

Nicole K. Richards-Henderson

CONTACT INFORMATION

Chemical Sciences Division
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EDUCATION

Ph.D., Chemistry; Emphasis in Chemical Material Physics (2007-2011)

University of California Irvine

Ph. D. Dissertation: "Laboratory Studies of the Thermal and Photochemical Oxidation of Sea Salt Aerosols"

Research Advisor: Prof. Barbara J. Finlayson-Pitts

Master of Science, Chemistry; Emphasis in Chemical Material Physics (2007-2010)

University of California Irvine

Masters' Thesis: Enhanced Nitrate Ion Photolysis in the Presence of Bromide

Research Advisor: Prof. Barbara J. Finlayson-Pitts

Bachelor of Science, Chemistry; Minor in Physics (2003-2007; Honors)

University of California Santa Cruz

Undergraduate Thesis: Surface Enhanced Raman Scattering of Peptide

Research Advisor: Prof. Jin Zhang

RESEARCH

Postdoctoral Scholar (April 2014-Present)

Chemical Sciences Division, Lawrence Berkeley National Laboratory

Research Advisor: Dr. Kevin Wilson

- Studying heterogeneous reactions of liquid and solid organic aerosol with gas-phase oxidants.

Postdoctoral Scholar (March 2012-March 2014)*

Department of Land, Air, and Water Resources, University of California Davis

Research Advisor: Prof. Cort Anastasio

- Extracted ambient particles in a cell-free, surrogate lung fluid and measuring levels of reactive oxygen species (ROS) production.
- Characterized the ability of biogenic volatile organic compounds (BVOCs) to form secondary organic aerosol (SOA) via aqueous-phase reactions.
- Collected fog samples during a three month field campaign in Davis, CA

*Still currently affiliated.

Assistant Research Specialist-level 2 (December 2011-March 2012)

Department of Chemistry, University of California Irvine

Research Advisor: Prof. Barbara J. Finlayson-Pitts

- Developed novel techniques to generate and characterize organic coated sodium chloride aerosols.

Graduate Research Assistant (February 2008-December 2011)

Department of Chemistry, University of California Irvine

Research Advisor: Prof. Barbara J. Finlayson-Pitts

- Used interface mechanisms to understand the enhanced photochemical oxidation of sea salt particles with added nitrate to form NO_x and halogen gases.

Undergraduate Research Assistant (June 2005-June 2007)

Department of Chemistry, University of California Santa Cruz

Research Advisor: Prof. Jin Zhang

- Used Raman and surface enhanced Raman techniques to determine the vibrational structure of simple proteins coordinated to nano-particles.

FELLOWSHIPS/HONORS

- *NASA Postdoctoral Program Fellowship*, Ames, (2012, declined)
- *Regents' Dissertation Fellowship*, University of California Irvine (2011)
- *Division of Physical Chemistry poster award at 241th National Meeting of American Chemical Society*, Anaheim (2011)
- *Travel Grant*, University of California Irvine (2008, 2009 and 2011)
- *Graduate Assistance in Areas of National Need Fellow*, University of California Irvine (2007-2008)
- *University of California Leadership Excellence through Advanced Degrees Fellow*, University of California Santa Cruz (2005-2007)

PROFESSIONAL SERVICE

- Journal reviewer for Atmospheric Environment, Environmental Science and Technology, and Atmospheric Chemistry and Physics.
- Evaluated applications for UC Davis postdoctoral travel award.
- Evaluated paper presentations for Outstanding Student Paper Awards at AGU.

AFFILIATIONS

- American Geophysical Union
- American Chemistry Society
- American Association for Aerosol Research

RELEVANT TEACHING EXPERIENCE

TRAINING

- Trained five undergraduate students in data analysis and analytical instrumentation.

TEACHING AND TUTORING

Laboratory Instructor for AirUCI Annual Summer Science Teacher Training Program (June 2009-July 2009)

Department of Chemistry, University of California Irvine

- Supervised laboratory component of AirUCI Summer Teacher Workshop in environmental chemistry, focused on gas chromatography of gasoline.

Graduate Teaching Assistant

Department of Chemistry, University of California Irvine

- *Chem 11L* General Chemistry Laboratory (Winter 2008) - Lectured at weekly recitation sections and demonstrated experiments. Graded problem lab reports and tests.
- *Chem 152* Advanced Analytical Chemistry (Winter 2009) - Demonstrated experiments and taught students analytical techniques. Graded problem sets and tests.
- *Chem 1 C* General Chemistry (Spring 2009) - Prepared and presented selected classroom lectures. Lectured at weekly recitation sections.

Undergraduate Teaching Assistant

Department of Chemistry, University of California Santa Cruz

- *Chem 1B* General Chemistry (Fall 2005, Fall 2006, Winter 2007)
- *Chem 1C* General Chemistry (Winter 2006, Spring 2007)

Education Opportunity Program (EOP) Learning Assistant (September 2004-June 2007)

Department of Chemistry, University of California Santa Cruz

- Tutored introductory chemistry, inorganic chemistry, physical chemistry (quantum mechanics and statistical mechanics), introductory and multivariable calculus and introductory physics.
- Developed workshops for fellow tutors and also did quarterly evaluations of incoming science tutors.

PUBLICATIONS

PUBLISHED

- (1) **Nicole K. Richards-Henderson**, Amie K. Hansel, Kalliat T. Valsaraj, and Cort Anastasio, "Aqueous Oxidation of Green Leaf Volatiles by Hydroxyl Radical as a Source of SOA: Reaction Kinetics." *Atmos. Environ.*, DOI: 10.1016/j.atmosenv.2014.06.026
- (2) Jessica G. Charrier, Alexander S. McFall, **Nicole K. Richards-Henderson**, and Cort Anastasio, "Hydrogen Peroxide Formation in a Surrogate Lung Fluid by Transition Metals and Quinones Present in Particulate Matter." *Environ. Sci. Technol.*, DOI: 10.1021/es501011w
- (3) **Nicole K. Richards-Henderson**, Karen M. Callahan, Paul Nissenson, Noriko Nishino, Douglas J. Tobias and Barbara J. Finlayson-Pitts, "Production of Gas Phase NO₂ and Halogens from the Photolysis of Thin Water Films Containing Nitrate, Chloride and Bromide Ions at Room Temperature." *Phys. Chem. Chem. Phys.*, 15, 17636-17646, 2013. {ref: 2}
- (4) **Nicole K. Richards** and Barbara J. Finlayson-Pitts, "Production of Gas Phase NO₂ and Halogens from the Photochemical Oxidation of Aqueous Mixtures of Sea Salt and Nitrate Ions at Room Temperature." *Environ. Sci. Technol.*, 46 (19), 10447-10454, 2012. {ref: 7}
- (5) **Nicole K. Richards**, Lisa M. Wingen, Karen M. Callahan, Noriko Nishino, Michael T. Kleinman Douglas J. Tobias, and Barbara J. Finlayson-Pitts, "Nitrate Ion Photolysis in Thin Water Films in the Presence of Bromide Ion," *J. Phys. Chem. A (Buch Memorial)*, 115 (23), 5810-5821, 2011. {ref: 22}
- (6) Leo Seballos, **Nicole Richards**, Daniel J. Stevens, Mira Patel, Laura Schuresko, Scott Lokey, Glenn Millhauser, and Jin Z. Zhang, "Competitive Binding Effects on Surface-enhanced Raman Scattering of Peptide Molecules", *Chem. Phys. Lett.*, 447, 335-339, 2007. {ref: 14}

SUBMITTED

- (1) **Nicole K. Richards-Henderson**, Crisand Anderson, Cort Anastasio and Barbara J. Finlayson-Pitts, "The Effect of Cations on NO₂ Production from the Photolysis of Thin Water Films Containing Nitrate."
- (2) **Nicole K. Richards-Henderson**, Andrew T. Pham, and Cort Anastasio, "Secondary Organic Aerosol Formation from Aqueous Phase Reactions of Green Leaf Volatiles by Organic Triplet Excited States and Singlet Molecular Oxygen."
- (3) Jessica G. Charrier, **Nicole K. Richards-Henderson**, Keith J. Bein, Alexander S. McFall, Anthony S. Wexler, and Cort Anastasio, "Oxidant production from source-orientated particulate matter – Part 1: Oxidative potential using the Dithiothreitol (DTT) assay."
- (4) **Nicole K. Richards-Henderson**, Jessica G. Charrier, Keith J. Bein, Derek Bau, Anthony S. Wexler, and Cort Anastasio, "Oxidant production from source-oriented particulate matter – Part 2: Hydrogen Peroxide and Hydroxyl Radical. "
- (5) Amie K. Hansel, Franz Ehrenhauser, **Nicole K. Richards-Henderson**, Cort Anastasio, and Kalliat T. Valsaraj, "Aqueous Oxidation of Green Leaf Volatiles by Hydroxyl Radical as a Source of SOA: Product Identification."

IN PREPARATION

- (1) **Nicole K. Richards-Henderson**, and Cort Anastasio, "Secondary Organic Aerosol Formation from Aqueous Phase Reactions of Products of Green Leaf Volatiles by Atmospheric Oxidants."
- (2) **Nicole K. Richards-Henderson**, Neil Willits, Laurel Plummer, Jessica G. Charrier, Kent Pinkerton and Cort Anastasio, "Comparison of Reactive Oxygen Species Measurements from Source Oriented Particulate Matter to Health Endpoints."

- (3) Carol L. Tsai, **Nicole K. Richards-Henderson**, Karen M. Callahan, Barbara J. Finlayson-Pitts and Douglas J. Tobias, “Surface vs. Bulk Nitrate Photolysis in Aqueous Halide Salt Solutions: a Molecular Dynamics Investigation.”
- (4) Karen M. Callahan, Nicole K. Richards-Henderson, and Douglas J. Tobias, “The Effect of Cations on Nitrate Surface Propensity in Aqueous Nitrate Ion Solutions.”

ORAL PRESENTATIONS (presenter in bold)

NATIONAL CONFERENCES

- (1) **Nicole K. Richards** and Cort Anastasio, “Oxidation of Green Leaf Volatiles in Fog Water: Part 2 – Reaction Kinetics.”
245th American Chemical Society, April 2013, New Orleans, LO.
- (2) Barbara J. Finlayson-Pitts, **Nicole K. Richards**, Lisa M. Wingen, Karen M. Callahan, Noriko Nishino, Michael T. Kleinman, Douglas J. Tobias, “Laboratory Studies of Synergistic Photochemical Interactions between Halide Ions and Nitrate (*Invited*).”
American Geophysical Union Conference, December 2011, San Francisco, CA
- (3) **Nicole K. Richards**, Lisa M. Wingen, Karen M. Callahan, Douglas J. Tobias, Barbara J. Finlayson-Pitts, “Enhancement of Nitrate Ion Photolysis by Bromide Ions.”
American Association of Aerosol Research 29th Annual Conference, October 2010, Portland, OR

REGIONAL MEETINGS AND WORKSHOPS

- (1) **Nicole K. Richards-Henderson**, “Laboratory Studies of the Aqueous Phase Formation of SOA and Production of ROS from Ambient PM (*Invited*).”
Sandia National Laboratory, January 2014, Livermore, CA
- (2) **Nicole K. Richards**, **Carol Tsai**, Karen M. Callahan, Lisa M. Wingen, Douglas J. Tobias, Barbara J. Finlayson-Pitts, “Effects of Mixed Chloride/Bromide Ions on Nitrate Ion Photochemistry”
AirUCI Annual Workshop, January 2011, Laguna Beach, CA
- (3) **Nicole K. Richards**, Lisa M. Wingen, Karen M. Callahan, Douglas J. Tobias, Barbara J. Finlayson-Pitts, “Bromide Ion Enhancement of Nitrate Ion Photolysis”
21st Graduate Women in Science Conference, March 2010, Orange, CA
- (4) **Nicole K. Richards**, **Karen M. Callahan**, Lisa M. Wingen, Douglas J. Tobias, Barbara J. Finlayson-Pitts, “Interfacial Ion Distribution in Nitrate Halide Mixtures”
AirUCI Annual Workshop, January 2010, Laguna Beach, CA
- (5) **Nicole K. Richards**, **Karen M. Callahan**, Lisa M. Wingen, John Promlap, Douglas J. Tobias, Barbara J. Finlayson-Pitts, “Bromide Ion Enhancement of Nitrate Ion Photolysis”
AirUCI Annual Workshop, January 2009, Laguna Beach, CA

POSTER PRESENTATIONS (presenter in bold)

NATIONAL CONFERENCES

- (1) **Nicole K. Richards-Henderson**, Amie K. Hansel, Andrew T. Pham, Harasha S. Vempati, Kalliat T. Valsaraj, and Cort Anastasio, “Aqueous Oxidation of Green Leaf Volatiles as a Source of Secondary Organic Aerosol.”
American Geophysical Union Conference, December 2013, San Francisco, CA
- (2) **Nicole K. Richards**, Jessica G. Charrier, Keith J. Bein, Anthony S. Wexler and Cort Anastasio, “Generation of Reactive Oxygen Species from Source-Oriented, Ambient Submicron Particulate Matter in a Cell-free Surrogate Lung Fluid Solution.”
American Association of Aerosol Research 31st Annual Conference, October 2012, Minneapolis, MN
- (3) **Nicole K. Richards**, and Barbara J. Finlayson-Pitts, “Oxidation of Halides in Sea Salt by the Photolysis of Nitrate.”
American Geophysical Union Conference, December 2011, San Francisco, CA

- (4) **Nicole K. Richards**, Lisa M. Wingen, Karen M. Callahan, Douglas J. Tobias and Barbara J. Finlayson-Pitts, “Nitrate Ion Photolysis in Thin Water Films in the Presence of Bromide Ions.”
241st American Chemical Society, March 2011, Anaheim, CA
- (5) **Nicole K. Richards**, Lisa M. Wingen, Karen M. Callahan, Douglas J. Tobias, and Barbara J. Finlayson-Pitts, “Halide Ion Enhancement of Nitrate Ion Photolysis.”
American Geophysical Union Conference, December 2009, San Francisco, CA
- (6) **Nicole K. Richards**, Lisa M. Wingen, Karen M. Callahan, Douglas J. Tobias, and Barbara J. Finlayson-Pitts, “Is Nitrate Photolysis Affected by the Presence of Bromide Ions?”
American Geophysical Union Conference, December 2008, San Francisco, CA

REGIONAL MEETINGS

- (1) **Nicole K. Richards-Henderson**, Amie K. Hansel, Andrew T. Pham, Harasha S. Vempati, Kalliat T. Valsaraj, and Cort Anastasio, “Aqueous Oxidation of Green Leaf Volatiles as a Source of Secondary Organic Aerosol.”
12th Berkeley Atmospheric Science Symposium, 2014, Berkeley, CA
- (2) **Nicole K. Richards** and Barbara J. Finlayson-Pitts, “Oxidation of Halides in Sea Salt by the Photolysis of Nitrate”
29th Informal Symposium on Kinetics and Photochemistry in the Atmosphere, 2012, Fullerton, CA.
- (3) **Crisand Anderson, Nicole K. Richards**, Karen M. Callahan, Douglas J. Tobias and Barbara J. Finlayson-Pitts, “The Effect of Cations on Nitrate Surface Propensity in Aqueous Nitrate Ion Solutions”
29th Informal Symposium on Kinetics and Photochemistry in the Atmosphere, 2012, Fullerton, CA.
- (4) **Nicole K. Richards**, Karen M. Callahan, Lisa M. Wingen, Noriko Nishino, Douglas J. Tobias, and Barbara J. Finlayson-Pitts, “Release of Gas Phase NO₂ from the Photolysis of Thin Water films Containing Nitrate and [Cl⁻]/[Br⁻] Mixtures ”
28th Informal Symposium on Kinetics and Photochemistry in the Atmosphere, 2011, Irvine, CA.
- (5) **Carol Tsai, Nicole K. Richards**, Karen M. Callahan, Lisa M. Wingen, Barbara J. Finlayson-Pitts and Douglas J. Tobias, “Molecular Dynamics Simulations of the Fate of NO₃⁻ Photolysis in Seasalt Aerosols”
28th Informal Symposium on Kinetics and Photochemistry in the Atmosphere, 2011, Irvine, CA.
- (6) **Nicole K. Richards**, Lisa M. Wingen, Karen M. Callahan, Douglas J. Tobias, and Barbara J. Finlayson-Pitts, “Halide Ion Enhancement of Nitrate Ion Photolysis”
27th Informal Symposium on Kinetics and Photochemistry in the Atmosphere, 2010, San Diego, CA.
- (7) **Nicole K. Richards**, Lisa M. Wingen, Karen M. Callahan, Douglas J. Tobias and Barbara J. Finlayson-Pitts, “Bromide Ion Enhancement of Nitrate Photolysis”
26th Informal Symposium on Kinetics and Photochemistry in the Atmosphere, 2009, Riverside, CA.

COMMUNITY OUTREACH

- Volunteer at Air Aware Girl Scout Camp at UC Davis (July 2012).
- Judge at the 31st annual Irvine Unified School District Science Fair at University High School (February 2012)
- Proctored an exam for high school students at California State University Fullerton given by the local education committee for ACS (April 2011).
- Gave a presentation at Lincoln Elementary School in Santa Ana, CA on issues related to animal habitat destruction caused by global warming (November 5, 2010).
- “Ask a Scientist Night” at Rancho San Joaquin Hills Middle School in Irvine (September 2010).
- Lectured at a high school advanced placement class about air pollution and its effect on health and climate at Northwood High School in Irvine (June 3, 2010).
- Participated in a graduate student panel on the UCI campus sponsored by UC LEADS, which provides fellowships across the UC system for undergraduate students from communities that are underrepresented in science education (April 2010).

REFERENCES

Post Doctorate

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Doctorate

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