

Arthur P. Baddorf

Senior R&D Staff
Imaging Functionality Group Leader
Center for Nanophase Materials Sciences
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Education

Wheaton College, Wheaton, IL
University of Pennsylvania, PA

Math and Physics
Physics

B.A., *Summa Cum Laude*, 1980
Ph.D., 1987

Professional Experience

2010–p Group Leader, Imaging Functionality, Center for Nanophase Materials Sciences, Oak Ridge National Laboratory
2010–p Joint Institute for Advanced Materials Research Affiliate
2005–p Senior Research Staff Member, Center for Nanophase Materials Sciences, Oak Ridge National Laboratory
1990–2007 Research Staff Member, Low Dimensional Materials by Design, Materials Science and Technology Division, Oak Ridge National Laboratory
1987–1989 Research Associate, Surface Physics Group, Solid State Division, Oak Ridge National Laboratory

Professional and Synergistic Activities

2010–p Group Leader, Imaging Functionality, Center for Nanophase Materials Sciences
2010–p Program Advisory Board, Joint Institute for Advanced Materials
2008–2010 Team Leader, Scanning Probe Imaging, Center for Nanophase Materials Sciences
2008–2010 ORNL SEED Program Review Committee
1995–2004 Executive Board, Complex Materials Consortium Collaborative Access Team, Advanced Photon Source, Argonne, Ill.
1991–92, 2002–03 President, Tennessee Valley Chapter of the American Vacuum Society
2000 Lecturer, Louisiana State University Summer School
1988–p Member: Materials Research Society, AVS, and American Physical Society
2005–p Active in scientific outreach to K-12 students

Honors and Awards

2009 ORNL Significant Event Award for organization of 5th Annual Advanced PFM Workshop
2008 Cosslett Award for best invited paper at Microscopy & MicroAnalysis Conference
2006 ORNL Director's Award Outstanding Team Accomplishment in Science and Technology
2006 ORNL Award for Science and Technology

Publications (Over 107 publication in peer reviewed journals, 47 invited presentations)

Research Synopsis

1. *Domain Engineering: Ferroelectrics*
Extensions of Piezoresponse Force Microscopy are used to examine switching, domain growth, and domain control in thin film ferroelectrics.
2. *Conductivity at Ferroelectric Domain Walls*
We seek to identify and control the origins of enhanced conductivity observed at certain domain walls in ferroelectric materials such as bismuth ferrite and lead zirconate titanate using local conducting atomic force microscopy in a controlled environment.
3. *Transport in non-metallic oxides*
The transport of electrons in thin oxide films is mapped at nanometer length scales as a function of temperature, applied voltage, and internal polarization in ultra high vacuum as a tool to understand oxide behavior through injection, hopping, and vacancy motion.
4. *Ionic conductivity*

Electrochemical Strain Microscopy has been developed to map ionic motion near surfaces for both Li and oxygen vacancies. Materials useful for energy storage (batteries and fuel cells) are targeted.

5. *Atomic structure of oxide surfaces and interfaces*

Understanding and control of the wide range of properties discovered in oxide thin films and interfaces depend critically on the exact atomic structure, which we explore using scanning tunneling and non-contact force microscopies.

6. *Energy flow at the nanoscale*

We seek a fundamental understanding of energy flow and dissipation at nanometer scales using band excitation techniques in atomic force microscopy (tip surface dissipation) and inelastic tunneling spectroscopy in scanning tunneling microscopy (electronic excitation).

Patents

Asymmetric Ferroelectric Tunneling Element (AFTE) and Applications for Non-Volatile Random Access Memory,

S. V. Kalinin, H. M. Christen, A. P. Baddorf, and V. Meunier, 2010.

Ultra-high Density Ferroelectronic Storage and Lithography by Second Order Ferroelectroelastic Switching,

S. V. Kalinin, A. Gruverman, Junsoo Shin, H. N. Lee, H. M. Christen, A. P. Baddorf, E. Karapetian, and M. Kachanov, 2006.

Fourier Transform for Acoustic Microscopy, S. Jesse, A. P. Baddorf, and S. V. Kalinin, patent disclosure.

Graduate and Postdoc Advisors

Past Ph.D. Students

J. Shin (2003-2007), Physics, The University of Tennessee-Knoxville with E. W. Plummer

Current Postdoctoral Scholars

Qing Li, Thomas Arruda, Kendal Clark, Simon Kelly, Amit Kumar, Geoffrey Rojas, Jennifer Black, Whenzi Lin, Evgheni Strelcov

Recent Postdoctoral Scholars

Yunseok Kim (2011-12) Asst. Professor, Sungkyunkwan University, Korea

Shengyong Qin (2011-2012), RHK

Senli Guo (2009-2011), Bruker Research

Maxim Nikiforov (2008-2010), Hummingbird Scientific; Argonne National Laboratory

Katyayani Seal (2006-2009), University of Tennessee

Brian Rodriguez (2005-2007), Humboldt, Germany; University College Dublin

Stephen Jesse (2005-2007), Oak Ridge National Laboratory

Jing Zhou (2004-2006), University of Wyoming