

– KARTHISH MANTHIRAM –

ASSISTANT PROFESSOR, DEPARTMENT OF CHEMICAL ENGINEERING
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

CONTACT

Address: Massachusetts Institute of Technology
77 Massachusetts Avenue, 66-550
Cambridge, MA 02139

Phone: 617-715-5740

E-mail: karthish@mit.edu

PROFESSIONAL APPOINTMENTS

2017 – present **Assistant Professor**
Massachusetts Institute of Technology
Department of Chemical Engineering

2015 – 2016 **Postdoctoral Research Associate**
California Institute of Technology
Division of Chemistry and Chemical Engineering
Advisor: Robert. H. Grubbs

EDUCATION

2010 – 2015 **Ph.D. in Chemical Engineering**
University of California, Berkeley
Advisor: A. Paul Alivisatos, Department of Chemistry
Dissertation: Nanoscale metals and semiconductors for the storage of solar
energy in chemical bonds

2006 – 2010 **B.S. in Chemical Engineering with Honors and Distinction**
Minor in Materials Science and Engineering
Stanford University
Advisors: Yi Cui, Materials Science and Engineering
Jim Swartz, Chemical Engineering
Honors Thesis: Progress Towards Developing a Red-Shifted Mutant of the Gaussia
Luciferase

HONORS AND AWARDS

2019	NSF CAREER Award
2019	American Chemical Society Petroleum Research Fund Doctoral New Investigator Award
2019	3M Nontenured Faculty Award
2019	MIT Chemical Engineering Outstanding Graduate Teaching Award
2019	Young Innovator Award in NanoEnergy
2018	C. Michael Mohr Outstanding Undergraduate Teaching Award
2017	Forbes 30 Under 30 in Science
2016	Outstanding Postdoctoral Researcher Poster at Gordon Research Conference on Catalysis
2015	Materials Research Society Outstanding Student Presentation Award
2015	Electrochemical Society Dan Cubicciotti Award
2014	Poster Prize at Gordon Research Conference on Noble Metal Nanoparticles
2013	Selected to Attend Lindau Nobel Laureates Meeting, Lindau, Germany
2012	Dow Excellence in Teaching Award, University of California, Berkeley
2012	Chemical Engineering Departmental Teaching Award, University of California, Berkeley
2012	3rd Place Poster Prize, NaNaX 5 Meeting, Malaga, Spain
2010 – 2013	Department of Energy Office of Science Graduate Fellowship
2010 – 2011	Tau Beta Pi Fellowship
2010	National Science Foundation Graduate Fellowship (Declined)
2010	Mason and Marsden Prize in Chemical Engineering, Stanford University
2010	Faculty Award for Outstanding Honors Research, Chemical Engineering, Stanford University
2010	Frederick E. Terman Award for Scholastic Achievement in Engineering, Stanford University
2010	Award for Academic Achievement in Chemical Engineering, Stanford University
2009	Barry M. Goldwater Scholarship
2009	Channing Robertson Award in Chemical Engineering, Stanford University
2009	Merck Engineering and Technology Fellowship (Declined)
2009	Science and Technology at the Nanoscale Research Award, Materials Science and Engineering, Stanford University
2008	Vice Provost for Undergraduate Education Research Award, Chemical Engineering, Stanford University
2007	President's Award for Academic Excellence in the Freshman Year, Stanford University
2006	Valedictorian, Liberal Arts and Science Academy, Austin, Texas
2006	National Merit Scholarship

PUBLICATIONS

1. J. P. Welsh, K. G. Patel, **K. Manthiram**, and J. R. Swartz, "Multiply Mutated Gaussia Luciferases Provide Prolonged and Intense Bioluminescence," *Biochemical and Biophysical Research Communications* **389**, 563-568 (2009).
2. J. Bonomo, J. P. Welsh, **K. Manthiram**, and J. R. Swartz, "Comparing the functional properties of the Hsp70 chaperones, DnaK and BiP," *Biophysical Chemistry* **149**, 58-66 (2010).
3. **K. Manthiram** and A. P. Alivisatos, "Tunable Localized Surface Plasmon Resonances in Tungsten Oxide Nanocrystals," *Journal of the American Chemical Society* **134**, 3995-3998 (2012).
4. **K. Manthiram**,* B. J. Beberwyck,* D. V. Talapin, and A. P. Alivisatos, "Seeded Synthesis of CdSe/CdS Rod and Tetrapod Nanocrystals," *Journal of Visualized Experiments* **82**, 50731 (2013).

5. P. K. Jain, **K. Manthiram**, J. Engel, S. L. White, J. A. Faucheaux, and A. P. Alivisatos, "Doped semiconductor nanocrystals as plasmonic probes of redox chemistry," *Angewandte Chemie International Edition* **52**, 13671-13675 (2013).
6. **K. Manthiram**, Y. Surendranath, and A. P. Alivisatos, "Dendritic assembly of gold nanoparticles during fuel-forming electrocatalysis," *Journal of the American Chemical Society* **136**, 7237-7240 (2014).
7. **K. Manthiram**, B. J. Beberwyck, and A. P. Alivisatos, "Enhanced electrochemical methanation of carbon dioxide with a dispersible nanoscale copper catalyst," *Journal of the American Chemical Society* **136**, 13319-13325 (2014).
8. D. Hellebusch, **K. Manthiram**, B. J. Beberwyck, and A. P. Alivisatos, "In-situ TEM Imaging of Cadmium Selenide Nanorod Sublimation," *Journal of Physical Chemistry Letters* **6**, 605-611 (2015).
9. Q. Chen, H. Cho, **K. Manthiram**, M. Yoshida, X. Ye, and A. P. Alivisatos, "Interaction potentials of anisotropic nanocrystals from the trajectory sampling of particle motion in *in-situ* liquid phase transmission electron microscopy," *ACS Central Science* **1**, 33-39 (2015).
10. T. M. Mattox, X. Ye, **K. Manthiram**, A. P. Alivisatos, and J. J. Urban, "Chemical Controls of Plasmons in Metal Chalcogenide and Metal Oxide Nanostructures," *Advanced Materials* **27**, 5830-5837 (2015).
11. S. Nguyen, Q. Zhang, **K. Manthiram**, X. Ye, J. P. Lomont, C. B. Harris, H. Weller, and A. P. Alivisatos, "Study of Heat Transfer Dynamics from Gold Nanorods to the Environment via Time-Resolved Infrared Spectroscopy," *ACS Nano* **10**, 2144-2151 (2016).
12. Z. J. Schiffer and **K. Manthiram**, "Electrification and Decarbonization of the Chemical Industry," *Joule* **1**, 10-14 (2017).
13. M. Zhu, R. Ye, K. Jin, N. Lazouski, and **K. Manthiram**, "Elucidating the Reactivity and Mechanism of CO₂ Electroreduction at Highly Dispersed Cobalt Phthalocyanine," *ACS Energy Letters* **3**, 1381-1386 (2018).
14. N. Lazouski, Z. J. Schiffer, K. Williams, **K. Manthiram**, "Understanding Continuous Lithium-Mediated Electrochemical Nitrogen Reduction," *Joule* **3**, 1-13 (2019).
15. M. Zhu, D. Yang, R. Ye, J. Zeng, N. Corbin, **K. Manthiram**, "Inductive and electrostatic effects on immobilized cobalt porphyrins for electrocatalytic CO₂ reduction," *Catalysis Science and Technology* **9**, 974 - 980 (2019).
16. N. Lazouski and **K. Manthiram**, "Ambient lithium-mediated ammonia synthesis," *Trends in Chemistry* **1**, 1 (2019).
17. K. Williams, N. Corbin, J. Zeng, N. Lazouski, D. Yang, and **K. Manthiram**, "Protecting Effect of Mass Transport during Electrochemical Reduction of Oxygenated Carbon Dioxide Feedstocks," *Sustainable Energy and Fuels* **3**, 1225-1232 (2019).
18. Z. Schiffer, N. Lazouski, N. Corbin, and **K. Manthiram**, "Nature of the first electron transfer in electrochemical ammonia activation in a non-aqueous medium," *Journal of Physical Chemistry C* **123**, 9713-9720 (2019).

19. K. Jin, J. H. Maalouf, N. Lazouski, N. Corbin, D. Yang, and **K. Manthiram**, "Epoxidation of Cyclooctene Using Water as the Oxygen-Atom Source at Manganese Oxide Electrocatalysts," *Journal of the American Chemical Society* **141**, 6413-6418 (2019).
20. D. Yang, M. Zhu, Z. Schiffer, K. Williams, X. Song, X. Liu, and **K. Manthiram**, "Direct electrochemical carboxylation of benzylic C-N bonds with carbon dioxide," *ACS Catalysis* **9**, 4699-4705 (2019).
21. N. Corbin, J. Zeng, K. Williams, and **K. Manthiram**, "Heterogeneous molecular catalysts for electrocatalytic CO₂ reduction," *Nano Research*, **12**, 2093–2125 (2019).

INVITED TALKS

1. **K. Manthiram** and A. P. Alivisatos, "Tunable Localized Surface Plasmon Resonances in Tungsten Oxide Nanocrystals," NaNaX 5 Meeting, May 9, 2012, Malaga, Spain.
2. **K. Manthiram** and A. P. Alivisatos, "Tunable Localized Surface Plasmon Resonances in Tungsten Oxide Nanocrystals," University of Hamburg, May 11, 2012, Hamburg, Germany.
3. **K. Manthiram**, B. J. Beberwyck, and A. P. Alivisatos, "Electrochemical methanation of carbon dioxide with a highly dispersed copper nanocatalyst," Gordon Research Conference on Noble Metal Nanoparticles, June 19, 2014, South Hadley, Massachusetts.
4. **K. Manthiram**, "Electrochemical reduction of carbon dioxide with highly-dispersed metal nanoparticles," UC Santa Barbara Chemical Engineering Seminar Series, January 15, 2015, Santa Barbara, California. (Junior Faculty Candidate Seminar)
5. **K. Manthiram**, "Electrochemical reduction of carbon dioxide with highly-dispersed metal nanoparticles," Stanford Chemical Engineering Seminar, January 20, 2015, Stanford, California. (Junior Faculty Candidate Seminar)
6. **K. Manthiram**, "Electrochemical reduction of carbon dioxide with highly-dispersed metal nanoparticles," California Institute of Technology Chemical Engineering Seminar, January 30, 2015, Pasadena, California. (Junior Faculty Candidate Seminar)
7. **K. Manthiram**, "Electrochemical reduction of carbon dioxide with highly-dispersed metal nanoparticles," Berkeley Chemical and Biological Engineering Special Seminar, February 2, 2015, Berkeley, California. (Junior Faculty Candidate Seminar)
8. **K. Manthiram**, "Electrochemical reduction of carbon dioxide with highly-dispersed metal nanoparticles," Princeton Chemical and Biological Engineering Seminar, February 4, 2015, Princeton, New Jersey. (Junior Faculty Candidate Seminar)
9. **K. Manthiram**, "Electrochemical reduction of carbon dioxide with highly-dispersed metal nanoparticles," Minnesota Chemical Engineering and Materials Science Seminar, February 10, 2015, Minneapolis, MN. (Junior Faculty Candidate Seminar)
10. **K. Manthiram**, "Electrochemical reduction of carbon dioxide with highly-dispersed metal nanoparticles," University of Illinois at Urbana-Champaign Chemical and Biomolecular Engineering, February 17, 2015, Urbana, IL. (Junior Faculty Candidate Seminar)

11. **K. Manthiram**, "Electrochemical reduction of carbon dioxide with highly-dispersed metal nanoparticles," Massachusetts Institute of Technology Chemical Engineering Seminar Series, February 27, 2015, Cambridge, MA. (Junior Faculty Candidate Seminar)
12. **K. Manthiram**, "Putting carbon to work: Leapfrogs for carbon capture, utilization, and storage," CERAWEEK Meeting Panel, March 7, 2017, Houston, TX.
13. **K. Manthiram**, "Mechanistic Insights into Highly Active Metal Phthalocyanine Catalysts for Electrochemical Carbon Dioxide Reduction," Electrochemical Society Meeting, May 16, 2018, Seattle, WA.
14. **K. Manthiram**, "Point-of-need synthesis of critical chemicals, fuels, and materials," Aberdeen Proving Ground, Army Research Laboratory, May 23, 2018, Aberdeen, MD.
15. **K. Manthiram**, "Point-of-need synthesis of critical chemicals, fuels, and materials," Adelphi Laboratory Center, Army Research Laboratory, May 24, 2018, Adelphi, MD.
16. **K. Manthiram**, "Mechanism of carbon dioxide reduction at metal tetrapyrrole macrocycles," Telluride Science Research Center Workshop on Molecular Chemistry in Electrochemical Energy Storage, July 12, 2018, Telluride, CO.
17. **K. Manthiram**, "Reactivity and mechanism of carbon dioxide reduction at supported metal phthalocyanines," Catalysis East Workshop, August 14, 2018, Hancock, MA.
18. **K. Manthiram**, "Molecular-level insights into electrocatalytic carbon dioxide reduction by cobalt macrocycles," American Chemical Society Meeting, August 19, 2018, Boston, MA.
19. **K. Manthiram**, "Tailoring electrocatalytic surfaces for selective alcohol functionalization," American Chemical Society Meeting, August 22, 2018, Boston, MA.
20. **K. Manthiram**, "Modular electrochemical synthesis through molecular-level tuning of catalytic interfaces," 3M, September 25, 2018, Maplewood, MN.
21. **K. Manthiram**, "Direct oxidative functionalization of alcohols at electrode surfaces," American Institute of Chemical Engineers Meeting, November 1, 2018, Pittsburgh, PA.
22. **K. Manthiram**, "Modular ammonia synthesis," Mitsui Interbusiness Research Institute Meeting, November 7, 2018, Cambridge, MA.
23. **K. Manthiram**, "Making Fuels and Fertilizers Out of Thin Air," Da Vinci Lecture, Massachusetts Institute of Technology, November 9, 2018, Cambridge, MA.
24. **K. Manthiram**, "Synthetic electrocatalysis: molecular-level insights into controlling charge transfers at interfaces," Oklahoma State University, February 19, 2019, Stillwater, OK.
25. **K. Manthiram**, "Electrochemically forming and breaking the N-H bond in ammonia," American Chemical Society, April 2, 2019, Orlando, FL.
26. **K. Manthiram**, "Electrochemistry of the N-H bond: synthesis and oxidation of ammonia," Electrochemical Society, May 28, 2019, Dallas, TX.

27. **K. Manthiram**, “Synthetic Electrocatalysis for Modular Chemical Production,” National Renewable Energy Laboratory, August 15, 2019, Golden, CO.
28. **K. Manthiram**, “Electrochemical Epoxidation of Olefins Using Water as Oxygen-atom Source,” American Chemical Society, August 27, 2019, San Diego, CA.
29. **K. Manthiram**, “Understanding Lithium-Mediated Ammonia Synthesis,” American Chemical Society, August 27, 2019, San Diego, CA.
30. **K. Manthiram**, “Electrification and Decarbonization of Chemical Synthesis,” Tufts University, September 9, 2019, Medford, MA.
31. **K. Manthiram**, “Chemical Energy Storage,” National Rural Utilities Boston100 Meeting, September 20, 2019, Cambridge, MA.
32. **K. Manthiram**, “Sustainable Chemical Manufacturing Using Renewable Energy,” Madurai Kamraj University, September 23, 2019, Madurai, India.
33. **K. Manthiram**, “Sustainable Chemical Manufacturing Using Renewable Energy,” Manonmaniam Sundaranar University, September 24, 2019, Tirunelveli, India.
34. **K. Manthiram**, “Carbon dioxide as a sustainable one-carbon synthon,” CellPress Lablinks on Carbon Dioxide Capture and Utilization, Harvard University, October, 14, 2019, Cambridge, MA.
35. **K. Manthiram**, “Electrification of Chemical Manufacturing,” Annual Research Conference, Energy Initiative, MIT, November 6, 2019, Cambridge, MA.
36. **K. Manthiram**, “Manthiram Lab: Electrification and decarbonization of chemical transformations,” Annual Research Conference, Energy Initiative, MIT, November 7, 2019, Cambridge, MA.
37. **K. Manthiram**, “New strategies for scalable production of hydrogen and hydrogen-carriers,” Hydrogen Workshop, Industrial Liaison Program, MIT, November 12, 2019, Cambridge, MA.
38. **K. Manthiram**, “Continuous Lithium-Mediated Ammonia Synthesis at Ambient Conditions,” American Institute of Chemical Engineers Annual Meeting, November 13, 2019, Orlando, FL.
39. **K. Manthiram**, “Electrification and Decarbonization of Chemical Synthesis,” Advances, Challenges, and Long-Term Opportunities of Electrochemistry: Addressing Societal Needs, Chemical Sciences Roundtable, National Academies, November 19, 2019, Washington, D.C.
40. **K. Manthiram**, “Lithium-Mediated Nitrogen Reduction to Ammonia at Ambient Conditions,” Materials Research Society, December 5, 2019, Boston, MA.
41. **K. Manthiram**, “Electrification and decarbonization of chemical manufacturing,” TEDxMIT, December 6, 2019, Cambridge, MA.
42. **K. Manthiram**, “Electrification and decarbonization of chemical manufacturing,” Industry Technologies for a Stable Climate, Climateworks, December 12, 2019, Cambridge, MA.

CONFERENCE PRESENTATIONS

1. T. Chen, S. J. Bless, and **K. Manthiram**, “High-Velocity Impact Damage on Glass Laminates,” 2007 ASME Applied Mechanics and Materials Conference (McMAT 2007), June 3, 2007, Austin, Texas.
2. R. Russell, S. J. Bless, C. Persad, and **K. Manthiram**, “Reaction of Projectiles with Targets during Hypervelocity Impact,” 16th American Physical Society Topical Conference on Shock Compression of Condensed Matter, June 30, 2009, Nashville, Tennessee.
3. J. P. Welsh, K. G. Patel, **K. Manthiram**, and J. R. Swartz, “A Modified Gaussia Luciferase Demonstrates Prolonged and Intense Glow Kinetic,” American Institute of Chemical Engineers Annual Meeting, November 13, 2009, Nashville, Tennessee.
4. **K. Manthiram** and A. P. Alivisatos, “Tunable Localized Surface Plasmon Resonances in Tungsten Oxide Nanocrystals,” American Chemical Society Meeting, March 29, 2012, San Diego, California.
5. **K. Manthiram** and A. P. Alivisatos, “Tunable Localized Surface Plasmon Resonances in Tungsten Oxide Nanocrystals,” American Institute of Chemical Engineers Meeting, November 1, 2012, Pittsburgh, PA.
6. **K. Manthiram**, Y. Surendranath, and A. P. Alivisatos, “Assembly of gold nanoparticle electrocatalysts into high surface area dendrites during CO₂ reduction,” American Chemical Society Meeting, March 20, 2014, Dallas, Texas.
7. **K. Manthiram**, Y. Surendranath, and A. P. Alivisatos, “Morphological evolution of gold nanoparticles during electrochemical CO₂ reduction,” Materials Research Society Meeting, April 25, 2014, San Francisco, CA.
8. **K. Manthiram**, B. Beberwyck, and A. P. Alivisatos, “Electrochemical methanation of CO₂ with a highly dispersed copper nanocatalyst,” American Chemical Society Meeting, August 13, 2014, San Francisco, CA.
9. **K. Manthiram** and A. P. Alivisatos, “Activity and Stability of Gold and Copper Nanoparticles for Electrochemical Carbon Dioxide Reduction,” American Institute of Chemical Engineers Meeting, November 17, 2014, Atlanta, GA.
10. **K. Manthiram**, B. Beberwyck, and A. P. Alivisatos, “Activity and Stability of Gold and Copper Nanoparticles for Electrochemical Carbon Dioxide Reduction,” Materials Research Society Meeting, April 9, 2015, San Francisco, CA.
11. **K. Manthiram**, A. Q. Fenwick, J. P. Edwards, R. H. Grubbs, “Influence of Anion-Exchange Ionomers on Electrocatalysts for Carbon Dioxide Reduction,” Electrochemical Society Meeting, October 4, 2016, Honolulu, HI.
12. **K. Manthiram**, A. Q. Fenwick, J. P. Edwards, R. H. Grubbs, “Interaction of Anion-Exchange Ionomers with Carbon Dioxide Reduction Electrocatalysts,” American Institute of Chemical Engineers Meeting, November 14, 2016, San Francisco, CA.
13. **K. Manthiram**, M. Zhu, R. Ye, and K. Jin, “High turnover frequencies and mechanism of carbon dioxide reduction at metal phthalocyanines,” Gordon Research Conference on Electrochemistry, January 11, 2018, Ventura, CA.
14. **K. Manthiram**, M. Zhu, R. Ye, K. Jin, and N. Lazouski, “Supported Metal Phthalocyanines with High Turnover Frequencies for Electrochemical Carbon Dioxide Reduction,” Materials Research Society Meeting, April 4, 2018, Phoenix, AZ.

15. **K. Manthiram**, "Molecular-level insights into electrocatalytic carbon dioxide reduction at cobalt macrocycles," American Institute of Chemical Engineers Meeting, October 29, 2018, Pittsburgh, PA.
16. **K. Manthiram**, "Inductive and electrostatic promotion of carbon dioxide reduction at metal macrocycles," Materials Research Society Meeting, November 26, 2018, Boston, MA.
17. **K. Manthiram**, "Electrochemical Epoxidation of Olefin Substrates using Water as the Oxygen Atom Source," American Institute of Chemical Engineers Annual Meeting, November 15, 2019, Orlando, FL.

TEACHING

2017 - 2019

Instructor

Massachusetts Institute of Technology

Electrochemical Energy Systems ChemE 10.426/626

Heat and Mass Transfer

ChemE 10.302

Instructor Rating: 6.7/7

Instructor Rating: 6.8/7

2013

Head Graduate Student Instructor

UC Berkeley

Chemical Engineering Laboratory, CBE 154

2012

Graduate Student Instructor

UC Berkeley

Chemical Engineering Laboratory, CBE 154

MEMBERSHIP IN PROFESSIONAL SOCIETIES

2015 – *present*

Electrochemical Society

2012 – *present*

American Chemical Society

2010 – *present*

Materials Research Society

2008 – *present*

Tau Beta Pi, Engineering Honor Society

2008 – *present*

American Institute of Chemical Engineers