

Heath R. Kersell

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Chemical, Biological, and Environmental Engineering | Oregon State University | Corvallis, Oregon

EDUCATION & EXPERIENCE

2021 – Present	Res. Assoc.	Chem. Biol. Envir. Engin.	Oregon State University
2019 – 2021	Postdoc	Advanced Light Source	Lawrence Berkeley National Laboratory
2016 – 2018	Postdoc	Materials Sciences Division	Lawrence Berkeley National Laboratory
2011 – 2015	Ph.D.	Condensed Matter Physics	Ohio University
2008 – 2011	M.S.	Condensed Matter Physics	Ohio University
2003 – 2008	B.S.	Physics	Ohio University

RESEARCH EXPERTISE

- X-ray photoelectron spectroscopy (ultrahigh vacuum and ambient pressure)
- Atomic and nanoscale phenomena at solid-gas interfaces
- Scanning tunneling microscopy (STM) in – UHV to near ambient pressures | 5 K to 300 K
- Synchrotron X-Ray Assisted Scanning Tunneling Microscopy for – nanometer resolution X-ray Absorption Spectroscopy
- Grazing Incidence X-ray scattering
- Interactions and Dynamics of Molecular Systems and Networks

HONORS AND AWARDS

- 2013 Ohio University Condensed Matter and Surface Science Fellowship
- 2012 Midwestern Association of Graduate Schools Distinguished Master's Thesis Award
- 2011 NSF SPIRE Graduate Recipient
- 2008 NSF SPIRE Undergraduate Recipient

INVITED TALKS

- *Chemical and Nanoscale Structural Probes in Ambient Pressures: A Practical Tutorial in AP-XPS and AP-STM*, **Pacific Northwest American Vacuum Society**, Corvallis OR, 09/2021
- *The Role of Vacancies in CO Oxidation by CoO_x-Pt Catalysts: A spectroscopic, structural and theoretical approach*, **American Chemical Society**, Virtual/San Francisco CA, 8/2020
- *Resolving X-ray Based Spectroscopies toward the Sub-nanometer Regime*, **University of California Davis Condensed Matter Seminar**, Davis CA, 03/2019
- *Activity Dependence on Phase and Composition of Oxide and Bimetal Catalysts*, **Advanced Light Source User Meeting**, Berkeley CA, 10/2018

PUBLICATIONS

1. H. P. Martins, G. Conti, I. Cordova, L. Falling, **H. Kersell**, F. Salmassi, E. Gullikson, I. Vishik, C. Baeumer, P. Naulleau, C. M. Schneider, S. Nemsak, *Near total reflection x-ray photoelectron spectroscopy: quantifying chemistry at solid/liquid and solid/solid interfaces*, **J. Phys. D.**, 2021

2. **H. Kersell**, P. Chen, H. Martins, Q. Lu, F. Brausse, B.-H. Liu, M. Blum, S. Roy, B. Rude, A. Kilcoyne, H. Bluhm, S. Nemšák, *Simultaneous ambient pressure X-ray photoelectron spectroscopy and grazing incidence X-ray scattering in gas environments*, **Rev. Sci. Instrum.**, 2021
3. **H. Kersell**, Z. Hooshmand, G. Yan, D. Le, H. Nguyen, B. Eren, C. H. Wu, I. Waluyo, A. Hunt, S. Nemšák, G. Somorjai, T. S. Rahman, P. Sautet, Miquel Salmeron, *CO oxidation mechanisms on CoO_x-Pt thin films*, **J. Am. Chem. Soc.**, 2020
4. C. R. O'Connor, M. A. van Spronsen, T. Egle, F. Xu, **H. Kersell**, J. Oliver-Meseguer, M. Karatok, M. Salmeron, R. J. Madix, C. M. Friend, *Dramatic rate enhancement at restructuring interfaces*, **Nat. Commun.**, 2020
5. C. Morales, D. Díaz-Fernández, P. Prieto, C. Escudero, V. Pérez-Dieste, J. Méndez, A. del Campo, P. Ashby, Y.-H. Lu, **H. Kersell**, M.B. Salmeron, L. Soriano, *Nanochannels, nanostrips, and nanorings: an in-situ study of the carbon gasification reaction of highly oriented pyrolytic graphite promoted by cobalt oxides*, **Carbon**, 2020
6. I. Orozco, E. Huang, R. A. Gutiérrez, Z. Liu, F. Zhang, M. Mahapatra, J. Kang, **H. Kersell**, S. Nemsak, P. Ramírez, S. D. Senanayake, P. Liu, J. A. Rodriguez, *Hydroxylation of ZnO/Cu(111) Inverse Catalysts under Ambient Water Vapor and the Water-gas Shift Reaction*, *accepted*, **J. Phys. D**, 2019
7. M. A. van Spronsen, K. Daunmu, C. R. O'Connor, T. Egle, **H. Kersell**, J. Oliver-Meseguer, M. B. Salmeron, R. J. Madix, P. Sautet, and C. M. Friend, *Dynamics of Surface Alloys: Rearrangement of Pd/Ag(111) Induced by CO and O₂*, **J. Phys. Chem. C**, 2018
8. Y. Li, A. T. Ngo, A. DiLullo, K. Z. Latt, **H. Kersell**, B. Fisher, P. Zapol, S. E. Ulloa, and S.-W. Hla, *Anomalous Kondo resonance mediated by semiconducting graphene nanoribbons in a molecular heterostructure*, **Nat. Commun.**, 2017
9. B. Eren, **H. Kersell**, R. S. Weatherup, C. Heine, E. J. Crumlin, C. M. Friend, and M. B. Salmeron, *Structure of the Clean and Oxygen-Covered Cu(100) Surface at Room Temperature in the Presence of Methanol Vapor in the 10-200 mTorr Pressure Range*, **J. Phys. Chem. B**, 2017
10. **H. Kersell**, N. Shirato, M. Cummings, H. Chang, D. Miller, D. Rosenmann, S.-W. Hla, and V. Rose, *Detecting Element Specific Electrons from a Single Cobalt Nanocluster with Synchrotron X-Ray Scanning Tunneling Microscopy*, **Appl. Phys. Lett.**, 2017
11. M. Cummings, N. Shirato, **H. Kersell**, H. Chang, D. Rosenmann, J. W. Freeland, S.-W. Hla, and V. Rose, *Controlled Modulation of Hard and Soft X-ray Induced Tunneling Current Utilizing Coaxial Metal-Insulator-Metal Probe Tips*, **J. Appl. Phys.**, 2017
12. Y. Zhang, **H. Kersell**, R. Stefak, J. Echeverria, V. Iancu, U.G.E Perera, Y. Li, A. Deshpande, K.-F. Braun, G. Rapenne, C. Joachim, and S.-W. Hla, *Simultaneous and Coordinated Rotational Switching of all Molecular Rotors in a Network*, **Nat. Nanotechnol.**, 2016
13. J. Niederhausen, **H. R. Kersell**, C. Christodoulo, G. Heimel, H. Wonneberger, K. Müllen, J. P. Rabe, S.-W. Hla, and N. Koch, *Monolayer Phases of a Dipolar Perylene Derivative on Au(111) and Surface Potential Built-Up in Multilayers*, **Langmuir**, 2016
14. A. DiLullo, N. Shirato, M. Cummings, **H. Kersell**, H. Chang, D. Rosenmann, D. Miller, J. Freeland, S.-W. Hla, V. Rose, *Local X-ray Magnetic Circular Dichroism Study of Fe/Cu(111) Using a Tunneling Smart Tip*, **J. of Synchrotron Rad.**, 2016

15. N. Shirato, M. Cummings, **H. Kersell**, Y. Li, D. Miller, D. Rosenmann, S.-W. Hla, and V. Rose, *Hard X-ray beam damage study of monolayer islands using SX-STM*, **Mater. Res. Soc. Symp. Proc.**, 2015
16. N. Shirato, M. Cummings, **H. Kersell**, Y. Li, B. Stripe, D. Rosenmann, S.-W. Hla, V. Rose, *Elemental fingerprinting of materials with sensitivity at the atomic limit*, **Nanolett.**, 2014
17. U.G.E. Perera, F. Ample, **H. Kersell**, Y. Zhang, G. Vives, J. Echeverria, M. Grisolia, G. Rapenne, C. Joachim, and S.-W. Hla, *Controlled clockwise and anticlockwise rotational switching of a molecular motor*, **Nat. Nanotechnol.**, 2013

RESEARCH EXPERIENCE

2021 – Present Oregon State University

Research Associate

- Perform and support investigations into solid-gas interfaces

2016 – 2021 Lawrence Berkeley National Laboratory

Postdoctoral Fellow

- Investigated in-situ structure and chemistry of patterned metallic arrays on oxide substrates, porous oxide-polymer hybrid nanocomposites, and ALD grown films using NAP-XPS & GIXS.
- Designed, constructed, commissioned, and used a new system combining Near Ambient Pressure X-ray Photoelectron Spectroscopy (NAP-XPS) with Grazing Incidence X-ray Scattering (GIXS).
- Prepared the above combined NAP-XPS/GIXS system for user experiments.
- Developed ultrathin bimetal, oxide, and alloy model systems to investigate atomic scale phenomena at solid-gas interfaces *in-situ* using High Pressure Scanning Tunneling Microscopy (HPSTM).
- Characterized chemical properties of above model systems *in-situ* using Ambient Pressure X-ray Photoelectron Spectroscopy (APXPS) to understand structure-activity-relationships.

2014 – 2015 Argonne National Laboratory, Center for Nanoscale Materials

Research Assistant

- Examined magnetic interactions of metalloporphyrins with metal surfaces and with graphene nanoribbons.
- Established the use of Synchrotron X-ray assisted STM (SXSTM) for measuring X-ray absorption spectroscopy with two nanometer lateral resolution, and for XMCD on individual nanoscale structures, and studied X-ray standing wave phenomena in SXSTM.
- Designed custom UI software for analysis of synchrotron X-ray assisted STM data.

2013 Ohio University, Department of Physics and Astronomy

Research Assistant

- Demonstrated symmetry effects on properties of dipolar molecular motor networks.
- Established threshold tip-molecule dissociation interactions for molecular networks on Ag(111) through tip induced field-dipole interactions.
- Probed elemental sensitivity in SXSTM with 2 nm lateral resolution via core level electron excitations.
- Measured X-ray absorption cross sections for individual nanoscale structures during beamtimes at the Advanced Photon Source (APS).

- 2012 Argonne National Laboratory, Center for Nanoscale Materials**
Research Assistant
Worked with Electronic & Magnetic Materials & Devices group for 10 months.
- Designed and built UHV system for laser assisted, low temperature STM.
 - Designed the first of its kind **Low Temperature–Synchrotron X-ray assisted–STM (LT-SXSTM)** for coupling synchrotron X-rays into STM tip–sample junction at low temperature.
 - Investigated X-ray photoabsorption for atomic islands on metal substrates with SXSTM at the APS.
- 2011 Summer – Humboldt University, Berlin, Germany**
- Characterization of dipolar molecular monolayers on metal surfaces in the Department of Physics, Humboldt University, Berlin, Germany.
- 2009 – 2011 Ohio University, Department of Physics and Astronomy**
Research Assistant
- Established controlled directional rotation in molecular systems via inelastic electron tunneling in STM & investigated the effects of molecular potentials on rotational motion.
 - Probed coupled molecular motor interactions, molecule–substrate adsorption and diffusion properties, and inelastic electron tunneling induced molecular switching.
- 2008 Summer – University of Hamburg, Institute for Applied Physics, Germany**
- Traveled to Hamburg, Germany for 10-week undergraduate research experience (as the first UG student awarded travel to Germany under an NSF-PIRE program) in Prof. Roland Wiesendanger’s group at the Institute for Applied Physics, Hamburg University, Hamburg, Germany.

SELECTED PRESENTATIONS

- *A Simultaneous Probe for Chemical and Structural Transformations in Ambient Pressure Environments*, **7th Annual Ambient pressure X-ray Photoelectron Spectroscopy workshop**, Virtual/Pohang South Korea, 12/2020
- *Resolving X-ray Based Spectroscopies in the Sub-nanometer Regime: Atomic Scale Insights into CO Adsorption on Thin Film Surfaces*, **American Vacuum Society**, Columbus OH, 10/2019
- *The nature of active sites for room temperature CO oxidation on CoO-Pt catalysts*, **International Conference on Vacuum Ultraviolet and X-ray Physics (VUVX)**, San Francisco CA, 7/2019
- *Synchronized and Coupled Rotation of Molecular Machines*, **International Workshop on Nanoscale Spectroscopy and Nanotechnology (NSS8)**, 07/2014.
- *Development of Synchrotron X-ray Assisted STM*, **American Vacuum Society**, Long Beach CA, 10/2013.
- *Directionally controlled switching of a molecular rotor*, **Ohio Regional Meeting of the American Physical Society**, Athens OH, 03/2013
- *Investigations on the complex rotations of molecular nanomachines*, Annual Meeting of the **Midwestern Association of Graduate Schools**, Chicago IL, 04/2012.
- *Complex Rotation Mechanisms of a Molecular Machine Probed by STM*, **American Vacuum Society**, Nashville TN, 11/2011.
- *4Fc3SeT Molecular Rotors: Mechanism of Rotation*, **SPIRE Summit Workshop**, Hamburg, Germany, 07/2011.

- *Low Temperature STM Manipulation of a Molecular Rotor*, **American Physical Society**, Portland OR, 03/2010.

TEACHING

2008 – 2013 **Ohio University, Department of Physics and Astronomy**
Teaching Assistant (Fall 2008 – Fall 2010, Fall 2011, Spring 2013)

PROFESSIONAL SOCIETIES

American Chemical Society

American Vacuum Society