Arthur P. Baddorf

Senior R&D Staff, Scanning Probe Microscopy
Center for Nanophase Materials Sciences Oak Ridge National Laboratory
baddorfap@ornl.gov (865) 574-5241

Education

Wheaton College, Wheaton, IL	Math and Physics	B.A., *Summa Cum Laude*, 1980
University of Pennsylvania, PA	Physics	Ph.D., 1987

Professional Experience

2005–p	Senior Research Staff, Center for Nanophase Materials Sciences, ORNL
2010–2020	Group Leader, Scanning Probe Microscopy, Center for Nanophase Materials Sciences ORNL
1990–2007	Research Staff, Low Dimensional Materials by Design, Solid State Division, ORNL
1987–1989	Research Associate, Surface Physics Group, Solid State Division, ORNL

Professional Activities, Honors, Awards:

Fellow of the AVS, 2017
Canadian Foundation for Innovation Expert Committee 2017
Journal of Physics D Advisory Panel, 2015-p
ORNL Materials Characterization Committee, 2015-p
Institute for Functional Imaging Advisory Board. 2015-19
Initiative Review Committee, ORNL Laboratory Directed Research and Development, 2015-18
Committee of Visitors Review Panel, NSF Division of Materials Science 2015
Triennial Review Board, DOE Environmental Molecular Sciences Lab (EMSL), PNNL, 2014
ORNL Research Conflict of Interest Advisory Committee, 2014-p
Nature Scientific Reports Editorial Board, 2014-p
Triennial Review Board, DOE Center for Nanoscale Materials (CNM), ANL, 2013
Program Advisory Board, Joint Institute for Advanced Materials, 2010-15
Theme Leader, Electronic and Ionic Functionality, Center for Nanophase Materials Sciences, 2010-13
Cosslett Award for best invited paper at Microscopy & MicroAnalysis Conference, 2008
Team Leader, Scanning Probe Imaging, Center for Nanophase Materials Sciences, 2008-10
ORNL Director's Award Outstanding Team Accomplishment in Science and Technology, 2006
ORNL Award for Science and Technology, 2006
ORNL SEED Program Review Committee, 2008-10
Executive Board, Complex Materials Consortium, Advanced Photon Source, Argonne, IL, 1995-2004
President, Tennessee Valley Chapter of the American Vacuum Society, 1991–92, 2002–03
Lecturer, Louisiana State University Summer School, 2000

Professional Memberships:

American Physical Society
American Vacuum Society
Materials Research Society

Research Synopsis

1. *Quantum excitations at the nanoscale*
   The fundamentals of energy dynamics and excitations unique to the nanoscale and quantum materials are discovered from atomic scale spectroscopies and transport.
2. *Atomic structure of oxide surfaces and interfaces*
   Understanding and control of properties in oxide thin films and interfaces depend critically on the atomic structure, which we explore using scanning tunneling and non-contact force microscopies.

3. *Domain Engineering: Ferroelectrics*
   Extensions of Piezoresponse Force Microscopy are used to examine switching, domain growth, and domain control in thin film ferroelectrics.
4. *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.

Patents

Semiconductor Composition Containing Fe, Dy, and Tb, R. C. Pooser, B. J. Lawrie, A. P. Baddorf, A. Malasi, H. Taz, A. Farah, R. Kalyanaraman, G. Duscher, M. Patel, 2017 U.S. Patent 9,773,876.

Ferroelectric Tunneling Element and Energy Applications Which Utilize the Tunneling Element, S. V. Kalinin, H. M. Christen, A. P. Baddorf, and V. Meunier, 2010, U.S. Patent 7,759,713.

Ultra-high Density Ferroelectronic Storage and Lithography by High Order Ferroic Switching, S. V. Kalinin, A. Gruverman, Junsoo Shin, H. N. Lee, H. M. Christen, A. P. Baddorf, E. Karapetian, and M. Kachanov, 2006, U.S. Patent 7,292,768.

Selected Peer-Reviewed Publications: (total 152, *h*-index 42, citations 5,726)

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Arthur P. Baddorf, Adam J. Rondinone, and Dake K. Hensley, "Work Function Measurements of Clean and Modified Carbon Nanospikes," accepted in *Carbon*, 2020.

Rama K. Vasudevan, Hemant Dixit, Alexander Tselev, Liang Qiao, Tricia Meyer, Valentino R. Cooper, Arthur P. Baddorf, Ho-Nyung Lee, P. Ganesh, and Sergei V. Kalinin, "Surface reconstructions and modified surface states in $La_{1-x}Ca_xMnO_3$," *Physical Review Materials* **2**, 104418 (2018).

Y. Song, D. Johnson, R. Peng, D. K. Hensley, P. V. Bonnesen, L. Liang, J. Huang, F. Yang, F. Zhang, R. Qiao, A. P. Baddorf, T. J. Tschaplinski, N. L. Engle, M. C. Hatzell, Z. Wu, D. A. Cullen, H. M. Meyer III, B. G. Sumpter, A. J. Rondinone, "A Physical Catalyst for the Electrolysis of Nitrogen to Ammonia," *Science Advances* **4** e1700336 (2017).

Chuanxu Ma, Zhongcan Xiao, Alex A Puretzky, Arthur P Baddorf, Wenchang Lu, Kunlun Hong, J. Bernholc, An-Ping Li, "Oxidization stability of atomically precise graphene nanoribbons," *Physical Review Materials*, **2**, 014006 (2018).

Ivan Vlassiouk, Yijing Stehle, Pushpa Raj Pudasaini, Raymond R. Unocic, Philip D. Rack, Arthur P. Baddorf, Ilia N. Ivanov, Nickolay V. Lavrik, Frederick List, Nitant Gupta, Ksenia Bets, Boris I. Yakobson, and Sergei Smirnov, "Evolutionary Selection in Growth of Single Crystal Continuous Graphene Films," *Nature Materials* **17**, 318 (2018).

Saban M. Hus, X.-G. Zhang, Giang D. Nguyen, Arthur P. Baddorf, Yong P. Chen and An-Ping Li, "Detection of Spin-Chemical Potential in Topological Insulators Using Spin-Polarized Four-Probe STM," *Physical Review Letters* **119**, 137202 (2017).

M. Ziatdinov, A. Banerjee, A. Maskov, 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 Communications* **7**, 13774 (2016).

Jun Wang, Dan C. Sorescu, Seokmin Jeon, Alexei Belianinov, Sergei V. Kalinin, Arthur P. Baddorf, and Petro Maksymovych, "Atomic intercalation to measure adhesion of graphene on graphite," *Nature Communications* **7**, 13263 (2016).

Chuanxu Ma, Jewook Park, Lei Liu, Yong-Sung Kim, Mina Yoon, Arthur P. Baddorf, Gong Gu, An-Ping Li, "Interplay between intercalated oxygen superstructures and monolayer h-BN on Cu(110)," *Phys. Rev B* **94**, 064106 (2016).

Z. Gai, W. Lin, J. D. Burton, K. Fuchigami, P. C. Snijders, T. Z. Ward, E. Tsymbal, J. Shen, S. Jesse, S. V. Kalinin, and A. P. Baddorf, "Chemically-induced Jahn-Teller ordering on manganite surfaces," *Nature Com.*, **5**, 4528 (2014).

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).

P. Maksymovych, A. N. Morozovska, P. Yu, E. A. Eliseev, Y.-H. Chu, R. Ramesh, A. P. Baddorf, and S. Kalinin, "Tunable Metallic Conductance in Ferroelectric Nanodomains," *Nano Lett.*, **12**, 209 (2012).