

KURTIS M. CARSCH

College of Natural Sciences
The University of Texas at Austin
105 E 24TH ST
Austin, TX 78712

+1 (469) 569-6651
KCarsch@utexas.edu
ORCID: 0000-0003-4432-7518
linkedin.com/in/kurtis-carsch-91b37895

PROFESSIONAL APPOINTMENTS

The University of Texas at Austin, Austin, TX *Starting Winter 2025*
Assistant Professor of Chemistry

University of California, Berkeley, Berkeley, CA *2021 – current*
Arnold O. Beckman Postdoctoral Fellow
Research Advisor: Prof. Jeffrey R. Long
Research: High-Temperature Adsorptive Separations and Organometallic Mediated Separations

EDUCATION

Harvard University, Cambridge, MA *2016 – 2021*
GPA: 3.9/4.0, Ph.D. in Chemistry
Fannie and John Hertz Fellow & National Science Foundation Graduate Research Fellow
Research Advisor: Prof. Theodore A. Betley
Thesis: Ligand Field Inversion in Sterically Confined Copper Architectures

Danish Technical University (DTU), Lyngby, Denmark *Fall 2014*
Copenhagen Scholars, Study-Abroad Scholarship
Research Advisor: Prof. Sussane Mossin
Research: Synthesis of Transition Metal Complexes with Phenolate-Based Tripodal Scaffolds

California Institute of Technology (Caltech), Pasadena, CA *2012 – 2016*
GPA: 4.0/4.0, Joint B.S./M.S. in Chemistry
Research Advisors: Prof. Theodor Agapie, Prof. William A. Goddard, III
Thesis: Bio-Inspired Clusters Relevant to the Oxygen-Evolving Complex of Photosystem II

University of North Texas (UNT), Denton, TX *2010 – 2012*
GPA: 4.0/4.0, Texas Academy of Mathematics and Science Program
Research Advisor: Prof. Thomas R. Cundari
Research: Computational Modeling of Methane Hydroxylation through Homogeneous Catalysis

RESEARCH INTERESTS

My research program at UT Austin aims to establish new paradigms within green and sustainable chemistry across synthesis, organometallic catalysis, and gas separations relevant to alkane homologation, C–H functionalization, ambient air separations, liquid chemisorption, microporous metallopolymers, ultramicroporous polycrystalline membranes, ligand field inversion, frustrated metalloradical pair catalysis, MOF gels, and liquid porous materials.

HONORS AND AWARDS

2022 CAS Future Leader	Summer 2022
Fannie and John Hertz Thesis Prize – <i>for monumental scientific advancements</i>	Spring 2022
Eric and Wendy Schmidt Science Fellowship Finalist (<i>withdrawn</i>)	Spring 2022
Ruth L. Kirschstein NIH F32 Fellowship, 1.0 Percentile (14 Impact Score, <i>withdrawn</i>)	Spring 2021
Arnold O. Beckman Postdoctoral Fellowship	Spring 2021
Peter Strauss Fellowship – <i>endowed fellowship by the Hertz Foundation</i>	Spring 2020
Ludo Frevel Crystallography Scholarship	Winter 2020

Harvard Distinction in Teaching Award	Spring 2019
Harvard Chemistry and Chemical Biology Travel Prize – <i>for outstanding achievement</i>	Spring 2019
2016 ACS Undergraduate Award in Inorganic Chemistry	Spring 2016
Richard P. Schuster Memorial Prize – <i>for academic promise</i>	Spring 2016
George W. Green Memorial Prize – <i>for evidence of creative scholarship</i>	Spring 2016
Fannie and John Hertz Foundation Fellowship	Spring 2016
National Science Foundation Graduate Research Fellowship (NSF GRF)	Spring 2016
MIT Robert T. Haslam Presidential Fellowship (<i>declined</i>)	Winter 2016
University of Chicago Freud Scholarship (<i>declined</i>)	Winter 2016
University of Chicago McCormick Fellowship (<i>declined</i>)	Winter 2016
U. Washington Excellence in Chemistry Graduate Fellowship Award (<i>declined</i>)	Winter 2016
Patrick Hummel and Harry Gray Travel Grant	Winter 2016
Caltech Summer Undergraduate Research Fellowship	Summer 2015
Arie J. Haagen-Smit Memorial Award – <i>for recognized contributions to Caltech</i>	Spring 2015
Copenhagen Scholars Study Abroad Scholarship	Fall 2014
American Chemical Society/Society for Chemical Industry Scholarship	Spring 2014
Renuka D. Sharma Award – <i>for outstanding performance during freshman year</i>	Spring 2014
Class of 1952 Scholarship	Fall 2012
Caltech Summer Undergraduate Research Fellowship	Summer 2012
Intel Science Talent Search Finalist	Spring 2012
University of North Texas Dean’s Honor Roll	2011–2012
University of North Texas Dean’s Research Award	Fall 2011
Texas Academy of Math and Science Summer Research Scholarship	Summer 2011
Jasper High School Friendliest Freshman	Spring 2008
Various Statewide Awards and Recognitions for Flute and Piccolo Performances (>20)	2005–2010

SCIENTIFIC PUBLICATIONS – †equal contribution; see [Google Scholar Profile](#)

(27) **Carsch, K. M.**†; Rohde, R. C.†; Yabuuchi, Y.; Dods, M. N.; Huang, A. J.; Jiang, H. Z. H.; Klein, R. A.; Pourghaderi, A.; Kwon, H.; Karstens, S. L.; Taylor, J. W.; Teat, S. J.; Reimer, J. A.; Brown, C. M.; Giesy, T. J.; Long, J. R. High-Temperature π -Acid Separations in a Porous Material with Open Metal Sites. *Manuscript in preparation.*

(26) **Carsch, K. M.**; Peltier, J. L.; Jiang, H. Z. H.; Klein, R.; Rosen, A. S.; Murphy, R. A.; Huang, A. J.; Dods, M. N.; Hasanbasri, Z.; Kwon, H.; Karstens, S. L.; Yabuuchi, Y.; Börgel, J.; Taylor, J. W.; Meihaus, K. R.; Bustillo, K. C.; Minor, A. M.; Persson, K. A.; Brown, C. M.; Britt, R. D.; Long, J. R. Cooperative Multi-Gas Sorption at Organometallic Nodes in a Metal–Organic Framework. *Manuscript in preparation.*

(25) MacMillan, S. N.†; **Carsch, K. M.**†; DiMucci, I. M.; Yang, J.; Nordlund, D.; Betley, T. A.; Lancaster, K. M. Scrutinizing Metal–Dioxygen Covalency via Oxygen X-Ray Absorption Spectroscopy. *Manuscript in preparation.*

(24) **Carsch, K. M.**; Gonzalez, M. I.; Clarke, R. M.; DiMucci, I. M.; Nava, M.; Moss, F.; Zheng, S.-L.; Lancaster, K. M.; Betley, T. A. Radical Reactivity from a Terminal Copper Hydroxide. *Manuscript in preparation.*

(23) Oh, J.; Zheng, S.-L.; **Carsch, K. M.**; Latendresse, T. P.; Casaday, C. E.; Campbell, B. M.; Betley, T. A. An Open-Shell Fe(IV) Nitrido. *Manuscript in review, J. Am. Chem. Soc.*

(22) Juda, C.; Casaday, C.; Teesdale, J.; Bartholomew, A.; Lin, B.; **Carsch, K. M.**; Musgrave, R.; Zheng, Shao-Liang; Wang, X.; Hoffmann, C.; Wang, S.-Y.; Chen, Y.S.; Betley, T.A. Composition Determination of Heterometallic Trinuclear Clusters via Anomalous X-Ray and Neutron Diffraction. *Manuscript in review, J. Am. Chem. Soc.*

(21) Rohde, R. C.[†]; **Carsch, K. M.**[†]; Dods, M. N.; Jiang, H. Z. H.; McIsaac, A. R.; Klein, R. A.; Kwon, H.; Karstens, S. L.; Wang, Y.; Huang, A. J.; Taylor, J. W.; Yabuuchi, Y.; Tkachenko, N. V.; Meihaus, K. R.; Furukawa, H.; Yanhe, D. R.; Bustillo, K. C.; Minor, A. M.; Reimer, J. A.; Head-Gordon, M.; Brown, C. M.; Long, J. R. High-Temperature CO₂ Capture in a Porous Material with Terminal Zinc–Hydride Sites. *Science* **2024**, *accepted*.

(20) Tkachenko, N. V.; Yabuuchi, Y.; **Carsch, K. M.**; Furukawa, H.; Long, J. R.; Head-Gordon, M. Computational Optimization of Room Temperature Usable Capacity for Hydrogen Storage in MFU-4-Type Metal–Organic Frameworks via Pairwise Metal Substitutions. *Chem. Sci* **2024**, *accepted*.

(19) Yabuuchi, Y.; Furukawa, H.; **Carsch, K. M.**; Klein, R.A.; Tkachenko, N. V.; Huang, A. J.; Cheng, Y.; Taddei, K. M.; Novak, E.; Brown, C. M.; Head-Gordon, M. Geometric Tuning of Coordinatively Unsaturated Copper(I) Sites in Metal–Organic Frameworks for Ambient-Temperature Hydrogen Storage. *J. Am. Chem. Soc.* **2024**, *146*, 22759.

(18) **Carsch, K. M.**; Huang, A. J.; Dods, M. N.; Parker, S. T.; Rohde, R. C.; Jiang, H. Z. H.; Yabuuchi, Y.; Kwon, H.; Karstens, S. L.; Chakraborty, R.; Bustillo, K. C. Meihaus, K. R.; Furukawa, H.; Minor, A. M.; Head-Gordon, M.; Long, J. R. Oxygen-Selective Adsorption from Air with a Metal–Organic Framework Featuring Open Copper Sites. *J. Am. Chem. Soc.* **2024**, *146*, 3160–3170.

(17) Chakraborty, R.; Talbot, J. J.; Shen, H.; Yabuuchi, Y.; **Carsch, K. M.**; Jiang, H. Z. H.; Furukawa, H.; Long, J. R.; Head-Gordon, M. Quantum Chemical Modeling of Single and Multiple Hydrogen Binding in MOFs: Validation, Insight, Predictions, and Challenges. *Phys. Chem. Chem. Phys.* **2024**, *26*, 6490–6511.

(16) **Carsch, K. M.**; North, S.; DiMucci, I. M.; Iliescu, A.; Vojackova, P.; Cundari, T.; Lancaster, K. M.; Betley, T.A. Nitrene Transfer from a Sterically Confined Copper Complex. *Chem. Sci.*, **2023**, *14*, 10847–10860.

(15) Funke, L. M.; Chakraborty, R.; **Carsch, K. M.**; Head-Gordon, M.; Long, J. R.; Reimer, J. A. Assessment of Adsorbate π -backbonding in Copper(I) Metal–Organic Frameworks via Multinuclear NMR Spectroscopy and Density Functional Theory Calculations. *J. Phys. Chem. C* **2023**, *127*, 7513–7519.

(14) Chakraborty, R.; **Carsch, K. M.**; Jaramillo, D. E.; Yabuuchi, Y.; Furukawa, H.; Long, J. R.; Head-Gordon, M. Prediction of Multiple Hydrogen Ligation at a Vanadium(II) Site in a Metal–Organic Framework. *J. Phys. Chem. Lett.* **2022**, *13*, 10471–10478.

(13) **Carsch, K. M.**[†]; Iliescu, A.[†]; McGillicuddy, R. D.; Mason, J. A.; Betley, T. A. Reversible Scavenging of Dioxygen from Air by a Copper Complex. *J. Am. Chem. Soc.* **2021**, *143*, 18346–18352.

(12) **Carsch, K. M.**; Ho, W.; Lui, K. H.; Valtierra, G.; Dogutan, D. L.; Nocera, D. G.; Zheng, S.-L. The Crystal Structure of the RuPhos Ligand. *Acta Crystallogr. E* **2021**, *77*, 171–174.

• *Media Coverage*: “Chem-145 undergraduates publish papers on novel crystals” *Harvard Chemistry and Chemical Biology*. Prepared Fall 2020 (CHEM145, experimental inorganic chemistry).

(11) **Carsch, K. M.**; Elder, S. E.; Dogutan, D. K.; Nocera, D. G.; Yang, J.; Zheng, S.-L.; Daniel, T.; Betley, T. A. Syntheses and Solid-state Structures of Two Cofacial (bis)dipyrrin Dichromium Complexes in Different Charge States. *Acta Crystallogr. C* **2021**, *77*, 161–166.

• *Media Coverage*: “Chem-145 undergraduates publish papers on novel crystals” *Harvard Chemistry and Chemical Biology*. Prepared Fall 2020 (CHEM145, experimental inorganic chemistry).

(10) **Carsch, K. M.**; DiMucci, I. M.; Lukens, J. T.; Iovan, D.A.; Zheng, S.-L.; Lancaster, K. M.; Betley, T. A. Electronic Structures and Reactivity Profiles of Aryl Nitrenoid–Bridged Dicopper Complexes. *J. Am. Chem. Soc.* **2020**, *142*, 2264–2276.

(9) DiMucci, I. M.[†]; Lukens, J. T.[†]; Chatterjee, S.[†]; **Carsch, K. M.**; Titus, C. J.; Lee, S. J.; Nordlund, D.; Betley, T. A.; MacMillan, S. N.; Lancaster, K. M. The Myth of d⁸ Cu(III). *J. Am. Chem. Soc.* **2019**, *141*, 18508–18520.

• *Media Coverage*: “Credit ligands for copper-complex chemistry” *C&EN Chemical & Engineering News*
“Copper comeuppance” *Nature Chemistry Reviews*

(8) **Carsch, K. M.**; DiMucci, I. M.; Iovan, D. A.; Li, A.; Zheng, S.-L.; Titus, C. J.; Lee, S. J.; Irwin, K. D.; Nordlund, D.; Lancaster, K. M.; Betley, T. A. Synthesis of a Copper-Supported Triplet Nitrene Complex Pertinent to Copper-Catalyzed Amination. *Science* **2019**, *365*, 1138–1143.

• *Media Coverage*: “Break it up” *Harvard Chemistry and Chemical Biology News, Harvard Gazette*
“Discovered architecture of a copper-nitrenoid complex could revolutionize synthesis” *Phys.org, ScienceDaily*
“Missing electrons reveal the true face of a new copper-based catalyst” *CornellChronicle, Newswise*,
“Metalloenzyme mastery” *ChemistryWorld*

(7) Lionetti, D.; Suseno, S.; Tsui, E. Y.; Lu, L.; Stich, T. A.; **Carsch, K. M.**; Nielsen, R. J.; Goddard, A. W.; Britt, R. D.; Agapie, T. Effects of Lewis Acidic Metal Ions (M) on Oxygen-Atom Transfer Reactivity of Heterometallic Mn_3MO_4 Cubane and $Fe_3MO(OH)$ and $Mn_3MO(OH)$ Clusters. *Inorg. Chem.* **2019**, *58*, 2236–2245.

(6) **Carsch, K. M.**; de Ruiter, G.; Agapie, T. Intramolecular C–H and C–F Bond Oxygenation by Site-Differentiated Tetranuclear Manganese Models of the OEC. *Inorg. Chem.* **2017**, *7*, 9044–9054.

(5) de Ruiter, G.; **Carsch, K. M.**; Takase, M.; Agapie, T. Selectivity of C–H vs. C–F Bond Oxygenation by Homo- and Hetero-metallic Fe_4 , Fe_3Mn , and Mn_4 Clusters. *Chem. Eur. J.* **2017**, *23*, 10744–10748.

(4) de Ruiter, G.[†]; **Carsch, K. M.**[†]; Gul, S.; Chatterjee, R.; Thompson, N. B.; Takase, M. K.; Yano, J.; Agapie, T. Accelerated Oxygen Atom Transfer and C–H Bond Oxygenation by Remote Redox Changes in Fe_3Mn -Iodosobenzene Adducts. *Angew. Chem. Int. Ed.* **2017**, *56*, 4772–4776.

(3) Kanady, J. S.; Lin, P. L.; **Carsch, K. M.**; Nielsen, R. J.; Takase, M. K.; Goddard, W. A.; Agapie, T. Toward Models for the Full Oxygen-Evolving Complex of Photosystem II by Ligand Coordination to Lower the Symmetry of the Mn_3CaO_4 Cubane: Demonstration that Electronic Effects Facilitate Binding of a Fifth Metal. *J. Am. Chem. Soc.* **2014**, *136*, 14373–14376.

(2) Jiajun, M.; **Carsch, K. M.**; Freitag, C. R.; Gunnoe, T. B.; Cundari, T. R. Variable Pathways for Oxygen Atom Insertion into Metal–Carbon Bonds. *J. Am. Chem. Soc.* **2012**, *135*, 424–437.

(1) **Carsch, K. M.**; Cundari, T. R. DFT Modeling of a Methane-to-Methanol Catalytic Cycle Via Group 6 Organometallics. *Comp. Theor. Chem.* **2012**, *980*, 133–137.

• *Media Coverage*: “Teen Finding Ways to Cut Energy Costs” *NBC Dallas Fort Worth (NBCDFW) News*

PATENTS

(4) **Carsch, K. M.**; Rohde, R. C.; Long, J. R. Isothermal π -Acid Separation with Porous Materials. *US Provisional Patent Application filing in progress.*

(3) **Carsch, K. M.**; Peltier, J. L.; Börgel, J.; Long, J. R. Selective Carbon Monoxide Uptake by Porous Materials with Metal Carbanions. *US Provisional Patent 63/516,154 filed on June 13, 2023.*

(2) **Carsch, K. M.**; Long, J. R. Direct Capture of Oxygen from Air with Porous Materials. *US Provisional Patent 63/460,810 filed on April 20, 2023.*

(1) Rohde, R. C.; **Carsch, K. M.**; Long, J. R. Acidic Gas Capture through Metal–Ligand Insertion in Porous Materials at Elevated Temperatures. *US Provisional Patent 63/477,976 filed on December 30, 2022.*

INVITED SEMINARS AND CONTRIBUTED PRESENTATIONS – [†]scheduled seminar

(36) UNIST, Department of Chemistry – Ulsan, South Korea	Fall 2024
(35) POSTECH, Department of Chemistry – Pohang, South Korea	Fall 2024
(34) Seoul National University, Department of Chemistry – Seoul, South Korea	Fall 2024
(33) The University of Texas at Austin, Department of Chemistry – Austin, TX	Summer 2024
(32) ACS Fall 2024 National Meeting & Expo – Denver, CO	Summer 2024

(31) Fannie and John Hertz 2024 Summer Workshop – Mont-Tremblant, Canada	Summer 2024
(30) Arnold O. Beckman Annual Symposium, <i>Plenary Speaker</i> – Irvine, CA	Summer 2024
(29) The University of Tokyo, <i>Zasshikai Seminar 1951st</i> – Tokyo, Japan	Summer 2024
(28) MOF2024 – Singapore, Singapore	Summer 2024
(27) Organometallics Gordon Research Seminar & Conference – Newport, RI	Summer 2024
(26) University of California, Berkeley, Research Symposium – Berkeley, CA	Spring 2024
(25) Mosaic Materials, Inc., Baker Hughes – Alameda, CA	Spring 2024
(24) University of California, Irvine, Department of Chemistry – Irvine, CA	Winter 2024
(23) Caltech, Department of Chemistry and Chemical Engineering – Pasadena, CA	Winter 2024
(22) Johns Hopkins University, Department of Chemistry – Baltimore, MD	Winter 2024
(21) The University of Chicago, Department of Chemistry – Chicago, IL	Winter 2024
(20) New York University, Department of Chemistry – New York City, NY	Winter 2023
(19) Cornell, Department of Chemistry and Chemical Biology – Ithaca, NY	Winter 2023
(18) Stanford, Department of Chemistry – Stanford, CA	Winter 2023
(17) The University of Texas at Austin, Department of Chemistry – Austin, TX	Winter 2023
(16) ACS Fall 2023 National Meeting – San Francisco, CA	Fall 2023
(15) Nanoporous Gordon Research Conference – Andover, NH	Summer 2022
(14) Arnold O. Beckman Annual Symposium – Irvine, CA	Summer 2022
(13) Organometallics Gordon Research Seminar & Conference – Newport, RI	Summer 2022
(12) Harvard, Chemical & Chemical Biology Department – Cambridge, MA	Summer 2022
(11) Fannie and John Hertz Foundation Board of Directors Meeting – Livermore, CA	Summer 2022
(10) ACS Fall 2022 National Meeting – Chicago, IL	Summer 2022
(9) 2022 CAS Future Leaders Symposium – Columbus, OH	Summer 2022
(8) Arnold O. Beckman Annual Symposium – Irvine, CA	Summer 2022
(7) ACS Fall 2020 National Meeting & Expo – Virtual Presentation	Summer 2020
(6) Global Inorganic Discussion Weekday – Virtual Presentation	Summer 2020
(5) Reaction Mechanisms Gordon Research Seminar & Conference – Galveston, TX	Spring 2019
(4) 255th ACS National Meeting – New Orleans, LA	Spring 2018
(3) 251st ACS National Meeting – San Diego, CA	Spring 2016
(2) Low Temperature Hydrocarbon Fuels DARPA Symposium – Pasadena, CA	Summer 2013
(1) Center for Catalytic Hydrocarbon Functionalization Meeting – Charlottesville, VA	Summer 2012

INDUSTRY EXPERIENCE

Honeywell UOP, Des Plaines, IL Summer 2014
Chemistry Intern – Zeolite Synthesis, Scale-up, and Materials Characterization

SAFCCell, Inc., Pasadena, CA June 2013 – June 2016
Research Assistant – Fuel Cell Characterization

TEACHING EXPERIENCE

Guest lectures in crystallography, inorganic chemistry, and organometallic chemistry *Ongoing*

CHEM145, Experimental Inorganic Chemistry, Undergraduate Advanced Lab
Teaching Fellow, Harvard University (Prof. Daniel G. Nocera) Fall 2020
Teaching Fellow, Harvard University (Prof. Theodore A. Betley) Fall 2018

Ch120a, Nature of the Chemical Bond, Graduate Quantum Mechanics
Teaching Assistant, Caltech (Prof. William A. Goddard, III) Fall 2015

MENTORSHIP

Prior mentoring experience – graduate students (14), undergraduate students (3), and high school students (1)

DEPARTMENTAL SERVICE AND COMMUNITY SERVICE

Fannie and John Hertz Foundation, Thesis Prize Selection Committee	2023 – <i>current</i>
Fannie and John Hertz Foundation, Fellowship Interviewer	2023 – <i>current</i>
Fannie and John Hertz Foundation, West Coast Community Representative	2022 – 2024
UC Berkeley Catalysis Center, Sorption Manager	2022 – 2024
Letters to a Pre-Scientist (LPS), Pen Pal	2022 – 2024
ACS Coordination Chemistry: Synthesis & Characterization, Session Co-chair	Summer 2022
Fannie and John Hertz Foundation, Fall Retreat Organizer	Fall 2020
Chemistry Club President, Caltech	2015 – 2016
Chemistry Student–Faculty Conference Organizer, Caltech	Spring 2015
Undergraduate Peer Tutor, Caltech (undergraduate & graduate chemistry courses)	2012 – 2016
TeachAndLearn Peer Tutoring Co–Founder, University of North Texas	2011 – 2012
Research Organization Competition Director, University of North Texas	2011 – 2012
Outreach (chemistry demonstrations, recruitment, local inclusion initiatives)	<i>Ongoing</i>
UNT (TAMS), Caltech, Harvard, UC Berkeley, UT Austin Recruitment	<i>Ongoing</i>
<i>Ad hoc</i> Peer Reviewer (<i>J. Am. Chem. Soc.</i> , <i>Chem. Sci.</i> , <i>Chem. Commun.</i> , <i>Inorg. Chem.</i> , <i>Chem. Soc. Rev.</i> , <i>Angew. Chem. Int. Ed.</i> , <i>Science</i> , <i>Sci. China Chem.</i>)	<i>Ongoing</i>

PROFESSIONAL REFERENCES

Prof. Jeffrey R. Long (UC Berkeley, jrlong@berkeley.edu)
Prof. Theodore A. Betley (Harvard, betley@chemistry.harvard.edu)
Prof. Kyle M. Lancaster (Cornell, kml236@cornell.edu)
Prof. Theodor Agapie (Caltech, agapie@caltech.edu)
Prof. William A. Goddard (Caltech, wag@caltech.edu)
Prof. Thomas R. Cundari (UNT, thomas.cundari@unt.edu)