Rachael G. Farber

The University of Chicago | Department of Chemistry and The James Franck Institute
929 E 57th Street | Chicago, IL 60637
(773) 702-7207 | rgf33@uchicago.edu

EDUCATION AND EMPLOYMENT

Kadanoff-Rice Postdoctoral Fellow, The University of Chicago — May 2018 - Present
Laboratory of: Prof. Steven J. Sibener, Department of Chemistry and The James Franck Institute

Ph.D. Loyola University Chicago — 2018
Laboratory of: Prof. Dan Killelea, Department of Chemistry and Biochemistry
Thesis: Structural and Chemical Consequences of High Oxygen Coverages on Rh(111)

B.S. Case Western Reserve University, Cleveland, OH — 2013
Major: Chemistry

AREAS OF EXPERTISE

Surface science, ultra-high vacuum science and technology, fundamental heterogeneous catalysis, fundamental superconducting radio frequency material growth and characterization

RESEARCH EXPERIENCE

The University of Chicago — May 2018 - Present
Department of Chemistry and The James Franck Institute
Chicago Materials Research Center Kadanoff-Rice Postdoctoral Fellow, Laboratory of: Prof. Steven J. Sibener, Ph.D.

- Investigated the rate of growth mechanism of niobium (Nb) hydride formation and the effect of nitrogen incorporation on Nb hydride formation
- Designed and constructed a tin (Sn) electron-beam evaporation chamber
- Ongoing investigations into the mechanism for Sn incorporation on Nb to form Nb_3Sn

Loyola University Chicago — Spring 2014 - Spring 2018
Department of Chemistry and Biochemistry
Graduate Researcher, Laboratory of: Prof. Dan Killelea, Ph.D.

- Determined the water structure formation on highly stepped platinum (Pt) surfaces
- Characterized oxide phases on rhodium (Rh) and silver (Ag) surfaces
- Elucidated the influence of dissolved oxygen on surface structures and reactivity of Rh and Ag surfaces

Case Western Reserve University — Spring 2011 – Spring 2013
Department of Chemistry
Undergraduate Researcher, Laboratory of: Prof. James Burgess, Ph.D.

- Studied methods to increase myoglobin detection limits
- Developed a method to fabricate 10 μm carbon electrodes to detect cholesterol levels in cell membranes

FELLOWSHIPS & AWARDS

- Chicago Materials Research Center Kadanoff-Rice Fellowship, The University of Chicago Postdoctoral Fellow 2018
- Anna Louise Hoffman Award for Outstanding Achievement in Graduate Research, Iota Sigma Pi 2018
- The Dumbach Award for Excellence in Chemistry, Loyola University Chicago 2018
- Morton M. Traum Surface Science Student Award, AVS 64th International Symposium and Exhibition 2017
- Nellie Yeoh Whetten Award, AVS 64th International Symposium and Exhibition 2017
- Arthur J. Schmitt Dissertation Fellowship 2017
- Best Graduate Student Poster, Third place, AVS Prairie Chapter Symposium 2015

TEACHING EXPERIENCE

The University of Chicago May 2018 – Present

- Co-mentoring a graduate student at Cornell University through the Center for Bright Beams regarding materials chemistry and Nb_3Sn growth procedures
- Mentored 2 graduate students and 1 undergraduate student on scanning tunneling microscopy techniques, ultra-high vacuum science and technology, and data processing techniques
- Assisted 1 graduate student in their Ph.D. candidacy preparation including research proposal revisions and oral presentation guidance

Loyola University Chicago Fall 2013 - Fall 2016

- Teaching assistant for General Chemistry Laboratory (majors and non-majors) and Physical Chemistry Laboratory courses
- Guest lecturer for Physical Chemistry (Thermodynamics) in Fall 2014, 2015, and 2016
- Directly mentored 1 junior graduate student and 2 undergraduate students whose lab contributions resulted in authorship on peer reviewed journal articles

LEADERSHIP AND OUTREACH

Conference and Scientific Community Leadership

Scientific Organization and Community

- *Co-chair*, AVS Early Career Professionals Committee Summer 2019-present
- *Guest Editor and Special Topic Organizer* January 2021-present
  - *JVST A* Special Topic Collection: Celebrating the Early Career Professionals Contributing to the Advancement of Thin Films, Surfaces, Interfaces, and Plasmas
- *Committee member*, Conference for Undergraduate Women in Physics (CUWiP), University of Chicago 2019-2020

Discussion Leader and Moderator

- Virtual International Workshop on Nb_3Sn SRF Science, Technology, and Applications (Nb3SnSRF'20) 2020
- AVS 67 Virtual Showcase, Professional Development Session 2020
- Gordon Research Seminar, Dynamics at Surface, Newport, RI 2019
- AVS Prairie Chapter Symposium, Chicago, IL 2018
- Gordon Research Seminar, Chemical Reactions at Surfaces, Lucca, Italy 2017
- Gordon Research Seminar, Dynamics at Surface, Newport, RI 2015

Chair and Co-Chair

- *Invited organizer*, AVS 67th International Symposium and Exhibition, Panel Discussion with the Leaders in Energy and the Environment Focus Topic 2021
- *Nominated co-chair,* AVS 66th International Symposium and Exhibition, Energy Transition Leaders Focus Topic 2018-2019
- *Elected Chair*, 2017 Gordon Research Seminar, Dynamics at Surfaces 2015-2017

Seminar Committee Member

- Center for Bright Beams Seminar Committee Spring 2019-Present
- James Franck Institute Women in Science, University of Chicago Fall 2018-Present

Community Outreach

The University of Chicago

- Physics with a Bang lab demonstration Winter 2018
- Physics with a Bang lab demonstration Winter 2019

Loyola University Chicago

- Emerging Scientists Workshop Fall 2017
- Emerging Scientists Workshop Fall 2014

Chicago Public School System

- Senn High School; In-class chemistry lab support Spring 2015, 2016, 2017
- Murray Language Academy; scientific demonstration Fall 2019

PRESENTATIONS

Invited Oral Presentations

1) AVS 67th International Symposium and Exhibition, Charlotte, NC, *2021* "Towards a Mechanistic Understanding of Next-Generation Particle Accelerator Materials Growth: Nb Hydride Growth and Suppression and Nb3Sn Formation on (3×1)-O Nb(100)"
2) Loyola University Chicago, Department Seminar (Virtual), Chicago, IL *2020* "Understanding the Surface Chemistry of Next-Generation Particle Accelerator Materials: Oxidized Nb(100) as a Model System"
3) Gordon Research Conference, Dynamics at Surfaces, Newport, RI, *2019* "STM Studies of the Growth and Suppression Mechanisms of Niobium Hydrides for Next Generation Superconducting RF Accelerators and Light Sources"
4) Center for Bright Beams Annual Meeting, Cornell University, Ithaca, NY, *2019* "STM Studies of the Growth and Suppression Mechanisms of Niobium Hydrides for Next Generation Superconducting RF Accelerators and Light Sources"
5) JFI Postdoctoral Seminar, The University of Chicago, Chicago, IL, *2019* "Atomic-Scale Growth Mechanism of Niobium Hydrides on Hydrogen Infused Nb(100)"
6) Iota Sigma Pi – Aurum Iota Initiation, DePaul University, Chicago, IL *2019* "Understanding Surface Mediated Chemistry at the Atomic Scale: From Heterogeneous Catalysis to Particle Accelerator Technology"
7) Loyola University Chicago, Department Seminar, Chicago, IL *2017* "Structural and Chemical Consequences of High Oxygen Coverages on Rh(111)
8) Leiden Institute of Chemistry, Catalysis and Surface Chemistry, The Netherlands *2017* "High Oxygen Coverages on Ag(111) and Rh(111): Surface Structures and Reactivity"

Oral Presentations

1) International Workshop on Nb_3Sn SRF '20, Virtual Workshop, *2020* "Spatially Resolved Adsorption Structures and Diffusion Dynamics of Sn on (3×1)-O Nb(100)"
2) AVS 66th International Symposium and Exhibition, Columbus, OH, *2019* "Atomic-Scale Growth Mechanisms of Niobium Hydrides on Hydrogen Infused Nb(100)"
3) 2019 AVS Prairie Chapter Symposium, Urbana-Champaign, IL, *2019* "Nano-Scale Characterization of the Growth and Suppression Behavior of Niobium Hydrides for Next Generation Superconducting RF Accelerators and Light Sources"
4) Catalysis Club of Chicago 2018 Spring Symposium, Naperville, IL, *2018* "Structural and Chemical Consequences of High Oxygen Coverages on Rh(111)"
5) AVS 64th International Symposium and Exhibition, Tampa, FL, *2017* "Structural Consequences of High Oxygen Coverages on Rh(111)"
6) 2017 AVS Prairie Chapter Symposium, Milwaukee, WI, *2017* "Structural Consequences of High Oxygen Coverages on Rh(111)"
7) AVS 63rd International Symposium and Exhibition, Nashville, TN, *2016* "Step-Type Selective Oxidation on Pt Surfaces"
8) AVS 62nd International Symposium and Exhibition, San Jose, CA, *2015* "Submonolayer Water Adsorption on Stepped and Planar Pt Surfaces"
9) American Chemical Society Regional Conference. Grand Rapids, MI, *2015* "Atomic Oxygen on Ag(111) and Rh(111)"

Poster Presentations

1) 2021 International Conference on RF Superconductivity, Virtual Meeting, *2021* "Visualization of Sn Adsorption Behavior and Thermally Driven Diffusion Pathways on (3×1)-O Nb(100)"
2) Gordon Research Seminar, Dynamics at Surfaces, Newport, RI, *2019* "STM Studies of the Growth and Suppression Mechanisms of Niobium Hydrides for Next Generation Superconducting RF Accelerators and Light Sources"
3) AVS 65th International Symposium and Exhibition, Long Beach, CA, *2018*; "Oxidation of Nb(100) and Kinetics of Surface to Bulk Transport and Extension to Nb_3Sn"
4) 2018 AVS Prairie Chapter Symposium, Chicago, IL, *2018* "Oxygen Dissolution on Nb(100) and *In Situ* Nb_3Sn Growth Mechanisms"
5) AVS 64th International Symposium and Exhibition, Tampa, FL, *2017* "Structural Consequences of High Oxygen Coverages on Rh(111)"
6) 2017 AVS Prairie Chapter Symposium, Milwaukee, WI, *2017* "Structural Consequences of High Oxygen Coverages on Rh(111)"
7) Gordon Research Conference, Dynamics at Surfaces, Newport, RI, *2017* "Structural and Chemical Consequences of High Oxygen Coverages on Rh(111)"
8) Gordon Research Conference and Seminar, Chemical Reactions at Surfaces, Lucca, Italy, *2017* "Structural Consequences of Increased Oxygen Incorporation in Rh Surfaces"
9) 2016 AVS Prairie Chapter Symposium, Chicago, IL, *2016* "Step-Type Selective Oxidation on Pt Surfaces"
10) 2015 AVS Prairie Chapter Symposium, Notre Dame, IN, *2015* "Water Structures Formed on Pt(111) and Pt(553) Surfaces"
11) Gordon Research Conference and Seminar, Dynamics at Surfaces, Newport, RI, *2015* "Water Structures Formed on Pt(111) and Pt(553) Surfaces"

12) 2014 AVS Prairie Chapter Symposium, Chicago, IL, *2014* "Water Structures on Pt(111)"
13) 74th Physical Electronics Conference, La Crosse, WI, *2014* "Water Structures on Pt(111)"

PUBLICATIONS

1) **R. G. Farber**, Z. Sun, N. Majernik, O. Chubenko, and R. Roussel, "Expanding Accelerator Capabilities with the Center for Bright Beams", *APS Division of Physics of Beams Annual Newsletter*, 2021 (**Invited article**)
2) **R. G. Farber**, S. A. Willson, and S. J. Sibener, "The Influence of Nano-Scale Surface Defects on Sn Adsorption and Diffusion Behavior on Oxidized Nb(100)", *In Preparation* (**2021**)
3) **R. G. Farber**, S. A. Willson, A. Hire, R. Hennig, and S. J. Sibener, "Visualization of Sn Adsorption and Diffusion Pathways on Oxidized Nb(100)", *In Preparation* (**2021**)
4) M. E. Turano, E. A. Jamka, M. Z. Gillum, K. D. Gibson, **R. G. Farber**, W. Walkosz, S. J. Sibener, R. A. Rosenberg, and D. R. Killelea, "Emergence of Subsurface Oxygen on Rh(111)", *Journal of Physical Chemistry Letters* **2021**, *12*, 5844-5849
5) A. A. McMillan, J. D. Graham, S. A. Willson, **R. G. Farber**, C. J. Thompson, and S. J. Sibener, *Superconductor Science and Technology* **2020**, *33*, 105012
6) R. D. Veit*, **R. G. Farber***, N. S. Sitaraman, T. A. Arias, and S. J. Sibener, "Nano-Scale Characterization of Niobium Hydride Growth and Suppression Behaviors on Nb(100)", *The Journal of Chemical Physics* **2020**, *152*, 214703 (*Denotes dual authorship, **Invited article**)
7) M. E. Turano, **R.G. Farber**, G. Hildebrandt, and D. R. Killelea; "Temperature Dependence of CO Oxidation on Rh(111) by Adsorbed Oxygen", *Surface Science* **2020**, *695*, 121573
8) M. E. Turano, **R. G. Farber**, E. C. N. Oskorep, R. A. Rosenberg, and D. R. Killelea; "Characterization of Oxygenaceous Species Formed by Exposure of Ag(111) to Atomic Oxygen", *The Journal of Physical Chemistry C* **2020**, *124*, 1382-1389
9) N. S. Sitaraman, T. A. Arias, M. U. Liepe, J. T. Maniscalco, R. D. Veit, **R. G. Farber**, and S. J. Sibener, "Ab Initial Calculations on Impurity Doped Niobium and Niobium Surfaces, in *International Conference on RF Superconductivity (SRF)* 2019, *Dresden, Germany* **2019**
10) R. D. Veit, N. A. Kautz, **R. G. Farber**, and S. J. Sibener, "Oxygen Dissolution and Surface Oxide Reconstructions on Nb(100)", *Surface Science* **2019**, *688*, 63-68
11) **R. G. Farber**, M. E. Turano, and D. R. Killelea, "Identification of Surface Sites for Low-Temperature Heterogeneously Catalyzed CO Oxidation on Rh(111)", *ACS Catalysis* **2018**, *8*, 11483-11490
12) **R. G. Farber**, M. E. Turano, E. C. N. Oskorep, N. T. Wands, E. V. Iski, and D. R. Killelea, "The Quest for Stability: Structural Dependence of Rh(111) on Oxygen Coverage at Elevated Temperature", *The Journal of Physical Chemistry C* **2017**, *121*, 10470-10475
13) **R. G. Farber**, M. E. Turano, E. C. N. Oskorep, N. T. Wands, L. B. F. Juurlink, and D. R. Killelea, "Exposure of Pt(553) and Rh(111) to Atomic and Molecular Oxygen: Do Defects Enhance Subsurface Oxygen Formation?", *Journal of Physics: Condensed Matter* **2017**, *29*, 164002
14) C. Badan, **R. G. Farber**, Y. Heyrich, M. T. M. Koper, D. R. Killelea, and L. B. F. Juurlink, "Step-Type Selective Oxidation of Pt Surfaces", *The Journal of Physical Chemistry C* **2016**, *120*, 22927-22935
15) J. Derouin, **R. G. Farber**, M. E. Turano, E. V. Iski, and D. R. Killelea, "Thermally Selective Formation of Subsurface Oxygen in Ag(111) and Consequent Surface Structures", *ACS Catalysis* **2016**, *6*, 4640-4646

16) M.J. Kolb, **R.G. Farber**, J. Derouin, C. Badan, F. Calle-Vallejo, L.B.F. Juurlink, D.R. Killelea, M.T.M. Koper; "Double Stranded Water on Stepped Platinum Surfaces" *Physical Review Letters* **2016**, *116*,136101 (**Cover**)
17) J. Derouin, **R.G. Farber**, S.L. Heslop, and D.R. Killelea; "Formation of Surface Oxides and Ag_2O Thin Films with Atomic Oxygen on Ag(111)", *Surface Science* **2015**, *641*, L1-5 (**Cover**)
18) J. Derouin, **R.G. Farber**, and D.R. Killelea; "Combined STM and TPD Study of Rh(111) Under Conditions of High Oxygen Coverage", *The Journal of Physical Chemistry C* **2015**, *119*, 14748-14755
19) V.A. Valencia, A.A. Thaker, J. Derouin, D.N. Valencia, **R.G. Farber**, D.A. Gebel, and D.R. Killelea; "Preparation of Scanning Tunneling Microscopy Tips Using Pulsed Alternating Current Etching", *Journal of Vacuum Science and Technology A* **2015**, *33*, 023001

PROFESSIONAL ASSOCATIONS

- AVS 2014-Present
- Iota Sigma Pi – National Honor Society for Women in Chemistry 2018-Present