microscopy, April 25, 2000, Princeton Materials Institute, Princeton, NJ

Invited talks – Seminars

125. S.V. KALININ, *Ferroionic states in ferroelectric films*, Czech Academy of sciences, 2018

126. S.V. KALININ, *Imaging in information dimension: from materials design to atomic fabrication*, Ernst Ruska Institute, Juelich 2018

127. S.V. KALININ, *Imaging in information dimension: from materials design to atomic fabrication*, Zernicke lecture, Groeningen 2018

128. S.V. KALININ, *Ferroionic states in ferroelectric films*, NUS, Singapore 2017

129. S.V. KALININ, *Big Data in Atomically Resolved imaging: from Materials Genome to Atom by Atom Fabrication*, Imperial College, London, July 2017

130. S.V. KALININ, *Big Data in Atomically Resolved imaging: from Materials Genome to Atom by Atom Fabrication*, NIST, July 2017

131. S.V. KALININ, *Electrochemistry on Nano- and Atomic Levels: Scanning Probe Microscopy Meets Deep Data*, U. Wash, January 2017

132. S.V. KALININ, *Big, Deep, and Smart Data in Imaging: from Full Information Capture to Atomic Manipulation*, CAMERA seminar, Berkeley, January 2017

133. S.V. KALININ, *Ferroionic states: coupling between surface electrochemical and bulk ferroelectric functionalities on the nanoscale*, UNL January 2017

134. S.V. KALININ, *Big, Deep, and Smart Data in Energy Materials Research: Atomic View on Materials Functionalities*, GaTech, May 2016

135. S.V. KALININ, *Electrochemistry on Nano- and Atomic Levels: Scanning Probe Microscopy Meets Deep Data*, Stanford, May 2016

136. S.V. KALININ, *Electrochemistry on Nano- and Atomic Levels: Scanning Probe Microscopy Meets Deep Data*, University of Maryland, May 2016

137. S.V. KALININ, *Electrochemistry on Nano- and Atomic Levels: Scanning Probe Microscopy Meets Deep Data*, Yale, April 2016

138. S.V. KALININ, *Big, Deep, and Smart Data in Energy Materials Research: Atomic View on Materials Functionalities*, UPenn April 2016

139. S.V. KALININ, *Electrochemistry on Nano- and Atomic Levels: Scanning Probe Microscopy Meets Deep Data*, Drexel April 2015

140. S.V. KALININ, *Big, Deep, and Smart Data in Energy Materials Research: Atomic View on Materials Functionalities*, Sung Kyun Kwan University, February 2016

141. S.V. KALININ, *Electrochemistry on Nano- and Atomic Levels: Scanning Probe Microscopy Meets Deep Data*, KAIST February 2016

142. S.V. KALININ, *Electrochemistry on Nano- and Atomic Levels: Scanning Probe Microscopy Meets Deep Data*, SNU, February 2016

143. S.V. KALININ, *Big, Deep, and Smart Data in Energy Materials Research: Atomic View on Materials Functionalities*, University of Tennessee-Knoxville, October 2015

144. S.V. KALININ, *Electrochemistry on Nano- and Atomic Levels: Scanning Probe Microscopy Meets Deep Data*, BNL CFN Seminar, October 2015

145. S.V. KALININ, *Big, Deep, and Smart Data in Energy Materials Research: Atomic View on Materials Functionalities*, BNL CFN Seminar, October 2015

146. S.V. KALININ, *Data Needs for Scientific Facilities: Electron and Scanning Probe Microscopies*, ASCR Workshop, September 2015

147. S.V. KALININ, *Electrochemistry on Nano- and Atomic Levels: Scanning Probe Microscopy Meets Deep Data*, Northwestern University ChiMAD seminar, September 2015

148. S.V. KALININ, *Big, Deep, and Smart Data in Energy Materials Research: Atomic View on Materials Functionalities*, ANL, September 2015

149. S.V. KALININ, *Electrochemistry on Nano- and Atomic Levels: Scanning Probe Microscopy Meets Deep Data*, UC Berkeley, September 2015

150. S.V. KALININ, *Big, Deep, and Smart Data in Energy Materials Research: Atomic View on Materials Functionalities*, LBL, September 2015

151. S.V. KALININ, *Big, Deep, and Smart Data in Energy Materials Research: Atomic View on Materials Functionalities*, Queens University Belfast, UK

152. S.V. KALININ, *Big, Deep, and Smart Data in Energy Materials Research: Atomic View on Materials Functionalities*, University College Dublin, Ireland

153. S.V. KALININ, *Imaging in information dimension*, Physical Sciences Directorate Advisory Meeting, Spring 2015

154. S.V. KALININ, *Deep Data in Scanning Probe Microscopy*, Materials Science Division Seminar Series, Spring 2014

155. S.V. KALININ, *Electrochemistry on the Nanoscale: The Force Dimension*, CalTech, January 9, 2014

156. S.V. KALININ, *Electrochemistry on the Nanoscale: The Force Dimension,* UPenn, December 2013

157. S.V. KALININ, *Electrochemistry on the Nanoscale: From Surface Ionic Transport to Chaos in Domain Switching,* Drexel, December 2013

158. S.V. KALININ, *Electrochemical Strain Microscopy of Li-ion and Oxygen conductors,* MPI Stuttgart (J. Maier group), October 2012

159. S.V. KALININ, *Electrochemical Strain Microscopy: How I stopped Doing Physics and Started to Love Electrochemistry*, Rutgers LSM symposium , February 2012

160. S.V. KALININ, *Materials Science on a Single Defect Level: Mapping Bias-induced Transformation in Ferroelectric and Electrochemical Systems*, University of Pennsylvania NBIC meeting, 2012

161. S.V. KALININ, *Electrochemical Strain Microscopy of Energy materials*, Caltech, May 2011

162. S.V. Kalinin, *Electrochemical Strain Microscopy: mapping ionic flows and electrochemical reactivity on the nanoscale*, West Virginia U. March 2011

163. S.V. Kalinin, *Electrochemical Strain Microscopy: mapping ionic flows and electrochemical reactivity on the nanoscale*, University of Pennsylvania, February 2011

164. S.V. Kalinin, *Electrochemical Strain Microscopy: mapping ionic flows and electrochemical reactivity on the nanoscale*, Sandia National Laboratory, October 2010

165. S.V. Kalinin, *Electrochemical Strain Microscopy: mapping electrochemical reactivity at the 10 nm lenghtscale*, Heyrovsky institute, September 2010

166. S.V. Kalinin, *Electromechanics on the Nanoscale: from Ferroelectrics and Multiferroics to Energy Storage Materials*, Argonne, June 2010

167. S.V. Kalinin, *Novel Applications of Piezoresponse Force Microscopy: from Ferroelectrics and Multiferroics to Energy Storage Materials*, Simon Fraser University, April 2010

168. S.V. Kalinin, *Mapping* Li-*ion dynamics on the Nanoscale: Novel Applications of Piezoresponse Force Microscopy*, LBL, April 2010

169. S.V. Kalinin, *Mapping* Li-*ion dynamics on the Nanoscale: Novel Applications of Piezoresponse Force Microscopy*, IBM Almaden, April 2010

170. S.V. KALININ, *Spatially-resolved Spectroscopic Probing of Polarization Switching in Ferroelectrics and Multiferroics on a Single Defect Level,* Tokyo Institute of Technology, Japan August 2009.

171. S.V. KALININ, *Direct Imaging of Bias-Induced Phase Transitions on a Single Defect Level*, Argonne CNM, November 2008.

172. S.V. KALININ, *Direct Imaging of Phase Transformations and Energy Dissipation in Ferroelectric Materials on a Single Defect Level*, Penn State, June 2008.

173. S.V. KALININ, *The Hunt for a Snark: Imaging Nucleation Centers in Ferroelectric Materials*, RTW Aachen, June 2008

174. S.V. KALININ, *The Hunt for a Snark: Imaging Nucleation Centers in Ferroelectric Materials*, MPI Halle, June 2008

175. S.V. KALININ, *The Hunt for a Snark: Imaging Nucleation Centers in Ferroelectric Materials*, University of Geneva, Switzerland, May 2008

176. S.V. KALININ, *The Hunt for a Snark: Imaging Nucleation Centers in Ferroelectric Materials*, EPFL, Switzerland, May 2008

177. S.V. KALININ, *Real-Space Imaging of Nucleation Centers and Energy Dissipation in Ferroelectrics*, Physics Department, Vanderbilt University, April 2008

178. S.V. KALININ, *Direct Imaging of Nucleation Centers and Energy Dissipation in Ferroelectric Materials*, University of Minnesota, February 2008

179. S.V. KALININ, *Direct Imaging of Nucleation Centers and Energy Dissipation in Ferroelectric Materials*, Penn State, December 2007.

180. S.V. KALININ, *The Hunt for the Snark: Microstructural Origins of Landauer Paradox*, Argonne User Meeting, May 2007.

181. S.V. KALININ, *The Hunt for the Snark: Real-Space Imaging of Nucleation Centers and Energy Dissipation in Ferroelectrics*, Physics Department, Vanderbilt University, April 2007

182. S.V. KALININ, *Electromechanics on the Nanoscale: A New Dimension in Scanning Probe Microscopy of Biomaterials*, Biology Department, Vanderbilt University, April 2007

183. S.V. KALININ, *Electromechanics on the Nanoscale – A New Dimension in the Scanning Probe Microscopy*, BioSecurity and Nanoscience Directorate, Lawrence Livermore National Laboratory, April 2007

184. S.V. KALININ, *The Hunt for the Snark: Real-Space Imaging of Nucleation Centers and Energy Dissipation in Ferroelectrics*, IBM-Almaden, April 2007

185. S.V. KALININ, *The Hunt for the Snark: Real-Space Imaging of Nucleation Centers and Energy Dissipation in Ferroelectrics*, Molecular Foundry Seminar, Lawrence Berkeley Laboratory, April 2007

186. S.V. KALININ, *The Hunt for the Snark: Real Space Imaging of Microstructural Origins of Landauer Paradox*, Department of Materials Science, University of Tokyo, Japan, December 2006.

187. S.V. KALININ, *Electromechanics on the nanoscale: A new dimension in Scanning Probe Microscopy*, NCSU NIRT Meeting, September 2006.

188. S.V. KALININ, *Electromechanical Imaging by Scanning Probe Microscopy: Galvani's experiment on the Nanoscale*, South Carolina Bioengineering School, Clemson University, Greenville, SC, June 16, 2006

189. S.V. KALININ, *Electromechanics on the Nanoscale: a New Dimension in Scanning Probe Microscopy*, Leeds University, June 2006.

190. S.V. KALININ, *Electromechanics on the Nanoscale: Imaging, Spectroscopy, and Control of Ferroelectric Materials and Devices*, University of Nebraska-Lincoln, April 28, 2006

191. S.V. KALININ, *A Biased View on the Nanoworld: Transport and Electromechanics on the Nanoscale*, University of Nebraska-Lincoln, April 27, 2006

192. S.V. KALININ, *Electromechanical Imaging of Calcified and Connective Tissues*, University of Pennsylvania, Dental School, January 2006

193. S.V. KALININ, *Electromechanical Imaging of Calcified and Connective Tissues: from Bones to Butterflies*, University of Pennsylvania, Dept. Mat. Sci., January 2006

194. S.V. KALININ, *A Biased View on the Nanoworld: Electromechanical Imaging of Perovskites and Proteins, Brown University*, Department of Mechanical Engineering, December 2005.

195. S.V. KALININ, *Nanoelectromechanical Imaging: From Bone to Ceramics*, Tufts University, Departmen of Mechanical Engineering, November 10, 2005

196. S.V. KALININ, *A Biased View on the Nanoworld: From Complex Oxides to Biosystems*, Suffolk University, Fall 2005

197. S.V. KALININ, *Probing Nanoscale Electromechanical Phenomena in Inorganic and Biological Systems*, Asylum Research, January 2006

198. S.V. KALININ, *A Biased View on the Nanoworld: From Perovskites to Proteins*, MIT, Boston, MA, April 8, 2005

199. S.V. KALININ, *Bioelectromechanical Imaging by Scanning Probe Microscopy: Repeating Galvani's Experiment on the Nanoscale*, Rutgers University, Piscataway, NJ, April 6, 2005

200. S.V. KALININ, *A Biased View on the Nanoworld: From Perovskites to Proteins and Back*, Drexel University, Philadelphia, PA, April 5, 2005

201. S.V. KALININ, *Nanoelectromechanics of Scanning Probe Microscopy: From Perovskites to Proteins and Back*, University of Pennsylvania, Philadelphia, PA, April 4, 2005

202. S.V. KALININ, *Nanoelectromechanics of Scanning Probe Microscopy: from Perovskites to Proteins*, North Carolina State University, Raleigh, NC, November 12, 2005

203. S.V. KALININ, *Local mechanical and electromechanical behavior by SPM: Repeating Galvani's experiment on molecular level*, ORNL Life Sciences Division Seminar, November 8, 2004

204. S.V. KALININ, *A Biased View of the Nanoworld: Transport, Defects and Ferroelectrics*, National Institute of Standards and Technology, April 2004

205. *A Biased View on the Nanoworld: Nanoscale Electric Phenomena by Scanning Probe Microscopy*, Georgia Institute of Technology, Materials Science Department, April 2003

206. *Nanoscale Electric Phenomena by Scanning Probe Microscopy*, Oak Ridge National Laboratory, Solid State Division, February 2002

207. *Nanoscale Electric Phenomena by Scanning Probe Microscopy*, Lawrence Livermore National Laboratory, February 2002

208. *Nanoscale Electric Phenomena by Scanning Probe Microscopy*, North Carolina State University, Physics Department, February 2002

209. *Nanoscale Phenomena in Ferroelectric Oxides*, Cornell University, Applied Engineering Physics Department, Craighead group, January 2002

Conference Proceedings

1. E.J. LINGERFELT, A. BELIANINOV, E. ENDEVEC, O. OVCHINNIKOV, S. SOMNATH, J. BORREGUERO, N. GRODOWITZ, B. PARK, R.K. ARCHIBALD, C.T. SYMONS, S.V. KALININ, O.E.B. MESSER, M. SHANKAR, and S. JESSE, *BEAM: A Computational Workflow System for Managing and Modeling Material Characterization Data in HPC Environments*, Procedia Computer Science **80**, 2276–2280 (2016), International Conference on Computational Science 2016, ICCS 2016, 6-8 June 2016, San Diego, California, USA

2. S.V. KALININ, S. JESSE, A.Y. BORISEVICH, H.N. LEE, B.J. RODRIGUEZ, J. HANSON, A. GRUVERMAN, E. KARAPETIAN, and M. KACHANOV, *Recent developments in Electromechanical Probing on the Nanoscale: Vector and Spectroscopic Imaging, Resolution, and Molecular Orientation Mapping*, extended abstract for 12th US-Japan Workshop on Ferroelectric Materials, to be published

3. V. MEUNIER, S.V. KALININ, and P. LAMBIN, *Theory of Scanning Probe Microscopy of Carbon Nanostructures*, O12.1 in MRS Proceedings 838E, S.V. Kalinin, B. Goldberg, L.M. Eng, B.D. Huey (Eds) (2005 Fall meeting).

4. X. LEI, S. KALININ, Z. HU and D.A. BONNELL, *Ferroelectric Lithography of Multicomponent Nanostructures*, in "Ceramic Nanomaterials and Nanotechnology II", Ceramic Transactions, Volume **148**, M.R. De Guire, M.Z. Hu, Y. Gogotsi, and S.W. Lu, Editors (2004).

5. S.V. KALININ, J. SHIN, M. KACHANOV, E. KARAPETIAN, and A.P. BADDORF, *Piezoresponse Force Microscopy: Fields below the Surface*, in *Ferroelectric Thin Films XII*, ed. by A. Kingon, S. Hoffmann-Eifert, H. Funakubo, V. Joshi, and I. P. Koutsaroff, Materials Research Society, Warrendale, PA. (2003 Fall meeting).

6. SERGEI V. KALININ and DAWN A. BONNELL, *Temperature-dependent polarization and electric potential on ferroelectric* $BaTiO_3$ (100) *surface*, in "Dielectric Materials and Devices", Eds. K.M. Nair, A.S. Bhalla, T.K. Gupta, *et al*, Proceedings of 102 American Ceramic Society Meeting, 2002.

7. SERGEI V. KALININ and DAWN A. BONNELL, *Scanning Impedance Microscopy: from impedance spectra to impedance images*, Mater. Res. Soc. Symp. Proc. Vol. 699, (Electrically Based Microstructural Characterization III), R1.2, in print.

8. DAWN A. BONNELL and SERGEI V. KALININ, *Local polarization, charge compensation and chemical interactions on ferroelectric surfaces: a route towards new nanostructures*, Mater. Res. Soc. Symp. Proc. Vol. 688 (Ferroelectric Thin Films X), 317-328 (2002).

9. SERGEI V. KALININ and DAWN A. BONNELL, *Local potential at atomically abrupt oxide grain boundaries by scanning probe microscopy*, Diffusion and Defect Data--Solid State Data, Pt. B: Solid State Phenomena 80-81 (Polycrystalline Semiconductors VI), 33-44 (2001).

10. A.V. LUKASHIN, S.V. KALININ, S.R. LEE, A.V. KNOTKO, A.A. VERTEGEL, YU.D. TRETYAKOV, *Cationic and anionic substitution in layered double hydroxides as a way for the preparation of*

nanocomposite materials, in: *Functional gradient materials and surface layers prepared by fine particles technology* Eds. M.-I. Baraton and I. Uvarova. *NATO Science Series II: Mathematics, Physics and Chemistry*, **2001**, v.16, p. 177-189. 328p.

11. G.Y. POPOV, S.V. KALININ, T. ALVAREZ, M. GREENBLATT, and DAWN A. BONNELL, *Magnetoresistance and micromagnetic studies of* $La_xSr_{1-x}MnO_3$ *single crystals*, Mater. Res. Soc. Symp. Proc. Vol. 658 (Solid State Chemistry of Inorganic Materials III), GG5.6.
12. SERGEI V. KALININ and DAWN A. BONNELL, *Imaging mechanism and quantification of scanning probe microscopies on ferroelectric surfaces*, Mater. Res. Soc. Symp. Proc. Vol. 655 (Ferroelectric Thin Films IX), CC7.2.
13. SERGEI V. KALININ and DAWN A. BONNELL, *Polarization screening and image formation in SSPM, EFM and Piezoresponse Imaging of ferroelectric* $BaTiO_3$ (100) *surface*, Microsc. Microanal. 6(Suppl 2: Proceedings), 706-707 (2000).
14. DAWN A. BONNELL and SERGEI V. KALININ, *Determining grain boundary potential from electrostatic force based scanning probe imaging*, Microsc. Microanal. 6(Suppl 2: Proceedings), 720-721 (2000).
15. SERGEI V. KALININ and DAWN A. BONNELL, *Local potential at atomically abrupt oxide interfaces by scanning probe microscopy* Mater. Res. Soc. Symp. Proc. 586 (Interfacial Engineering for Optimized Properties II), 15-20 (2000).
16. SERGEI V. KALININ and DAWN A. BONNELL, *Characterization of ferroelectric* BaTiO3 (100) *surfaces by variable temperature scanning surface potential microscopy and piezoresponse imaging*, Mater. Res. Soc. Symp. Proc. 596 (Ferroelectric Thin Films VIII), 327-332 (2000).
17. S.V. KALININ, A.A. VERTEGEL, and YU.D. TRETYAKOV, *Cryosol synthesis of nanocomposite materials*, Mater. Res. Soc. Symp. Proc. 547 (Solid-State Chemistry of Inorganic Materials II), 499-504 (1999).
18. A.V. LUKASHIN, S.V. KALININ, M.P. NIKIFOROV, A.I. ZHIROV, L.I. KHEIFETS, V.I. PRIVALOV, and A.A. VERTEGEL, *Influence of the preparation conditions on the structure of hydrotalcite layered double hydroxides*, Mater. Res. Soc. Symp. Proc. 547 (Solid-State Chemistry of Inorganic Materials II), 239-242 (1999).
19. S.V. KALININ, D.L. GORBACHEV, K.V. TOMASHEVITCH, A.YU. BORISEVICH, A.A. VERTEGEL, A.J. MARKWORTH, and YU.D. TRETYAKOV, *Evolution of fractal particles in systems with conserved order parameter*, Mater. Res. Soc. Symp. Proc. 538 (Multiscale Modelling of Materials), 151-156 (1999).
20. S.M. KUDRYAVTSEVA, A.A. VERTEGEL, S.V. KALININ, L.I. KHEIFETS, J. VAN LANDUYT, L.L. MESHKOV, S.N. NESTERENKO, E.S. REMBEZA, and A.M. GASKOV, *Microstructure and sensing properties of cryosol derived nanocrystalline tin dioxide*, Mater. Res. Soc. Symp. Proc. 536 (Microcrystalline and Nanocrystalline Semiconductors--1998), 389-394 (1999).
21. A.A. VERTEGEL, S.V. KALININ, N.N. OLEYNIKOV, and YU.D. TRETYAKOV, *Dehydration of fractal particles of iron(III) and aluminum hydroxides*, Mater. Res. Soc. Symp. Proc. 407 (Disordered Materials and Interfaces), 405-9 (1996).