

Carl K. Brozek

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Professional Appointments

Assistant Professor, University of Oregon **06/2018–Present**
Postdoctoral Fellow, University of Washington (Advisor: Daniel Gamelin) **07/2015–05/2018**

Education

Ph.D. in Inorganic Chemistry (Advisor: Mircea Dincă) *Massachusetts Institute of Technology*, June, **2015**
S.B. Honors in Chemistry (Advisor: Gregory Hillhouse) *University of Chicago*, June, **2010**

Awards and Honors

Cottrell Scholar Award **2022**
Young Investigator Award – ACS Division of Inorganic Chemistry **2016**
Alan Davison Prize (Best Inorganic Thesis) – MIT **2015**
Washington Research Foundation Innovation Fellow in Clean Energy **2015**
MIT School of Science Appreciation Award **2015**
National Science Foundation Graduate Research Fellowship **2010-2014**
Beckman Scholars Program in Molecular Sciences Fellowship **2007-2009**

External Funding

“Synthetic Control over MOF Particle Growth and Surface Chemistry” **2021-2024**
National Science Foundation, Division of Materials Research – \$450,000
“Impacts of Dynamic Bonding on the Properties of Porous Materials” **2021-2024**
Department of Energy, Basic Energy Sciences – \$525,000
“Clean Water from Porous Nanocrystals: An Undergraduate Training Program in Soft Skills and Sustainable Materials” **2022-2025**
Research Corporation for Science Advancement, Cottrell Scholar Award – \$100,000

Research Group Members and Alumni

Current

Checkers R. Marshall (PhD candidate)
Michael A. LeRoy (PhD candidate)
Jacob McKenzie (PhD candidate)
Kevin Fabrizio (PhD candidate)
Audrey Davenport (PhD candidate)
Ashley Mapile (PhD candidate)
Faiqa Khaliq (PhD candidate)
Dr. Kentaro Kadota (postdoctoral fellow)
Dr. Jiawei Huang (postdoctoral fellow)
Dr. Kasinath Ojha (postdoctoral fellow)
Anastasia B. Andreeva (Senior, Chemistry)
Jeremy Love (Junior, Chemistry)
Kelsie Heffernan (Sophomore, Chemistry)
Eliza Lawrence (Sophomore, Chemistry)
Prof. Sergio Tatay (visiting scientist)

Alumni

Dr. Konstantinos Lazarou – September 2019 through April 2020
Augie Witkowski – M.S. – June 2020 through April 2021
Emma E. Timmel – M.S. – June through August 2020
Maria Anderson – Undergraduate – October 2019 through June 2020
Sara A. Staudhammer – Undergraduate – June 2018 through June 2020
Micaela Verbitsky – Undergraduate – October 2019 through June 2021

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Jiayi Yin – Undergraduate – September 2019 through March 2020

Complete Publication List

- (43) Nolan McNeill, J. N.; Karas, L. J.; Bard, J. P.; Fabrizio, K.; Zakharov, L. N.; MacMillan, S. N.; **Brozek, C. K.**; Wu, J. I.; Johnson, D. W.;* Haley, M. M.*
"Controlling Tautomerization in Pyridine-Fused Phosphorus-Nitrogen Heterocycles"
2022, *Chem—Eur. J.* **28**, e2022004.
- (42) Fabrizio, K.; Le, K. N.; Andreeva, S. B.†; Hendon, C. H.*; Brozek, C. K.*
"Determining Optical Band Gaps of MOFs"
2022, *ACS Mater. Lett.* **4**, 457.
- (41) McKenzie, J.; Le, K. N.; Bardgett, D. J.; Collins, K.; Ericson, T.; Wojnar, M. E.; Chouinard, J.; Gollidge, S.; Cozzolino, A. F.; Johnson, D.C.; Hendon, C. H.*; Brozek, C. K.*
"Conductivity in Open Framework Chalcogenides Tuned via Band Engineering and Redox Chemistry"
2022, *Chem. Mater.* **34**, 1905.
- (40) Marshall, C. R.; Dvorak, J. P.; Twight, L. P.; Chen, L.; Kadota, K.; Andreeva, A. B.†; Overland, A. E.†; Ericson, T.; Cozzolino, A. F.; **Brozek, C. K.***
"Solution-Processable Nanocrystals of Conductive MOFs"
J. Am. Chem. Soc. **2022**, **144**, 5784.
- (39) Andreeva, S. B.; Le, K. N.; Kadota, K.; Horike, S.; Hendon, C. H.*; **Brozek, C. K.***
"Cooperativity and Metal Linker Dynamics in Spin Crossover Framework Fe(1,2,3-Triazolate)₂"
Chem. Mater. **2021**, **33**, 8534.
- (38) López-Olvera, A.; Flores, J. G.; Aguilar-Pliego, J.; **Brozek, C. K.***; Gutierrez-Alejandre, A.*; Ibarra, I.*
"Chemical transformation of H₂S within the pores of MOFs: formation of polysulfides"
Chem. Mater. **2021**, **33**, 6269.
- (37) Mancuso, J.; Fabrizio, K.; **Brozek, C. K.***; Hendon, C. H.*
"On the limit of proton-coupled electronic doping in a Ti(IV)-containing MOF"
Chem. Sci. **2021**, **12**, 11779.
- (36) Araujo, J.; **Brozek, C. K.**; Liu, H.; Merkulova, A.; Li, X.; Gamelin, D.
"Tunable Band-Edge Potentials and Charge Storage in Colloidal Tin-Doped Indium Oxide (ITO) Nanocrystals"
ACS Nano. **2021**, **15**, 14116.
- (35) Allendorf, M.*; Stavila, V.; Witman, M.; **Brozek, C. K.**; Hendon, C. H.
"What Lies Beneath a MOF Crystal Structure: New Design Principles from Unexpected Behaviors"
J. Am. Chem. Soc. **2021**, **143**, 6705.
- (34) "Tunable Band Gaps in MUV-10(M): A Family of Photoredox-Active MOFs with Earth-Abundant Open Metal Sites"
Fabrizio, K.; Lazarou, K. A.; Payne, L. I.; Twight, L.; Hendon, C. H.*; **Brozek, C. K.***
J. Am. Chem. Soc. **2021**, **143**, 12609.
- (33) Boettcher, S. W.*; Oener, S. Z.; Lonergan, M. C.; Surendranath, Y.; Ardo, S.; **Brozek, C. K.**; Kempler, P. A.
"Potentially Confusing: Potentials in Electrochemistry"
ACS Energy Lett. **2020**, **6**, 261.
- (32) LeRoy, M. A.; Mroz, A. M.; Mancuso, J. L.; Miller, A.; Van Cleve, A.; Check, C.; Heinz, H.; Hendon, C. H.; **Brozek, C. K.*** "Post-Synthetic Modification of Ionic Liquids Using Redox and Ligand-Exchange Coordination Chemistry."
J. Mater. Chem. A **2020**, **8**, 22674.
- (31) Andreeva, S. B.; Le, K. N.; Chen, L.; Kellman, M. E.; Hendon, C. H.*; **Brozek, C. K.*** "Soft Mode Metal-Linker Dynamics in Carboxylate MOFs Evidenced by Variable-Temperature Infrared Spectroscopy"
J. Am. Chem. Soc. **2020**, **142**, 19291.
- (30) Marshall, C. R.; Timmel, E.; Staudhammer, S. A.; **Brozek, C. K.*** "Experimental Evidence for a General Model of Modulated MOF Nanoparticle Growth."
Chem. Sci. **2020**, **11**, 11539.

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- (29) Schaub, T. A.; Prantl, E. A.; Kohn, J.; Bursch, M.; Marshall, C. R.; Leonhardt, E. J.; Lovell, T. C.; Zakharov, L. N.; **Brozek, C. K.**; Waldvogel, S. R.; Grimme, S.; Jasti, R. "Exploration of the Solid-State Sorption Properties of Shape-persistent Macrocyclic Nanocarbons as Bulk Materials and Small Aggregates." *J. Org. Chem.* **2020**, *142*, 8763.
- (28) Jover, J.; **Brozek, C. K.**; Dincă, M.; Lopez, N. "Computational exploration of NO single-site disproportionation on Fe-MOF-5" *Chem. Mater.* **2019**, *31*, 8875.
- (27) Van Raden, J.; Leonhardt, E.; Zakharov, L.; Pérez-Guardiola, A.; Pérez-Jiménez, Á.; Marshall, C.; **Brozek, C.**; Sancho-García, J.-C.; Jasti, R. "Precision Nanotube Mimics via Self-Assembly of Programmed Carbon Nanohoops" *J. Org. Chem.* **2019**, *85*, 129.
- (26) Marshall, C. R.; Staudhammer, S. A.; **Brozek, C. K.*** "Size Control of Metal-Organic Framework Porous Nanocrystals." *Chem. Sci.* **2019**, *10*, 9396.
- (25) Araujo, J.; **Brozek, C. K.**; Kroupa, D.; Gamelin, D. R.; "Degenerately n-Doped Colloidal PbSe Quantum Dots: Band: Assignments and Electrostatic Effects." *Nano Lett.* **2018**, *18*, 3893.
- (24) **Brozek, C. K.**; Zhou, D.; Liu, H.; Li, X.; Kittilstved, K. R.; Gamelin, D. R. "Soluble Supercapacitors: Large and Reversible Charge Storage in Colloidal Fe-Doped ZnO Nanocrystals." *Nano Lett.* **2018**, *18*, 3297.
- (23) Hartstein, K. H.; **Brozek, C. K.**; Hinterding, S. O. M.; Gamelin, D. R. "Copper-Coupled Electron Transfer in Colloidal Plasmonic Copper-Sulfide Nanocrystals Probed by in Situ Spectroelectrochemistry." *J. Am. Chem. Soc.* **2018**, *140*, 3434.
- (22) Liu, H.; **Brozek, C. K.**; Sun, S.; Lingerfelt, D. B.; Gamelin, D. R.; Li, X. "A Hybrid Quantum-Classical Model of Electrostatics in Multiply Charged Quantum Dots." *J. Phys. Chem. C* **2017**, *121*, 26086.
- (21) **Brozek, C. K.**; Ozarowski, A.; Stoian, S. A.; Dincă, M. "Dynamic Structural Flexibility of Fe-MOF-5 Evidenced by ⁵⁷Fe Mössbauer Spectroscopy." *Inorg. Chem. Front.* **2017**, *3* 782.
- (20) Carroll, G. M.; Tsui, E. Y.; **Brozek, C. K.**; Gamelin, D. R. "Spectroelectrochemical Measurement of Surface Electrostatic Contributions to Colloidal CdSe Nanocrystal Redox Potentials." *Chem. Mater.* **2016**, *28*, 7912.
- (19) **Brozek, C. K.**; Hartstein, K. H.; Gamelin, D. R. "Potentiometric Titrations for Measuring the Capacitance of Colloidal Photodoped ZnO Nanocrystals." *J. Am. Chem. Soc.* **2016**, *138*, 10605.
- (18) Carroll, G. M.; **Brozek, C. K.**; Hartstein, K. H.; Tsui, E. Y.; Gamelin, D. R. "Potentiometric Measurements of Semiconductor Nanocrystal Redox Potentials." *J. Am. Chem. Soc.* **2016**, *138*, 4310.
- (17) Metzger, E. D.; **Brozek, C. K.**; Comito, R. J.; Dincă, M. "Selective dimerization of ethylene to 1-butene with a porous catalyst" *ACS Central Science* **2016**, *2*, 148.
- (16) Akimbekov, Z.; Wu, D; **Brozek, C. K.**; Dincă, M.; Navrotsky, A. "Thermodynamics of Solvent Interaction with the Metal-Organic Framework MOF-5" *Phys. Chem. Chem. Phys.* **2016**, *18*, 1158.
- (15) **Brozek, C. K.**; Dincă, M. "Thermodynamic parameters of cation exchange in MOF-5 and MFU-4l" *Chem. Commun.* **2015**, *51*, 11780.
- (14) Bellarosa, L.; **Brozek, C. K.**; Garcia-Melchior, M.; Dincă, M.; López, N. "When the Solvent Locks the Cage: Theoretical Insight into the Transmetalation of MOF-5 Lattices and its Kinetic Limitations" *Chem. Mater.* **2015**, *27*, 3422.
- (13) **Brozek, C. K.**; Miller, J. T., Stoian, S. A.; Dincă, M. "NO Disproportionation at a Mononuclear Site-Isolated Fe²⁺ Center in Fe²⁺-MOF-5" *J. Am. Chem. Soc.* **2015**, *137*, 7495.

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- (12) **Brozek, C. K.**; Michaelis, V. K.; Ong, T.-C.; Bellarosa, L.; López, N.; Griffin, R. G.; Dincă, M. "Dynamic DMF Binding in MOF-5 Enables the Formation of Metastable Cobalt-Substituted MOF-5 Analogs" *ACS Central Science* **2015**, *1*, 252.
- (11) Sheberla, D.; Sun, L.; Blood-Forsythe, M. A.; Er, S.; Wade, C. R.; **Brozek, C. K.**; Aspuru-Guzik, A.; Dincă, M. "High Electrical Conductivity in Ni₃(2,3,6,7,10,11-hexaiminotriphenylene)₂, a Semiconducting Metal-Organic Graphene Analogue" *J. Am. Chem. Soc.* **2014**, *136*, 8859.
- (10) **Brozek, C. K.**; Dincă, M. "Cation Exchange at the Secondary Building Units of Metal-organic Frameworks" *Chem. Soc. Rev.* **2014**, *43*, 5456.
- (9) **Brozek, C. K.**; Bellarosa, L.; Soejima, T.; Clark, T. V.; Lopez, N.; Dincă, M. "Solvent-Dependent Cation Exchange in Metal-organic Frameworks" *Chem.–Eur. J.* **2014**, *20*, 6871.
- (8) Kuppuswamy, S.; Powers, T. M.; Johnson, B. M.; **Brozek, C. K.**; Krogman, J. P.; Bezpalko, M. W.; Berben, L. A.; Keith, J. M.; Foxman, B. M.; Thomas, C. M. "One-electron Oxidation Chemistry and Subsequent Reactivity of Diiron Imido Complexes" *Inorg. Chem.* **2014**, *53*, 5429.
- (7) Cozzolino, A. F.; **Brozek, C. K.**; Palmer, R. D.; Yano, J.; Li, M.; Dincă, M. "Ligand Redox Non-innocence in the Stoichiometric Oxidation of Mn₂(2,5-dioxidoterephthalate) (Mn-MOF-74)" *J. Am. Chem. Soc.* **2014**, *136*, 3334.
- (6) Kuppuswamy, S.; Bezpalko, M. W.; Powers, T. M.; Wilding, M. J. T.; **Brozek, C. K.**; C. K.; Foxman, B. M.; Thomas, C. M. "A Series of C₃-Symmetric Heterobimetallic Cr/M (M = Fe, Co, and Cu) Complexes" *Chem. Sci.* **2014**, *5*, 1617.
- (5) **Brozek, C. K.**; Dincă, M. "Ti³⁺-, V^{2+/3+}-, Cr^{2+/3+}-, Mn²⁺-, and Fe²⁺-Substituted MOF-5 and Redox Reactivity in Cr- and Fe-MOF-5" *J. Am. Chem. Soc.* **2013**, *135*, 12886.
- (4) **Brozek, C. K.**; Cozzolino, A. F.; Teat, S. J.; Chen, Y.-C.; Dincă, M. "Quantification of Site-Specific Cation Exchange in Metal-organic Frameworks Using Multi-Wavelength Anomalous X-ray Dispersion" *Chem. Mater.* **2013**, *25*, 2998.
- (3) Kuppuswamy, S.; Powers, T. M.; Johnson, B. M.; Bezpalko, M. W.; **Brozek, C. K.**; Foxman, B. M.; Berben, L. A.; Thomas, C. M. "Metal-Metal Interactions in C₃-Symmetric Diiron Imido Complexes Linked by Phosphinoamide Ligands" *Inorg. Chem.* **2013**, *52*, 4802.
- (2) **Brozek, C. K.**; Dincă, M. "Lattice-Imposed Geometry in Metal-Organic Frameworks: Lacunary Zn₄O Clusters in MOF-5 Serve as Tripodal Chelating Ligands for Ni²⁺" *Chem. Sci.* **2012**, *3*, 2110.
- (1) Iluc, V. M.; Laskowski, C. K.; **Brozek, C. K.**; Harrold, N. D.; Hillhouse, G. L. "Monomeric and Dimeric Disulfide Complexes of Nickel(II)" *Inorg. Chem.* **2010**, *49*, 6817.

Patents

- (1) Dincă, M.; Metzger, E. M.; **Brozek, C. K.** "Compositions and methods for selective olefin oligomerization comprising metal-organic frameworks" **2016** – US10493441B2 – Active
- (2) Brozek, C.K.; Marshall, R. "Products comprising 1,2,3-triazolate metal-organic frameworks and methods of making and using the same" **October 26, 2021** – U.S. Provisional Patent Application No. 63/263,070 – Filed

Invited Seminars

- | | |
|---|---------------------------------------|
| (37) California Institute of Technology | Pasadena, CA, November 2022 |
| (36) University of Southern California | Los Angeles, CA, November 2022 |
| (35) Columbia University | New York, NY, October 2022 |
| (34) Yale University | New Haven, CT, October 2022 |

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(33) University of Chicago	Chicago, IL, September 2022
(32) University of Notre Dame	South Bend, IN, September 2022
(31) Fall 2022 National ACS	Chicago, IL, August 2022
(30) Materials Science Institute of Madrid	Madrid, Spain, July 2022
(29) Institut Catala de Nanociencia i Nanotecnologia	Barcelona, Spain, July 2022
(28) University of Valencia	Valencia, Spain, July 2022
(27) University of California—San Diego	La Jolla, CA, April 2022
(26) University of California—Los Angeles	Los Angeles, CA, April 2022
(25) Pacifichem 2021	Honolulu, HI, December 2021
(24) 14th Pacific Rim Conference	Vancouver, BC, Canada, December 2021
(23) Mississippi State University	Starkville, MS, October 2021
(22) Texas Tech University	Lubbock, TX, October 2021
(21) Wayne State University	Detroit, MI, September 2021
(20) Michigan State University	East Lansing, MI, September 2021
(19) University of Michigan	Ann Arbor, MI, September 2021
(18) University of Washington	Seattle, WA, August 2021
(17) MCARE 2021	Virtual, July 2021
(16) 259th National ACS Meeting (<i> canceled due to COVID-19</i>)	Philadelphia, PA, March 2020
(15) Pacific Lutheran University	Tacoma, WA, November 2019
(14) 2019 Southeastern Regional ACS Meeting	Savannah, GA, October 2019
(13) 2019 Nanoporous Materials GRS	Andover, NH, August 2019
(12) 255th National ACS Meeting, Inorganic Division	New Orleans LA, March 2018
(11) Cornell University	Ithaca NY, February 2018
(10) University of Colorado, Boulder	Boulder CO, February 2018
(9) University of California, Riverside	Riverside CA, January 2018
(8) Michigan State University	East Lansing MI, January 2018
(7) University of Oregon	Eugene OR, December 2017
(6) ETH-Zurich	Zurich CH, November 2017
(5) University of Washington	Seattle WA, January 2017
(4) Princeton University	Princeton NJ, January 2017
(3) California Institute of Technology	Pasadena CA, January 2017
(2) 252nd National ACS Meeting, Inorganic Division	Philadelphia PA, August 2016
(1) 8th Annual Mössbauer Symposium	Northeastern University, Boston MA, January 2015

Referee for > 50 manuscripts and funding agency proposals since 2018:

Journal of the American Chemical Society, Angewandte Chemie International Edition, Chemical Science, Chemical Society Reviews, Inorganic Chemistry, Dalton Transactions, ACS Applied Materials and Interfaces, ACS Applied Energy Materials, Materials Chemistry, Materials Chemistry Frontiers, Journal of Materials Science, Inorganica Chimica Acta, Crystal Growth and Design, ACS Nano, Nature Communications

Department of Energy, ACS Petroleum Research Fund, National Science Foundation

Other Synergistic Activities

Conferences organized: ACS NORM 2019 (Session organized on Chemistry of Renewable Energy)

Committee Service: Diversity, Equity, and Inclusion (2019–2021), Graduate Admissions (2018–present), Faculty Advisory Committee for the Center for Advanced Materials Characterization in Oregon (2019–present).

Recent Major Outreach and Teaching: I have conceived, initiated, and directed several major broader impacts efforts within UO aimed at improving diversity, equity, and inclusion. Specifically, I created a student-led peer mediator program called ChemREFS (<https://chemrefs.uoregon.edu/>) that trains students through a state-certified peer mediator program to act as neutral, third-party resources for alleviating stress and conflict for fellow peers. The success of this program has motivated the Psychology, Mathematics, Physics, and Neuroscience Departments to partner with me in expanding the program. Additionally, I created a new classroom course (as voluntary, unpaid teaching overload) to train graduate students in developing outreach efforts for both their community and as the basis of Broader Impacts for their NSF

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Graduate Research Fellowship proposals, which is has led to the greatest number of NSF GRFP awardees in the history of UO, on par with the total number of awardees from the state of Texas. Student projects are publicly disseminated at <https://chemimpacts.uoregon.edu>.

Collaborations and other affiliations

Danna Freedman (MIT), Caroline Ross, (MIT), Hendrik Heinz (Colorado University, Boulder), Kevin Kittilstved (University of Massachusetts, Amherst), Xiaosong Li (University of Washington), Nuria Lopez (Institute of Chemical Research of Catalonia), Daniel Gamelin (University of Washington), Adrzej Ozarowski (Florida State University), Sebastian Stoian (University of Idaho), Emily Tsui (University of Notre Dame), Tobias Schaub (Ruprecht-Karls University of Heidelberg), Stefan Grimme (University of Bonn), Christopher Hendon (University of Oregon), Ilich Ibarra (National Autonomous University of Mexico), Satoshi Horike (Kyoto University)

Selected Press

"MIT faculty share best practices in graduate student advising"

MIT News, **2015**

"Advising communication"

Science Magazine, **2015**

"Improving student advising"

Science Magazine, **2015**

"New Nanocrystals could remove contaminants from air and water"

Around the O, **2022**

"Chemistry prof honored for research innovation, teaching"

Around the O, **2022**