

Petro Maksymovych

Center for Nanophase Materials Sciences
Oak Ridge National Laboratory
Oak Ridge, TN, 37831
Phone: (865) 368-0936
E-mail: 5nm@ornl.gov



Education

University of Pittsburgh, PA	Physical Chemistry Ph. D., 04/2007	Advisor: Prof. John T. Yates, Jr.
Taras Shevchenko University Kiev, Ukraine	Physical Chemistry, B.Sc. (summa cum laude) 2001	Advisor: Prof. V. Yatsimirsky

Research experience

2009 – present	Research Staff Member, Center for Nanophase Materials Sciences, ORNL
2007 – 2009	Eugene P. Wigner Fellow, Oak Ridge National Laboratory
2001 – 2007	Graduate student at the University of Pittsburgh.
2000	Visiting student at the University of Pittsburgh
1998-2001	Undergraduate student, Kiev Taras Shevchenko University

Honors and Awards

- ⤴ 2011 ORNL Director's Award for Outstanding Accomplishment in Science and Technology
- ⤴ 2011 ORNL Early Career Award for Individual Scientific Accomplishment
- ⤴ 2010 Martin and Beathe Block Prize from the Aspen Center for Physics
- ⤴ 2007-2009 Eugene P. Wigner Fellowship, Oak Ridge National Laboratory, Oak Ridge, TN
- ⤴ 2007 Wayne B. Nottingham Prize from the Physical Electronics Conference
- ⤴ □2006 Morton M. Traum Award from the American Vacuum Society
- ⤴ 2001 Outstanding performance on entrance exams in four chemistry disciplines, Department of Chemistry, University of Pittsburgh

Research synopsis

1. Fundamental properties and complexity in molecular systems:

Emergent chemical and electronic properties in self-assembled complexes and large multifunctional molecules; engineering and control of strong intermolecular interactions; the role of surface relaxation, stress and delocalized electronic states in molecular self-assembly; hot-electron transport on metal surfaces and molecular overlayers.

2. Energy-focused science of oxide materials:

Thermoelectric energy conversion at the nanoscale; electronic and ionic transport in transition metal oxides; thermodynamics of nanoscale polarization dynamics in ferroelectric oxides; ferroic control of electron transport.

3. Development of ultrahigh vacuum force microscopy:

Novel nanoscale thermoelectric probes; non-contact atomic force microscopy and scanning tunneling microscopy; simultaneous measurements of piezoresponse and local conductivity.

Professional Affiliations and Activities

- Member of the American Physical Society and Materials Research Society
- Organization of conference symposia: 2011 International Materials Research Congress, Cancun, Mexico (Fundamentals and Applications of Complex Oxides for Information and Energy; 2012 Materials Research Society Congress (“Oxide Nanoelectronics and Multifunctional Dielectrics”))
- Review board of the Seed Money Fund at Oak Ridge National Laboratory: 2010-2012
- Referee in Journal of the American Chemical Society, Surface Science, Nanotechnology, Physical Chemistry Chemical Physics, Physical Review Letters, Physica Status Solidi, Journal of Physics D

PUBLICATIONS

Peter Maksymovych
Center for Nanophase Materials Sciences Division
Oak Ridge National Laboratory
Oak Ridge, TN 37831

(total >40 publications, >850 citations)

1. P. Maksymovych, A. N. Morozovska, P. Yu, E. A. Eliseev, Y.-H. Chu, R. Ramesh, A. P. Baddorf, S. V. Kalinin, “Tunable Metallic Conductance in Ferroelectric Nanodomains”, **Nano Lett** 12 (2012) 209.
2. Q. Li, C. Han, S. R. Horton, M. Fuentes-Cabrera, B. G. Sumpter, W. Lu, J. Bernholc, P. Maksymovych, M. Pan, “Supramolecular Self-Assembly of p-Conjugated Hydrocarbons via 2D Cooperative CH/π Interaction”, **ACS Nano** (2011), DOI:10.1021/nn203952e
3. P. Maksymovych, J. Seidel, Y.-H. Chu, P. Wu, A. P. Baddorf, L.-Q. Chen, S. V. Kalinin, R. Ramesh, “Dynamic Conductivity of Ferroelectric Domain Walls in BiFeO₃”, **Nano Letters** 11 (2011) 1906
4. P. Maksymovych, M. Pan, P. Yu, R. Ramesh, A. P. Baddorf, S. V. Kalinin, “Scaling and Disorder Analysis of Local I-V Curves from Ferroelectric Lead Zirconate Titanate” , **invited** paper to **Nanotechnology** 22 (2011) 254031.
5. P. Maksymovych, “Excitation and Mechanisms of Single Molecule Reactions in Scanning Tunneling Microscopy”, book chapter in **Scanning Probe Microscopy of Functional Materials**, Springer 2011, Part1, 3-37, DOI: 10.1007/978-1-4419-7167-8_1
6. 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, R. Ramesh, “Domain Wall Conductivity in La-Doped BiFeO₃”, **Physical Review Letters** 105 (2010) 197603.
7. A. N. Morozovska, E. A. Eliseev, S. V. Svechnikov, A. D. Krutov, V. Y. Shur, A. Y. Borisevich, P. Maksymovych, S. V. Kalinin, “Finite size and intrinsic field effect on the polar-active properties of ferroelectric-semiconductor heterostructures”, **Physical Review B** 81 (2010) 205308.
8. P. Maksymovych, O. Voznyy, D. B. Dougherty, D. C. Sorescu, J. T. Yates, Jr., “Gold adatom as a key structural component in self-assembled organosulfur molecules on Au(111)”, invited review to **Progress in Surface Science** 85 (2010) 206.
9. P. Maksymovych, S. Jesse, P. Yu, R. Ramesh, A. P. Baddorf, S. V. Kalinin, “Polarization Control of Electron Tunneling into Ferroelectric Surfaces,” **Science** 324 (2009) 1421.
10. A. N. Morozovska, E. A. Eliseev, Y. L. Li, S. V. Svechnikov, P. Maksymovych, V. Y. Shur, V. Gopalan, L. Q. Chen, S. V. Kalinin, “Thermodynamics of nanodomain formation and breakdown in scanning probe microscopy: Landau-Ginzburg-Devonshire approach”, **Physical Review B** 80 (2009) 214110.

11. O. Voznyy, J. J. Dubowski, J. T. Yates, Jr., [P. Maksymovych](#), “*The Role of Gold Adatoms and Stereochemistry in Self-Assembly of Methylthiolate on Au(111)*”, **Journal of the American Chemical Society**, 131 (2009) 12989.
12. [P. Maksymovych](#), N. Balke, S. Jesse, M. Huijben, R. Ramesh, A. P. Baddorf, S. V. Kalinin, “*Defect-induced asymmetry of Local Hysteresis Loops on BiFeO₃ Surfaces*”, **J. Materials Science** 44 (2009) 5095.
13. C. H. [Yang](#), J. [Seidel](#), S. Y. [Kim](#), P. B. [Rossen](#), P. [Yu](#), M. [Gajek](#), Y. H. [Chu](#), L. W., M. B. [Holcomb](#), Q. [He](#), [P. Maksymovych](#), N. [Balke](#), S. V. [Kalinin](#), A. P. [Baddorf](#), S. R. [Basu](#), M. L. [Scullin](#), R. [Ramesh](#), “*Electric Modulation of Conduction in Multiferroic Ca-doped BiFeO₃ films*”, **Nature Materials** 8 (2009) 485.
14. J. [Seidel](#), L. W. [Martin](#), Q. [He](#), Q. [Zhan](#), Y. H. [Chu](#), A. [Rother](#), M. E., [P. Maksymovych](#), P. [Yu](#), M. [Gajek](#), N. [Balke](#), S. V. [Kalinin](#), S. [Gemming](#), F. [Wang](#), G., J. F. [Scott](#), N. A. [Spaldin](#), J. [Orenstein](#), R. [Ramesh](#), “*Conduction at Domain Walls in Oxide Multiferroics*”, **Nature Materials**, 8 (2009) 229.
15. [P. Maksymovych](#), S. Jesse, M. Huijben, R. Ramesh, A. Morozovska, S. Choudhury, L.-Q. Chen, A. P. Baddorf, S. V. Kalinin, “*Intrinsic Nucleation Mechanism and Disorder Effects in Polarization Switching on Ferroelectric Surfaces*,” **Physical Review Letters** 102 (2009) 017601.
16. [P. Maksymovych](#), D. C. Sorescu, K. D. Jordan, and J. T. Yates, Jr., “*Collective Reactivity of Molecular Chains Self-Assembled on a Surface*,” **Science** 322 (2008) 1664.
17. S. V. [Kalinin](#), B. J. [Rodriguez](#), S. [Jesse](#), [P. Maksymovych](#), K. [Seal](#), M. P. [Nikiforov](#), A. P. [Baddorf](#), A. L. [Kholkin](#), R. [Proksch](#), “*Local bias-induced phase transitions*” **Materials Today**, 11 (2008) 16.
18. S. Jesse S, [P. Maksymovych](#), S. V. Kalinin, “*Rapid Multidimensional Data Acquisition in Scanning Probe Microscopy Applied to Local Polarization Dynamics and Voltage Dependent Contact Mechanics*”, **Applied Physics Letters**, 93 (2008) 12903.
19. [P. Maksymovych](#), D. B. Dougherty, X.-Y. Zhu and J. T. Yates, Jr., “*Non-Local Dissociative Chemistry of Adsorbed Molecules Induced by Localized Electron-Injection into Metal Surfaces*,” **Physical Review Letters** 99 (2007) 016101, selected as *Editor’s suggestion*.
20. [P. Maksymovych](#), and J. T. Yates, Jr., “*Au-adatoms in Self-assembly of Benzenethiol on Au(111)*”, **Journal of the American Chemical Society**, 130 (2008) 7518.
21. [P. Maksymovych](#), D. B. Dougherty, “*The Structure and Real-time Evolution of CH₃SH Monolayer on the Au(111) Surface: Influence of Anisotropic Surface Lattice on Molecular Self-assembly*”, **Surface Science** 602 (2008) 2017.
22. D. B. Dougherty, [P. Maksymovych](#), J. Lee, M. Feng, H. Petek and J.T. Yates, Jr., “*Tunneling Spectroscopy of Stark-shifted Image Potential States on Cu and Au Surfaces*”, **Physical Review B** 76 (2007) 125428.

Collaborations

A. N. Morozovska (V. Lashkaryov Institute for Semiconductor Physics, Ukraine), S. Choudhury (Pennsylvania State University), L.-Q. Chen (Pennsylvania State University), M. Huijben (University of Twente), R. Ramesh (UC California Berkeley), D. C. Sorescu (National Energy Technology Laboratory), D. B. Dougherty (North Carolina State University), J. I. Cerda (Instituto de Ciencia de Materiales de Madrid),

Oleksandr Voznyy (National Research Council Canada), John Mitchell (Argonne National Laboratory), Chang-Beom Eom (University of Wisconsin-Madison)

Funded Research Proposals

1. P. Maksymovych, “Thermopower at the Atomic Scale”, ORNL-SEED proposal, 2011.
2. P. Maksymovych, “Low-temperature Non-contact Force Microscopy for Molecular Imaging of Photoactive Interfaces”, instrumentation proposal to Basic Energy Sciences, U.S. Department of Energy, 2009.
3. M. Pan, S. Jesse, P. Maksymovych, V. Meunier, J. F. Wendelken, E. W. Plummer, “*Single-molecule Imaging and Spectroscopy*”, Director’s funding proposal at ORNL, 2007.
4. P. Maksymovych, “*Polarization Dependent Tunneling Across Ferroelectric Oxides*”, proposal to Wigner committee at ORNL, 2006.

Invited Presentations

- “Topological Size-effects in Polarization-controlled Transport through Ferroelectric Surfaces”, 2011 Spring Meeting of the Materials Research Society, San Francisco, CA
- “*Local Polarization-dependent Electron Transport Through Uni- and Multi-axial Ferroelectric Surfaces*”, 12th International Ceramics Congress/5th Forum on New Materials, Montecatini Terme, Italy, 2010
- “*Local Polarization-dependent Electron Transport Through Ferroelectric and Multiferroic Surfaces*”, 2010 Spring Meeting of the Materials Research Society, San Francisco, CA
- “Local Ferroelectric Switching and Size-effect of BiFeO₃ Films in Ultra-High Vacuum Down to 4 Unit Cells”, 2010 Spring Meeting of the Materials Research Society, San Francisco, CA
- “*Polarization-dependent Electron Tunneling into Ferroelectric Surfaces*”, 2009 International Symposium on Integrated Ferroelectrics, Colorado Springs, CO
- “*Polarization-dependent Electron Transport Through Ferroelectric and Multiferroic Surfaces*”, 2009 physical sciences colloquium at the North Carolina State University, Raleigh, NC
- “*Intrinsic Polarization Dynamics and Disorder Effects by Ultra-High Vacuum Piezoresponse Force Microscopy*”, 2009 Spring Meeting of the Materials Research Society, San Francisco, CA
- “*Imaging Hot-electron Transport using Scanning Tunneling Microscopy*”, physical sciences colloquium at the University of Tennessee, Knoxville, 2008.
- “*Imaging Hot-electron Transport using Chemical Reactions in Scanning Tunneling Microscopy*”, American Physical Society March Meeting, New Orleans 2008.
- “*The Role of Au(111) Herringbone Reconstruction as a Stress-landscape and Source of Adatoms*”, Center for Individual Nanoparticle Functionality, Technical University of Denmark, Lyngby, Denmark, 2006.
- “*Adatom-mediated Chemistry in Self-assembled Monolayers of Alkanethiols on Au(111)*”, University of Toronto, Canada 2006.