

Brendan C. Sweeny

EDUCATION

Doctor of Philosophy in Chemistry

University of Florida, Gainesville, FL

August 2009 – August 2015

- Specialized in physical chemistry under the direction of Dr. Wei David Wei

Bachelor of Arts in Chemistry – ACS Certified Degree

Saint Anselm College, Manchester, NH

September 2005 – May 2009

PROFESSIONAL EXPERIENCE

Plasma Chemistry Group, Space Vehicles Directorate, Air Force Research Lab

Kirtland Air Force Base

Albuquerque, NM 87117

National Research Council Postdoctoral Researcher

July 2016 – Present

- Measure temperature-dependent kinetics and product branching of gas-phase reactions between metal ions or metal clusters and neutral molecules
- Devise experiments that probe the kinetics of reactions with relevance to ionospheric chemistry, fuel additives, alternative fuels, and other Air Force interests
- Incorporate DFT calculations and statistical modeling (unimolecular rate theory, RRKM, PST) to gain mechanistic insight into chemical reactions
- Extended fundamental understanding of superatom behavior in Al_n^- clusters ($n = 2-30$)
- Maintain a laser vaporization variable-temperature selected ion flow tube mass spectrometer that enables temperature-dependent kinetics of metal cluster and neutral molecule reactions
- Write and maintain custom software (Python, LabVIEW) to monitor and control lab instrumentation
- Coauthored sixteen peer-reviewed publications in collaboration with eight group members and seven external scientists, one selected for AFRL branch quarterly publication award
- Authored NRC Advanced Level Review proposal for further study of Al_n^- reaction kinetics

Chemistry Department, University of Florida

214 Leigh Hall

P.O. Box 117200

Gainesville, FL 32611

Research Assistant

August 2009 – July 2016

- Developed novel gold, silver, and metal-oxide nanomaterials that improve visible light photocatalysis
- Devised experiments to elucidate the mechanism through which visible light improves catalytic activity
- Utilized internal facilities (Major Analytical Instrumentation Center, Nanoscale Research Facility) using spectroscopy (UV-Vis, FTIR, XPS, EDS, Raman, PL), microscopy (SEM, TEM, AFM), and diffraction (XRD) to explore the properties of metal-semiconductor nanostructure photocatalysts
- Collaborate with national labs (BNL, PNNL) to characterize catalysts with electron microscopy (HAADF-STEM) and spectroscopy (XPS, EELS)
- Coauthored two book chapters and three manuscripts in collaboration with seven group members and four external scientists highlighting research results
- Designed, built and maintained a custom gas-phase reactor that enables wavelength-dependent characterization of catalysts during reaction
- Modelled individual parts using computer-aided design software and advised machinists on fabrication
- Coauthored grant proposals (NSF Career, DOE)
- Organized lab start up, operation, and development, including equipment procurement and SOPs
- Mentored three undergraduate students and one visiting student through Research Experience for Undergraduates (REU) program

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SELECTED PUBLICATIONS

- **B. C. Sweeny**, D. C. McDonald II, J. C. Poutsma, S. G. Ard, A. A. Viggiano, N. S. Shuman. "Redefining the Mechanism of O₂ Etching of Al_n⁻ Superatoms: An Early Barrier Controls Reactivity, Analogous to Surface Oxidation" *J. Phys. Chem. Lett.*, 2020, 11 (1), 217-220.
- **B. C. Sweeny**, S. G. Ard, A. A. Viggiano, J. C. Sawyer, D. C. McDonald II, N. S. Shuman. "Thermal Kinetics of Al_n⁻ + O₂ (n = 2–30): Measurable Reactivity of Al₁₃⁻" *J. Phys. Chem. A*, 2019, 123 (29), 6123-6129.
- **B. C. Sweeny**, S. G. Ard, A. A. Viggiano, N. S. Shuman. "Reaction of Mass-Selected, Thermalized V_nO_m⁺ Clusters with CCl₄" *J. Phys. Chem. A*, 2019, 123 (23), 4817-4824.
- **B. C. Sweeny**, S. G. Ard, N. S. Shuman, A. A. Viggiano. "The Role of Non-Reactive Binding Sites in the AlVO₄⁺ + CO/AlVO₃⁺ + N₂O Catalytic Cycle" *ChemPhysChem*, 2018, 19, 2835-2838.
- **B. C. Sweeny**, S. G. Ard, D. C. McDonald II, O. Martinez, A. A. Viggiano, N. S. Shuman. "Discrepancy Between Experimental and Theoretical Predictions of the Adiabaticity of Ti⁺ + CH₃OH" *Chem. Eur. J.*, 2017, 23 (49), 11780–11783.
- J. S. DuChene, **B. C. Sweeny**, A. C. Johnston-Peck, D. Su, E. A. Stach, and W. D. Wei. "Prolonged Hot Electron Dynamics in Plasmonic-Metal/Semiconductor Heterostructures with Implications for Solar Photocatalysis" *Angew. Chem. Int. Ed.*, 2014, 53 (30), 7887–7891.
- K. Qian, **B. C. Sweeny**, A. C. Johnston-Peck, W. Niu, J. O. Graham, J. S. DuChene, J. Qiu, Y.-C. Wang, M. H. Engelhard, D. Su, and W. D. Wei. "Surface-Plasmon-Driven Water Reduction: Gold Nanoparticle Size Matters" *J. Am. Chem. Soc.*, 2014, 136 (28), 9842–9845.

ORAL PRESENTATIONS

- **B. C. Sweeny**, D. C. McDonald II, J. C. Poutsma, S. G. Ard, S. G. Ard, A. A. Viggiano, N. S. Shuman. "Al₁₃⁻ Superatoms: Temperature Dependent Kinetics Provide New Insight into O₂ Resistance" GRS Molecular and Ionic Clusters, 2020.
- **B. C. Sweeny**, S. G. Ard, A. A. Viggiano, J. C. Sawyer, D. C. McDonald II, N. S. Shuman. "New Insights into Al_n⁻ Cluster Reactivity with Oxygen through Investigation By Selected Ion Flow Tube" GRS Gaseous Ions: Structures, Energetics, and Reactions, 2019.
- **B. C. Sweeny**, S. G. Ard, N. S. Shuman, A. A. Viggiano. "Non-Reactive Binding Sites and Their Role in the AlVO₄⁺ + CO/AlVO₃⁺ + N₂O Catalytic Cycle" ACS Rocky Mountain Regional Meeting, 2018.
- **B. C. Sweeny**, S. G. Ard, N. S. Shuman, A. A. Viggiano. "Exploring the Critical Role of Two-State Reactivity in Gas Phase Metal Chemistry" 73rd Southwest Regional Meeting of the ACS, 2017.
- **B. C. Sweeny**, K. Qian, J. S. DuChene, J. Qiu, A. C. Johnston-Peck, D. Su, E. Stach, and W. D. Wei. "Plasmon-Driven CO Oxidation in Au-SrTiO₃ Nanostructures at Room Temperature" 249th ACS National Meeting & Exposition, 2015.
- **B. C. Sweeny**, K. Qian, J. S. DuChene, J. Qiu, A. C. Johnston-Peck, D. Su, and W. D. Wei. "Plasmon-Enhanced CO Oxidation in Au-SrTiO₃ Nanostructures" Florida Inorganic and Materials Symposium, 2013.

POSTER PRESENTATIONS

- **B. C. Sweeny**, D. C. McDonald II, S. G. Ard, N. S. Shuman, A. A. Viggiano. "Exploring the Critical Features of the Potential Energy Surface for the Reaction Between Ti⁺ and Methanol" GRC Gaseous Ions: Structures, Energetics and Reactions, 2017.
- **B. C. Sweeny**, K. Qian, J. S. DuChene, J. Qiu, A. C. Johnston-Peck, D. Su, and W. D. Wei. "Plasmon-Enhanced CO Oxidation in Au-SrTiO₃ Nanostructures" NanoFlorida, 2013.

SKILLS

Technical: Mass Spectrometry, Gas Chromatography, Ultraviolet-Visible Spectroscopy, Fourier Transform Infrared Spectroscopy, Electrochemical Workstation

Computer: Python, SolidWorks, LabVIEW, HTML/CSS, JavaScript, MATLAB