Kathryn E. Knowles

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Appointments

July 2023-Present	**Associate Professor of Chemistry,** *University of Rochester*
September 2017-Present	**Affiliated Faculty in Materials Science Program,** *University of Rochester*
July 2016-2023	**Assistant Professor of Chemistry,** *University of Rochester*

Education and Research Experience

August 2013 – May 2016	**Postdoctoral Research Associate**, *University of Washington* Advisor: Daniel R. Gamelin, Department of Chemistry Synthesis and investigation of the luminescence of copper-containing colloidal semiconductor nanocrystals
September 2008 – June 2013	**Ph.D. in Inorganic Chemistry**, *Northwestern University* Advisor: Emily A. Weiss Thesis: "Decay and Dissociation of Excitons in Colloidal Semiconductor Quantum Dots in the Presence of Small Molecules"
September 2004 – May 2008	**B.S. in Chemistry with Highest Distinction**, *University of Rochester Summa Cum Laude* Research Advisor: Richard Eisenberg Thesis: "Exploring Cobaloximes as Molecular Catalysts in a Multi-Component System for the Photocatalytic Production of Hydrogen from Water"
September 2004 – May 2008	**B.A. in Mathematics with Highest Distinction,** *University of Rochester Summa Cum Laude*
Summer 2007	**NSF Summer REU**, *North Carolina State University* Advisor: Paul Maggard, Department of Chemistry Synthesis, characterization, and photocatalytic activity of copper niobates
Summer 2003	**High School Summer Research Program**, *University of Rochester* Advisor: Jacques Delettrez, Laboratory of Laser Energetics

Awards

- National Science Foundation Early CAREER Award, 2021
- Scialog Fellow: Negative Emissions Sciences, 2020-2022

- *Dalton Transactions,* New Talent Americas, 2020
- ACS Petroleum Research Fund, Doctoral New Investigator Award, 2019
- *Journal of Materials Chemistry C* Emerging Investigator, 2018
- University of Rochester Furth Fund Award, 2018
- Department of Energy EERE Postdoctoral Research Award, 2014-2016
- Northwestern University Presidential Fellowship, 2012-2013
- Joseph Lambert Award for Excellence in Junior Graduate Research, 2011
- Department of Energy Office of Science Graduate Research Fellowship, 2010-2013
- National Science Foundation Graduate Research Fellowship Awardee, 2010
- Northwestern Materials Research Science and Engineering Center Fellowship, 2010
- Dr. E. W. and Maude V. Flagg Award, *University of Rochester* 2008
- Doris Ermine Smith Award, *University of Rochester* 2008
- Barry M. Goldwater Scholarship, 2007-2008
- Catherine M. Block Memorial Fund Prize, *University of Rochester* 2007
- Merck Scholar Award for Achievement in Chemistry, 2007
- Elected to Phi Beta Kappa, 2007
- Merck Index Award, 2005
- National Merit Scholarship, 2004

Publications

[*]denotes corresponding authorship [#]denotes undergraduate co-author [‡]denotes equal contributions

13. Beidelman, B. A.; Zhang, X.[#]; Matson, E. M.; **Knowles, K. E.**[*] Acidity of Carboxylic Acid Ligands Influences the Formation of VO_2(A) and VO_2(B) Nanocrystals under Solvothermal Conditions. *ACS Nanosci. Au*, **2023**, DOI: 10.1021/acsnanoscienceau.3c00014.

12. Shelton, J. L.; **Knowles, K. E.**[*] Polaronic Optical Transitions in Hematite (α-Fe_2O_3) Revealed by First-Principles Electron-Phonon Coupling. *J. Chem. Phys.,* **2022**, *157*, 174703.

11. Beidelman, B. A.; Zhang, X.[#]; Sanchez-Lievanos, K. R.; Selino, A. V.[#]; Matson, E. M.[*]; **Knowles, K. E.**[*] Influence of Water Concentration on the Solvothermal Synthesis of VO_2(B) Nanocrystals, *CrystEngComm*, **2022**, *24*, 6009-6017.

10. Sanchez-Lievanos, K. R.; **Knowles, K. E.**[*] Controlling Cation Distribution and Morphology in Colloidal Zinc Ferrite Nanocrystals. *Chem. Mater.*, **2022**, *34*, 7446-7459.

9. Chakraborty, S.[‡]; Schreiber, E.[‡]; Sanchez-Lievanos, K. R.; Tariq, M.; Brennessel, W. W.; **Knowles, K. E.**; Matson, E. M.[*] Modelling local structural and electronic consequences of proton and hydrogen-atom uptake in VO_2 with polyoxovanadate clusters. *Chem. Sci.*, **2021**, *12*, 12744-12753.

8. Brewster, D. A.[‡]; Koch, M. D.[‡]; **Knowles, K. E.**[*] Evaluation of electrochemical properties of nanostructured metal oxide electrodes immersed in redox-inactive organic media. *Phys. Chem. Chem. Phys.*, **2021**, *23*, 17904-17916.

7. Shelton, J. L.; **Knowles, K. E.**[*] Thermally Activated Optical Absorption into Polaronic States in Hematite. *J. Phys. Chem. Lett.,* **2021**, *12*, 3343-3351.

6. Sanchez-Lievanos, K. R.; Stair, J.; **Knowles, K. E.**[*] Cation Distribution in Spinel Ferrite Nanocrystals: Characterization, Impact on Physical Properties, and Opportunities for Synthetic

Control. *Inorg. Chem.*, **2021**, *60*, 4291-4305. (Invited contribution to the "Forum on the Inorganic Chemistry of Nanoparticles")

5. Sanchez-Lievanos, K. R.; Tariq, M.; Brennessel, W. W.; **Knowles, K. E.**[*] Heterometallic Trinuclear Oxo-centered Clusters as Single-Source Precursors for Synthesis of Stoichiometric Monodisperse Transition Metal Ferrite Nanocrystals. *Dalton Trans.*, **2020**, *49*, 16348-16358. (Invited Contribution to the *New Talent: Americas* Issue, designated a HOT article)

4. Brewster, D. A.; Bian, Y.[#]; **Knowles, K. E.**[*] Direct Solvothermal Synthesis of Phase-Pure Colloidal NiO Nanocrystals. *Chem. Mater.*, **2020**, *32,* 2004-2013.

3. Tariq, M.; Koch, M. D.; Andrews, J. W.; **Knowles, K. E.**[*] Correlation Between Surface Chemistry and Optical Properties in Colloidal Cu_2O Nanoparticles. *J. Phys. Chem. C*, **2020**, *124*, 4810-4819.

2. Brewster, D. A.; Sarappa, D. J.[#]; **Knowles, K. E.**[*] Role of Aliphatic Ligands and Solvent Composition in the Solvothermal Synthesis of Iron Oxide Nanocrystals. *Polyhedron*, **2019**, *157*, 54-62.

1. **Knowles, K.E.**[*]; Koch, M. D.[‡]; Shelton, J. L.[‡] Three Applications of Ultrafast Transient Absorption Spectroscopy of Semiconductor Thin Films: Spectroelectrochemistry, Microscopy, and Identification of Thermal Contributions. *J. Mater. Chem. C* **2018**, *6*, 11853-11867. (Invited Contribution to *2018 Emerging Investigators* Issue)

Prior to University of Rochester

25. Marchioro, A.; Whitham P. J.; Nelson, H. D.; De Siena, M. C.; **Knowles, K. E.**; Polinger, V. Z.; Reid, P. J.; Gamelin, D. R.[*] Strong Dependence of Quantum-Dot Delayed Luminescence on Excitation Pulse Width. *J. Phys. Chem. Lett.* **2017**, *8*, 3997-4003.

24. Marchioro, A.; Whitham, P. J.; **Knowles, K. E.**; Kilburn, T. B.; Reid, P. J.; Gamelin, D. R.[*] Tunneling in the Delayed Luminescence of Colloidal CdSe, Cu^+-Doped CdSe, and $CuInS_2$ Semiconductor Nanocrystals, and Relationship to Blinking. *J. Phys. Chem. C* **2016**, *120*, 27040-27049.

23. Yang, L.[#]; **Knowles, K. E.**; Gopalan, A.[#]; Hughes, K. E.; James, M. C.[#]; Gamelin, D. R. One-Pot Synthesis of Monodisperse Colloidal Copper-Doped CdSe Nanocrystals Mediated by Ligand-Copper Interactions. *Chem. Mater.* **2016**, *28*, 7375-7384.

22. Whitham, P. J.; Marchioro, A.; **Knowles, K. E.**; Kilburn, T. B.; Reid, P. J.; Gamelin, D. R.[*] Single-Particle Photoluminescence Spectra, Blinking, and Delayed Luminescence of Colloidal $CuInS_2$ Nanocrystals. *J. Phys. Chem. C* **2016**, *120*, 17136-17142.

21. **Knowles, K. E.**[*]; Hartstein, K. H.; Kilburn, T. B.; Marchioro, A.; Nelson, H. D.; Whitham, P. J.; Gamelin, D. R.[*] Luminescent Colloidal Semiconductor Nanocrystals Containing Copper: Synthesis, Photophysics, and Applications. Invited Review*, Chem. Rev.* **2016**, *116*, 10820-10851.

20. **Knowles, K. E.**; Nelson, H. D.; Kilburn, T. B.; Gamelin, D. R.[*] Singlet-Triplet Splittings in the Luminescent Excited States of Colloidal Cu^+:CdSe, Cu^+:InP, and $CuInS_2$ Nanocrystals: Charge-Transfer Configurations and Self-Trapped Excitons, *J. Am. Chem. Soc.* **2015**, *137*, 13138-13147.

19. Schimpf, A. M.; **Knowles, K. E.**; Carroll, G. M.; Gamelin, D. R.[*] Electronic Doping and Redox-Potential Tuning in Colloidal Semiconductor Nanocrystals, *Acc. Chem. Res.* **2015**, *48*, 1929-1937.

18. Whitham, P. J.; **Knowles, K. E.**; Reid, P. J.; Gamelin, D. R.* Photoluminescence Blinking and Reversible Electron Trapping in Copper-Doped CdSe Nanocrystals, *Nano Lett.* **2015**, *15*, 4045-4051.

17. Knowles, K. E.; Kilburn, T. B.; Alzate, D. G.#; McDowall, S.; Gamelin, D. R.* Bright $CuInS_2$/CdS Nanocrystal Phosphors for High-Gain Full-Spectrum Luminescent Solar Concentrators, *Chem. Commun.* **2015**, *51*, 9129-9132.

16. Bradshaw, L. R.; **Knowles, K. E.**; McDowall, S.; Gamelin, D. R.* Nanocrystals for Luminescent Solar Concentrators, *Nano Lett.* **2015**, *15*, 1315-1323.

Featured in *Nature: News and Views*: Debije, M. Renewable Energy: Better luminescent solar panels in prospect. *Nature* **2015**, *519*, 298.

15. Lefler, K. M.; Brown, K. E.; Salamant, W. A.; Dyar, S. M.; **Knowles, K. E.**; Wasielewski, M. R.* Triplet State Formation in Photoexcited Slip-Stacked Perylene-3,4:9,10-bis(dicarboximide) Dimers on a Xanthene Scaffold, *J. Phys. Chem. A* **2013**, *117*, 10333-10345.

14. Knowles, K. E.; Tagliazucchi, M.; Malicki, M.; Swenson, N. K.; Weiss, E. A.* Electron Transfer as a Probe of the Permeability of Organic Monolayers on the Surfaces of Colloidal PbS Quantum Dots, *J. Phys. Chem. C* **2013**, *117*, 15849-15857.

13. Knowles, K. E.; Peterson, M. D.; McPhail, M R.; Weiss, E. A.* Exciton Dissociation within Quantum Dot-Organic Complexes: Mechanisms, Use as a Probe of Interfacial Structure, and Applications, *J. Phys. Chem. C* **2013**, *117*, 10229-10243.

12. Knowles, K. E.; Malicki, M.; Parameswaran, R.; Cass, L. C.; Weiss, E. A.* Spontaneous Multi-Electron Transfer from the Surfaces of PbS Quantum Dots to Tetracyanoquinodimethane, *J. Am. Chem. Soc.* **2013**, *135*, 7264-7271.

11. Knowles, K. E.; Malicki, M.; Weiss, E. A.* Dual-Timescale Photoinduced Electron Transfer from PbS Quantum Dots to a Molecular Acceptor, *J. Am. Chem. Soc.* **2012**, *134*, 12470-12473.

10. Malicki, M.; **Knowles, K. E.**; Weiss, E. A.* Gating of Hole Transfer from Photoexcited PbS Quantum Dots to Aminoferrocene by the Ligand Shell of the Dots, *Chem. Commun.* **2013**, *49*, 4400-4402.

9. Evans, C. M.; Cass, L. C.; **Knowles, K. E.**; Tice, D. B.; Chang, R. P. H.; Weiss, E. A.* Review of the Synthesis and Properties of Colloidal Quantum Dots: The Evolving Role of Coordinating Surface Ligands, *J. Coord. Chem.* **2012**, *65*, 2391-2414.

8. Knowles, K. E.; Frederick, M. T.; Tice, D. B.; Morris-Cohen, A. J.; Weiss, E. A.* Colloidal Quantum Dots: Think Outside the (Particle-in-a-)Box, *J. Phys. Chem. Lett.* **2012**, *3*, 18-26.

7. Knowles, K. E.; McArthur, E. A.; Weiss, E. A.* A Multi-Timescale Map of Radiative and Nonradiative Decay Pathways for Excitons in CdSe Quantum Dots. *ACS Nano* **2011**, *5*, 2026-2035.

6. Frederick, M. T.; Achtyl, J. A.; **Knowles, K. E.**; Weiss, E. A.*; Geiger, F. M.* Surface-Amplified Ligand Disorder in CdSe Quantum Dots Determined by Electron and Coherent Vibrational Spectroscopies, *J. Am. Chem. Soc.* **2011**, *133*, 7476-7481.

5. Donakowski, M. D.; Godbe, J. M.#; Sknepnek, R.; **Knowles, K. E.**; Olvera de la Cruz, M.; Weiss, E. A.* A Quantitative Description of the Binding Equilibria of para-Substituted Aniline Ligands and CdSe Quantum Dots. *J. Phys. Chem. C* **2010**, *114*, 22526-22534.

4. McArthur, E. A.; Morris-Cohen, A. J.; **Knowles, K. E.**; Weiss, E. A.* Charge Carrier Resolved Relaxation of the First Excitonic State in CdSe Quantum Dots Probed with Near-Infrared Transient Absorption Spectroscopy, *J. Phys. Chem. B* **2010**, *114*, 14514-14520.

3. Morris-Cohen, A. J.; Donakowski, M. D.; **Knowles, K. E.**; Weiss, E. A.* The Effect of a Common Purification Procedure on the Chemical Composition of Surfaces of CdSe Quantum Dots Synthesized with Trioctylphosphine Oxide (TOPO), *J. Phys. Chem. C* **2010**, *114*, 897-906.

2. **Knowles, K. E.**; Tice, D. B.; McArthur, E. A.; Solomon, G. C.; Weiss, E. A.* Chemical Control of the Photoluminescence of CdSe Quantum Dot-Organic Complexes with a Series of Para-Substituted Aniline Ligands, *J. Am. Chem. Soc.* **2010**, *132*, 1041-1050.

1. Du, P.; **Knowles, K.#;** Eisenberg, R.* A Homogeneous System for the Photogeneration of Hydrogen from Water Based on a Platinum(II) Terpyridyl Acetylide Chromophore and a Molecular Cobalt Catalyst, *J. Am. Chem. Soc. 130*, **2008**, 12576-12577.

Patents

Patrick, D.; Gilbertson, J.; McDowall, S.; Erickson, C.; Gamelin, D. R.; Bradshaw, L.; McLaurin, E. J.; **Knowles, K. E.** Photoluminescent Semiconductor Nanocrystal-Based Luminescent Solar Concentrators. U.S. Patent 9,964,680 B2, May 8, 2018.

Funding

Active Support

University of Rochester University Research Award (PI) 2022-2023
"*Photoinduced Polaron Formation in Lead Halide Perovskite Semiconductors"*

Scialog: Negative Emissions Sciences Project Grant (co-PI) 2022-2023
(Sponsored by the Alfred P. Sloan Foundation)
"*Photochemical Amine Production from N_2 and CO_2*"

NSF CAREER Award (CHE-2044462, PI) 2021-2026
"*CAREER: CAS: Combining Main Group and Transition Metals to Tune the Electronic Structure, Photophysics, and Photocatalytic Activity of Spinel Oxide Nanocrystals*"

ACS Petroleum Research Fund Doctoral New Investigator Award (PI) 2020-2023
"*Colloidal Copper and Copper(I) Oxide Nanocrystals as Redox-Tunable Multi-Functional Catalysts and Photocatalysts for Cross-Coupling Reactions*"

NSF Standard Grant (CHE-1900125, co-PI) 2019-2023
"*Collaborative Research: Investigating Photoinduced Charge Transfer Dynamics Across Molecule-Nanocrystal Interfaces*"

Completed Support

Scialog: Negative Emissions Sciences Project Grant (co-PI) 2021-2022
(Sponsored by the Alfred P. Sloan Foundation)
"Integrated Low-Temperature Electrified Process for CO_2 Direct Air Capture and Transformation to Solid Carbon"

University of Rochester University Research Award (PI) 2019-2020
"*Polyoxovanadate Clusters as Single-Source Precursors for Colloidal Vanadium Oxide Nanocrystals*"

University of Rochester Furth Fund Award (PI) 2018-2019
"*Charge Carrier Dynamics at Metal Oxide Semiconductor/Electrolyte Interfaces*"

Invited Presentations

Gordon Research Conference on Colloidal Semiconductor Nanocrystals, July 2024
University of Richmond, October 2023
American Chemical Society National Meeting, San Francisco, CA, August 2023
Nanocrystals Northwest, July 2023
University of Washington, March 2023
Youngstown State University, December 2022
Northeast Regional Meeting of the American Chemical Society, October 2022
International Solvothermal and Hydrothermal Association, September 2022
Lehigh University, September 2022
American Chemical Society National Meeting, Chicago, IL August 2022
Cornell University, May 2022
University of Arkansas, April 2022
Rochester Collegiate Research Symposium, Keynote Speaker, April 2022
University of Oregon, April 2022
Notre Dame University, April 2022
University of Pennsylvania, March 2022
University of Vermont, March 2022
University of Michigan, February 2022
Pennsylvania State University, February 2022
University of Iowa, February 2022
Vanderbilt University, February 2022
Canisius College, February 2022
University of North Carolina, February 2022
American Chemical Society National Meeting, Fall 2021
Photochemistry Spotlight, July 2021
SUNY Buffalo, Graduate Student Symposium, Keynote Speaker June 2021
American Chemical Society National Meeting, Spring 2021
SUNY Potsdam, October 2020
American Chemical Society National Meeting, Fall 2020
Kenyon College, April 2020 (Cancelled due to COVID-19)
2020 NAGC Meeting, Cyprus (Cancelled due to COVID-19)
ACS National Meeting, Philadelphia, PA Spring 2020 (Cancelled due to COVID-19)
Canadian Society of Chemistry Annual Meeting, Quebec City, June 2019
Spring Meeting of the Materials Research Society, Phoenix, AZ April 2019
SUNY Brockport, February 2019
Barnard College, October 2018
SUNY Geneseo, September 2018
American Chemical Society National Meeting, Boston, MA Fall 2018

Northeast Regional Meeting of the American Chemical Society, Fall 2016
ACS National Meeting, Denver, CO Spring 2015
University of Rochester, Rochester, NY January 2015

Other Presentations

since becoming a faculty member at the University of Rochester

Gordon Research Conference on Colloidal Semiconductor Nanocrystals, July 2022, poster
Inter-American Photochemical Society Conference, January 2020, poster
National Academy of Sciences Arthur M. Sackler Colloquium, October 2018, poster
Gordon Research Conference on Colloidal Semiconductor Nanocrystals, July 2018, poster
QD2018 - Tenth International Conference on Quantum Dots, June 2018, poster
Gordon Research Conference on Colloidal Semiconductor Nanocrystals, August 2016, poster

Teaching and Advising Activities

Spring 2023	General Chemistry (CHEM 132), Co-Instructor
Fall 2021	Chemical Instrumentation (CHEM 231W), Instructor/Lab Coordinator
Spring 2018-2020	Molecular Spectroscopy (CHEM 232), Instructor/Lab Coordinator
Fall 2016-2018, 2020	Spectroscopy and Kinetics (CHEM 458), Instructor

University of Rochester Center for Excellence in Teaching and Learning Teaching Innovation Grant (2018-2020, with Prof. Ellen Matson) to support development of a joint, collaborative laboratory experience for CHEM 234 and CHEM 232

Graduate Students Mentored:

Mehrin Tariq (PhD, 2021)
Jordan Andrews (MS, 2018)
David Brewster (PhD, 2021)
Melissa Koch (PhD, 2022)
Jacob Shelton (2017-Present)
Brittney Beidelman (Mat. Sci. PhD, 2022)
Dominick Sarappa (MS, 2019)
Karla Sanchez Lievanos (Ph.D. 2023)
James Stair (2019-2023)
Erica Craddock (2021-Present)
Revathy Rajan (2021-Present)
Aida Gueye (Mat. Sci., 2022-Present)

Undergraduate Students Mentored:

Tae Ryoo (Spring 2017)
Joshua Lomeo (BS, 2018)
Dominick Sarappa (BS, 2028)
Yifeng Bian (BS, 2019)
Ana Claudia Fingolo (Summer 2017)
Karla Sanchez Lievanos (Summer 2018)
Garrett Hoteling (BS, 2019)
Sina Wrede (Summer 2019)
Annabel Selino (BS, 2020)
Hannah Roberts (BA, 2021)
Claire Lee (2020)
Brian Ganeles (2021-2022)
Francesca Elverson (Summer 2021)
Xiaotian (Tian) Zhang (2021-Present)
Tong (Molly) Sun (2022-Present)
MaryAgnes Balogun (Summer 2022)
Franklin Xu, (2022-Present)
Maddy Wahl (Summer 2023)
Elise Gendrich (2023-Present)

Service Activities

University Activities:	Chemistry Department Faculty Recruiting Committee, 2022-Present Chemistry Department Safety Committee, 2022-Present Chemistry Department iScholar Program Coordinator 2019-Present Chemistry Department Graduate Recruiting Committee, 2016-Present Chemistry Department Seminar/Colloquium Committee, 2018-2022 Chemistry Department Diversity, Equity, Inclusion, and Outreach Committee, 2020-Present University of Rochester Goldwater Campus Nomination Committee, 2017-Present
Community Activities:	Mentor for 2023 NSF Chemistry Early Career Investigator Workshop Symposium Organizer for 2022 Northeast Regional Meeting of the ACS Discussion Leader for 2020 Inter-American Photochemical Society Conference Discussion Leader for 2018 GRC on Colloidal Semiconductor Nanocrystals Discussion Leader for Gordon Research Seminar on Colloidal Semiconductor Nanocrystals, July 30-31, 2016
Reviewer Activities:	*Nature Communications, Journal of the American Chemical Society, Journal of Physical Chemistry, Nature Reviews Chemistry, Chemical Communications, Nano Letters, Inorganic Chemistry, Chemistry of Materials, ACS Nano, ACS Catalysis, ACS Materials & Interfaces*, *Polyhedron,* National Science Foundation, ACS Petroleum Research Fund, Question Reviewer for 2014 National Science Bowl
Outreach Activities:	Faculty Coordinator of National Chemistry Week Outreach Acitivities (2022), Developed Virtual Module on Electrochemistry for Upward Bound (2021), Developed and instructed Upward Bound summer course titled “Introduction to Solar Energy” (2017-2018)