Curriculum Vitae – Charles William Machan

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Personal

Born: April 17; Madison, WI.

Education and Training

University of California-San Diego	Molecular Electrochemistry	Postdoc (2013-2016)
Northwestern University	Inorganic Chemistry	Ph.D. (2012)
Washington U. in St. Louis	Chemistry and German	B.A. (2008)

Summary of Professional Experience

08/24/2022-present	Associate Professor, Department of Chemistry, University of Virginia
08/10/2016-08/24/2022	Assistant Professor, Department of Chemistry, University of Virginia
01/2013-07/2016	Postdoctoral Researcher, University of California San Diego ***Postdoc Advisor: Clifford P. Kubiak***. Spectroelectrochemical Characterization Methods and Electrocatalysis.
09/2008-12/2012	Doctoral Candidate, Chemistry Department, Northwestern University. ***Advisor: Chad A. Mirkin***. Organometallic and Reaction-Controlled Coordination Chemistries of Multidentate Ligands.

Awards and Honors

2020	Recipient of the 2020 ACS Division of Inorganic Chemistry Award for Undergraduate Research with mentee Julia M. Dressel.
2012	Edmund W. Gelewitz Award for Outstanding Senior Graduate Student, Northwestern University
2006-2008	All-Academic UAA Football Selection, Washington University in St. Louis
2005	Dean's List, Washington University in St. Louis

Publications

(* - denotes co-first authorship; # - corresponding author; underline – undergraduate author)

Peer-Reviewed Articles (Independent; 33 total)

57. Reid, A.G.; **Machan, C.W.**# "Redox Mediators in Homogeneous Co-electrocatalysis" *J. Am. Chem. Soc. ASAP* DOI: 10.1021/jacs.2c10033.
56. Dressel, J.M.; Cook, E.N.; Hooe, S.L.; Moreno, J.J.; Dickie, D.A.; **Machan, C.W.**# "Electrocatalytic hydrogen evolution reaction by a Ni(N_2O_2) complex based on 2,2′-bipyridine" *Inorg. Chem. Front. ASAP* DOI: 10.1039/D2QI01928K.
55. Reid, A.G.*; Hooe, S.L.*; Moreno, J.J.; Dickie, D.A.; **Machan, C.W.**# "Homogeneous Electrocatalytic Reduction of CO_2 by a CrN_3O Complex: Electronic Coupling with Redox-Active Terpyridine Fragment Favors Selectivity for CO" *Inorg. Chem.* **2022**, *61*, 16963–16970.

54. Cook, E.N.; **Machan, C.W.**[#] "Homogeneous Catalysis of Dioxygen Reduction by Molecular Mn Complexes" *Chem. Commun.* **2022**, *58*, 11746–11761.
53. Reid, A.G.; Moreno, J.J.; Hooe, S.L.; Baugh, K.R.; Thomas, I.H.; Dickie, D.A.; **Machan, C.W.**[#] "Inverse Potential Scaling in Co-Electrocatalytic Activity for CO_2 Reduction Through Redox Mediator Tuning and Catalyst Design" *Chem. Sci.* **2022**, *13*, 9595–9606.
52. Cook, E.N.*; Hooe, S.L.*; Dickie, D.A.; **Machan, C.W.**[#] "Homogeneous Catalytic Reduction of O_2 to H_2O by a Terpyridine-Based FeN_3O Complex" *Inorg. Chem.* **2022**, *61*, 8387–8392 **Featured Article.*
51. Cook, E.N.; **Machan, C.W.**[#] "Bioinspired Mononuclear Mn Complexes for O_2 Activation and Biologically Relevant Reaction" *Dalton Trans.* **2021**, *50*, 16871–16886. **HOT Paper**
50. Hooe, S.L.; Moreno, J.J.; Reid, A.R.; Cook, E.N.; **Machan, C.W.**[#] "Mediated Inner-Sphere Electron Transfer Induces Homogeneous Reduction of CO_2 via Through-Space Electronic Conjugation" *Angew. Chem., Int. Ed.* e202109645 DOI: 10.1002/anie.202109645 and *Angew. Chem.* 10.1002/ange.202109645. **VIP Designation*. *Corrigendum ibid* e202205139.
49. Cook, E.N.; Dickie, D.A.; **Machan, C.W.**[#] "Catalytic Reduction of Dioxygen to Water by a Bioinspired Non-Heme Iron Complex via a 2+2 Mechanism" *J. Am. Chem. Soc.* **2021**, *143*, 16411–16418.
48. Nichols, A.W.; Cook, E.N.; Gan, Y.J.; Miedaner, P.R.; Dressel, J.M.; Dickie, D.A.; Shafaat, H.S.; **Machan, C.W.**[#] "Pendent Relay Enhances H_2O_2 Selectivity During Dioxygen Reduction Mediated by bpy-based Co-N_2O_2 Complexes" *J. Am. Chem. Soc.* **2021**, *143*, 13605–12073.
47. Hooe, S.L.; Cook, E.N.; Reid, A.G.; **Machan, C.W.**[#] "Non-Covalent Assembly of Proton Donors and p-Benzoquinone Anions for Co-Electrocatalytic Reduction of Dioxygen" *Chem. Sci.* **2021**, *12*, 9733–9741.
46. Geer, A. M.; Musgrave III, C.; Webber, C.; Nielsen, R. J.; McKeown, B. A.; Liu, C.; Schleker, P. P. M.; Jakes, P.; Jia, X.; Dickie, D. A.; Granwehr, J.; Zhang, S.; **Machan, C. W.**[#]; Goddard, W. A.[#]; Gunnoe, T. B.[#], *ACS Catal.* **2021**, *11*, 7223–7240.
45. Moreno, J.J.; Hooe, S.H.; **Machan, C.W.**[#] "DFT Study on the Electrocatalytic Reduction of CO_2 to CO by a Molecular Chromium Complex" *Inorg. Chem.* **2021**, *60*, 3635–3650.
44. Freeman, L.A.; Obi, A.D.; Machost, H.R.; Molino, A.; Nichols, A.W.; Dickie, D.A.; Wilson, D.J.D.[#]; **Machan, C.W.**[#]; Gilliard Jr., R.J.[#] "Soluble, Crystalline, and Thermally Stable Alkali CO_2^- and Carbonite (CO_2^{2-}) Clusters Supported by Cyclic(Alkyl)(Amino) Carbenes" *Chem. Sci.* **2021**, *12*, 3544–3550.
43. Nichols, A.W.; Kuehner, J.S.; Huffman, B.L.; Miedaner, P.R.; Dickie, D.A.; **Machan, C.W.**[#] "Reduction of dioxygen to water by a Co(N_2O_2) complex with a 2,2′-bipyridine backbone" *Chem. Commun.* **2021**, *57*, 516–519.
42. Verma, P.K.; Huelsenbeck, L.; Nichols, A.W.; Islamoglu, T.; Heinrich, H.; **Machan, C.W.**; Giri, G.[#] "Controlling Polymorphism and Orientation of NU-901/NU-1000 Metal–Organic Framework Thin Films" *Chem. Mater.* **2020**, *32*, 10556–10565.
41. Popowski, Y.; Moreno, J.J.; Nichols, A.W.; Hooe, S.L.; Bouchey, C.J.; Rath, N.P.**; Machan, C.W.**[#]; Tolman, W.B.[#] "Mechanistic Insight into Initiation and Regioselectivity in the Copolymerization of Epoxides and Anhydrides by Al Complexes" *Chem. Commun.* **2020**, *56*, 14027–14030.

40. Nichols, A.W.; Hooe, S.L.; Kuehner, J.S.; Dickie, D.A.; **Machan, C.W.**[#] "Electrocatalytic CO_2 Reduction to Formate with Molecular Fe(III) Complexes Containing Pendent Proton Relays" *Inorg. Chem.* **2020**, *59*, 5854–5864.

39. **Machan, C.W.**[#] "Advances in the Molecular Catalysis of Dioxygen Reduction" *ACS Catal.* **2020**, *10*, 2640–2655.

38. Jiang, C.; Nichols, A.W.; Walzer, J.F.; **Machan, C.W.**[#] "Electrochemical CO_2 Reduction in a Continuous Non-Aqueous Flow Configuration with $[Ni(cyclam)]^{2+}$ Catalyst" *Inorg. Chem.* **2020**, *59*, 1883–1892.

37. Hooe, S.L.; Dressel, J.M.; Dickie, D.A.; **Machan, C.W.**[#] "Highly Efficient Electrocatalytic Reduction of CO_2 to CO by a Molecular Chromium Complex" *ACS Catal.* **2020**, *10*, 1146–1151.

36. Nichols, A.W.; **Machan, C.W.**[#] "Secondary-Sphere Effects in Molecular Electrocatalytic CO_2 Reduction" *Front. Chem.* **2019**, *7*, 397; DOI: 10.3389/fchem.2019.00397.

35. Lieske, L.E.; Hooe, S.L.; Nichols, A.W.; **Machan, C.W.**[#] "Electrocatalytic Reduction of Dioxygen by Mn(III)*meso*-Tetra(*N*-methyl-4-pyridyl) Porphyrin in Universal Buffers" *Dalton Trans.* **2019**, *48*, 8633–8641. **HOT Paper*

34. Huelsenbeck, L.D.*; Hooe, S.L.*; Ghorbanpour, A.; Heinrich, H.; **Machan, C.W.**[#]; Giri, G.[#] "Metal-Organic Frameworks as Porous Templates for Enhanced Cobalt Oxide Electrocatalyst Performance" *ACS Appl. Energy Mater.* **2019**, *2*, 3306–3313.

33. Jiang, C.; Nichols, A.W.; **Machan, C.W.**[#] "A Look at Periodic Trends in *d*-block Molecular Electrocatalysts for CO_2 Reduction" *Dalton Trans.* **2019**, *48*, 9454–9468, *invited*.

32. **Machan, C.W.**[#] "Recent Advances in Spectroelectrochemistry Related to Molecular Catalytic Processes" *Curr. Opin. Electrochem.* **2019**, *15*, 42–49; *invited*.

31. Lieske, L.E.*; Freeman, L.A.*; Wang, G.; Dickie, D.A.; Gilliard, R.J.[#]; **Machan, C.W.**[#] "Metal-Free Electrochemical Reduction of Carbon Dioxide Mediated by Cyclic(Alkyl)(Amino) Carbenes" *Chem. – Eur. J.* **2019**, *25*, 6098–6101.

30. Hooe, S.L.; **Machan, C.W.**[#] "Dioxygen Reduction to Hydrogen Peroxide by a Molecular Mn Complex: Mechanistic Divergence Between Homogeneous and Heterogeneous Reductants" *J. Am. Chem. Soc.* **2019**, *141*, 4379–4387.

29. Li, F.; Meyer, R.L.; Carpenter, S.H.; VanGelder, L.E.; Nichols, A.W.; **Machan, C.W.**; Neidig, M.L.; Matson, E.M. "Nitric oxide activation facilitated by cooperative multimetallic electron transfer within an iron-functionalized polyoxovanadate–alkoxide cluster" *Chem. Sci.* **2018**, *9*, 6379–6389.

28. Lieske, L.E.; Rheingold, A.L.; **Machan, C.W.**[#] "Electrochemical Reduction of Carbon Dioxide with a Molecular Polypyridyl Nickel Complex" *Sustainable Energy Fuels* **2018**, *2*, 1269–1277.

27. Heyer, A.J.*; Shivokevich, P.J.*; Hooe, S.L.; Welch, K.D.; Harman, W.D.[#]; **Machan, C.W.**[#]; "Reversible Modulation of the Redox Characteristics of Acid-Sensitive Scorpionate Molybdenum and Tungsten Complexes" *Dalton Trans.* **2018**, *47*, 6323–6332.

26. Nichols, A.W.; Chatterjee, S.; Sabat, M.; **Machan, C.W.**[#] "Electrocatalytic Reduction of CO_2 to Formic Acid by an Iron Schiff Base Complex" *Inorg. Chem.* **2018**, *57*, 2111–2121.

25. Hooe, S.L.; Rheingold, A.L.; **Machan, C.W.**[#] "Electrocatalytic Reduction of Dioxygen to Hydrogen Peroxide by a Molecular Manganese Complex with a Bipyridine-Containing Schiff Base Ligand" *J. Am. Chem. Soc.* **2018**, *140*, 3232–3241.

Peer-Reviewed Publications (Prior to Independent Career; 24 total)

24. Sahu, S.; Cheung, P.L.; **Machan, C.W.**; Chabolla, S.A.; Kubiak, C.P.; Gianneschi, N.C. "Charged Macromolecular Rhenium Bipyridine Catalysts with Tunable CO_2 Reduction Potentials" *Chem. – Eur. J.* **2017**, *23*, 8619–8622.

23. Huynh, M.R.; Mora, S.J.; Villalba, M.; Tejeda-Ferrari, M.E.; Liddell, P.A; Cherry, B.R.; Teillout, A.-L.; **Machan, C.W.**; Kubiak, C.P.; Gust, D.; Moore, T.A.; Hammes-Schiffer, S.; Moore, A.L. "Concerted One-Electron Two-Proton Transfer Processes in Models Inspired by the Tyr-His Couple of Photosystem II" *ACS Cent. Sci.* **2017**, *3*, 372–380.

22. Chabolla, S.A.; **Machan, C.W.**; Yin, J.; Dellamary, E.A.; Sahu, S.; Gianneschi, N.C.; Gilson, M.K.; Tezcan, F.A.; Kubiak, C.P. "Bio-inspired CO_2 reduction by a rhenium tricarbonyl bipyridine-based catalyst appended to amino acids and peptidic platforms: incorporating proton relays and hydrogen-bonding functional groups" *Faraday Discuss.* **2017,** *198*, 279–300.

21. **Machan, C.W.**; Kubiak, C.P. "Electrocatalytic Reduction of Carbon Dioxide with Mn(terpyridine) Carbonyl Complexes" *Dalton Trans.* **2016**, *45*, 17179–17186.

20. **Machan, C.W.**; Kubiak, C.P. "Interrogating Heterobimetallic Co-Catalytic Responses for the Electrocatalytic Reduction of CO_2 Using Supramolecular Assembly" *Dalton Trans.* **2016**, *45*, 15942–15950.

19. **Machan, C.W.**; Yin, J.; Chabolla, S.A.; Gilson, M.K.; Kubiak, C.P. "Improving the Efficiency and Activity of Electrocatalysts for the Reduction of CO_2 Through Supramolecular Assembly with Amino Acid-Modified Ligands" *J. Am. Chem. Soc.* **2016**, *138*, 8184–8193.

18. Stanton III, C.J.; **Machan, C.W.**; Vandezande, J.E.; Jin, T.; Majetich, G.; Schaefer III, H.F.; Kubiak, C.P.; Li, G.; Agarwal, J. "Re(I) NHC Complexes for the Electrocatalytic Conversion of CO_2" *Inorg. Chem.*, **2016**, *55*, 3136–3144.

17. Cheung, P.L.; **Machan, C.W.**; Malkhasian, Y.S.; Agarwal, J.; Kubiak, C.P. "Photocatalytic Reduction of Carbon Dioxide to CO and HCO_2H Using fac-Mn(CN)(bpy)$(CO)_3$' *Inorg. Chem.,* **2016**, *55*, 3192–3198.

16. Wixtrom, A.I.; Shao, Y.; Jung, D.; **Machan, C.W.**; Kevork, S.N.; Qian, E.A.; Axtell, J.C.; Khan, S.I.; Kubiak, C.P.; Spokoyny, A.M. "Rapid Synthesis of Redox-Active Dodecaborane $B_{12}(OR)_{12}$ Clusters Under Ambient Conditions" *Inorg. Chem. Front.* (Emerging Investigator Issue) **2016**, *3*, 711–717.

15. Clark, M.L.; Rudshteyn, B.; Ge, A.; Chabolla, S.A.; **Machan, C.W.**; Psciuk, B.T.; Song, J.; Canzi, G.; Lian, T.; Batista, V.S.; Kubiak, C.P. "Surface Orientation of Immobilized Cyano-Substituted Bipyridine Re(I) *fac*-Tricarbonyl Electrocatalysts on Au Surfaces" *J. Phys. Chem. C* **2016**, *120*, 1657–1665.

14. **Machan*, C.W.**; Stanton III*, C.J.; Vandezande, J.E.; Majetich, G.F.; Schaefer III, H.F; Kubiak, C.P.; Agarwal, J. "Electrocatalytic Reduction of Carbon Dioxide by Mn(CN)(2,2'-bipyridine$(CO)_3$: CN Coordination Alters Mechanism" *Inorg. Chem.* **2015**, *54*, 8849–8856.

13. **Machan, C.W.**; Chabolla, S.A.; Kubiak, C.P. "Reductive Disproportionation of Carbon Dioxide by an Alkyl-Functionalized Pyridine Monoimine Re(I) *fac*-tricarbonyl Electrocatalyst" *Organometallics* **2015**, *34*, 4678–4683.

12. **Machan, C.W.**; Sampson, M.D.; Kubiak, C.P. "A Molecular Ruthenium Electrocatalyst for the Reduction of Carbon Dioxide to CO and Formate" *J. Am. Chem. Soc.* **2015**, *137*, 8564–8571.

11. Vollmer, M.; **Machan, C.W.**; Clark, M.L.; Antholine, W.; Agarwal, J.; Schaefer III, H.F.; Kubiak, C.P; Walensky, J. "Synthesis, Spectroscopy, and Electrochemistry of (α-diimine)$M(CO)_3Br$, M = Mn, Re, Complexes: Ligands Isoelectronic to Bipyridyl Show Differences in CO_2 Reduction" *Organometallics* **2015**, *34*, 3–12.

10. **Machan, C.W.**; Chabolla, S.A.; Yin, J.; Gilson, M.K.; Tezcan, F.A.; Kubiak, C.P. "Supramolecular Assembly Promotes the Electrocatalytic Reduction of Carbon Dioxide by Re(I) Bipyridine Catalysts at a Lower Overpotential" *J. Am. Chem. Soc.* **2014**, *136*, 14598–14607.

9. Chabolla, S.A.; Dellamary, E.A.; **Machan, C.W.**; Tezcan, F.A.; Kubiak, C.P. "Combined Steric and Electronic Effects of Positional Substitution on Dimethyl-Bipyridine Rhenium(I) Tricarbonyl Electrocatalysts for the Reduction of CO_2" *Inorg. Chim. Acta* **2014**, *422*, 109–113.

8. **Machan, C.W.**; Sampson, M.D.; Chabolla, S.A.; Dang, T.; Kubiak, C.P. "Developing a Mechanistic Understanding of Molecular Electrocatalysts for CO_2 Reduction Using Infrared Spectroelectrochemistry" *Organometallics* **2014**, *33*, 4550–4559.

7. Kennedy*, R.D.; **Machan*, C.W.**; McGuirk, C.M.; Rosen, M.S.; Stern, C.L.; Mirkin, C.A. "General Strategy for the Synthesis of Rigid Higher-Order Platinum(II) Complexes via the Weak-Link Approach: Tweezers, Triple-Layers and Macrocycles" *Inorg. Chem.* **2013**, *52*, 5876–5888.

6. **Machan, C.W.**; Adelhardt, M.; Sarjeant, A.A.; Stern, C.L.; Sutter, J.; Meyer, K.; Mirkin, C.A. "One-Pot Synthesis of an Fe(II) Bisterpyridine Complex with Allosterically Regulated Electronic Properties" *J. Am. Chem. Soc.* **2012**, *134*, 16921–16924.

5. **Machan, C.W.**; Lifschitz, A.M.; Sarjeant, A.A.; Stern, C.L.; Mirkin, C.A. "Crystallographic Snapshots of the Bond-Breaking Isomerization Reactions of Ni(II) Complexes with Hemilabile Ligands" *Angew. Chem., Int. Ed.* **2012**, *51*, 1469–1472.

4. Spokoyny, A.M.; **Machan, C.W.**; Clingerman, D.C.; Rosen, M.S.; Wiester, M.J.; Kennedy, R.D.; Sarjeant, A.A.; Stern, C.L.; Mirkin, C.A. "A Coordination Chemistry Dichotomy for Carborane-Based Ligands" *Nature Chem.* **2011**, *3*, 590–596. Highlight by A. Weller, *ibid*.

3. **Machan, C.W.**; Spokoyny, A.M.; Jones, M.R.; Sarjeant, A.A.; Stern, C.L.; Mirkin, C.A. "The Plasticity of the Nickel(II) Coordination Environment in Complexes with Hemilabile Phosphino-Thioether Ligands" *J. Am. Chem. Soc.* **2011**, *33*, 3023–3033.

2. Rosen*, M.S.; Spokoyny*, A.M.; **Machan, C.W.**; Stern, C.L.; Sarjeant, A.A.; Mirkin, C.A. "The Chelating Effect as a Driving Force Leading to Selective Formation of Heteroligated Pt(II) Complexes with Bidentate Phosphine-Chalcoether Ligands" *Inorg. Chem.* **2011**, *50*, 1411–1419.

1. Spokoyny*, A.M.; Li*, T.C.; Farha, O.K.; **Machan, C.W.**; She, C.; Marks, T.J.; Hupp, J.T.; Mirkin, C.A. "Electronic Tuning of Nickel-Based Bis(dicarbollide) Redox Shuttles in Dye-Sensitized Solar Cells" *Angew. Chem., Int. Ed.* **2010**, *49*, 5339–5343.

Books and Book Chapters

2. **Machan, C.W.**[#] "Organometallic Chemistry of Carbon Dioxide" in *Comprehensive Organometallic Chemistry IV*, DOI: 10.1016/B978-0-12-820206-7.00063-9 (2021).

1. **Machan, C.W.**[#] "Spectroelectrochemistry: Tools for Electrochemical Mechanisms and Electrocatalysis" in *Comprehensive Coordination Chemistry III*, DOI: 10.1016/B978-0-08-102688-5.00077-5 (2021).

Other Articles

1. Hooe, S. L.; **Machan, C.W.**[#] "Catalytic Reduction of O_2 to H_2O_2 via a Mn Complex" *Trends in Chemistry* **2019**, *1*, 794–795.

Presentations *University of Virginia (August 2016-Present)*

66. "Earth-Abundant Molecular Catalyst Systems for the Reduction of Dioxygen and Carbon Dioxide" Powell Seminar Series, University of Richmond, September 23, 2022 (invited talk).
65. "(Co-)Electrocatalytic Systems for the Reduction of Carbon Dioxide" Emerging Areas in Inorganic Chemistry Symposium, ACS Fall 2022, Chicago, IL, August 22 (invited talk; symposium co-organizer).
66. "Earth Abundant Non-Porphyrinic Molecular Transition Metal Catalysts for Dioxygen Reduction" T. Brent Gunnoe Symposium in honor of Olah Award, ACS Fall 2022, Chicago, IL, August 21 (invited talk).
65. "Cr-based Catalysts and Catalytic Systems for Electrocatalytic CO_2 Reduction" Gordon Research Conference Solar Fuels 2022, Barga, IT, May 8-13, poster.
64. "Co-catalytic Electrochemical Reduction of O_2 with Molecular Mn Complexes and Electron-Proton Transfer Mediators" Pacifichem 2021, Virtual, December 15-20.
63. "Electrocatalytic Reduction of CO_2 with Molecular Cr Complexes" Pacifichem 2021, December 15-20.
62. "Cr Complexes for the Electrocatalytic Reduction of Carbon Dioxide" 2021 SERMACS, November 10-13, Tuscaloosa, AL (invited talk).
61. "Earth-Abundant Molecular Catalyst Systems for the Reduction of Dioxygen and Carbon Dioxide" Promotion Seminar, Department of Chemistry, University of Virginia, September 10, 2021 (invited talk).
60. "Improving the Activity and Selectivity of Catalytic CO_2 and O_2 Reduction by Inorganic Complexes Using Mediators" ACS National Meeting, Atlanta, GA, August 22-26, 2021.
59. "Cr Complexes for the Electrocatalytic Reduction of Carbon Dioxide" 2021 Virginia Clean Energy and Catalysis Summit, August 2, 2021 (invited talk).
58. "Earth-Abundant Molecular Catalyst Systems for the Reduction of Dioxygen and Carbon Dioxide" Virtual CBIC Seminar, Department of Chemistry, University of Minnesota, May 14, 2021 (invited talk).
57. "Earth-Abundant Molecular Catalyst Systems for the Reduction of Dioxygen and Carbon Dioxide" Virtual Seminar, Department of Chemistry, University of California Irvine, May 13, 2021 (invited talk).
56. "Earth-Abundant Molecular Catalyst Systems for the Reduction of Dioxygen and Carbon Dioxide" Virtual Seminar, Department of Chemistry, University of Missouri, April 30, 2021 (invited talk).
55. "Earth-Abundant Molecular Catalyst Systems for the Reduction of Dioxygen and Carbon Dioxide" Virtual Seminar, Department of Chemistry, Washington University in St. Louis, April 22, 2021 (invited talk).
54. "Earth-Abundant Molecular Catalyst Systems for the Reduction of Dioxygen and Carbon Dioxide" Virtual Seminar, Department of Chemistry, University of California Berkeley, April 23, 2021 (invited talk).

53. “Earth-Abundant Molecular Catalyst Systems for the Reduction of Dioxygen and Carbon Dioxide” Virtual Seminar, Department of Chemistry, University of Maryland, April 15, 2021 (invited talk).
52. “Earth-Abundant Molecular Catalyst Systems for the Reduction of Dioxygen and Carbon Dioxide” Virtual Seminar, Department of Chemistry and Biochemistry, University of California Los Angeles, April 7, 2021 (invited talk).
51. “Earth-Abundant Molecular Catalyst Systems for the Reduction of Dioxygen and Carbon Dioxide” Virtual Seminar, Department of Chemistry, University of Southern California, April 6, 2021 (invited talk).
50. “Earth-Abundant Molecular Catalyst Systems for the Reduction of Dioxygen and Carbon Dioxide” Virtual Seminar, Department of Chemistry, University of Wisconsin, March 29, 2021 (invited talk).
49. “Earth-Abundant Molecular Catalyst Systems for the Reduction of Dioxygen and Carbon Dioxide” Virtual Seminar, Department of Chemistry, Universidad de Puerto Rico – Recinto de Río Piedras, March 17, 2021 (invited talk).
48. “Earth-Abundant Molecular Catalyst Systems for the Reduction of Dioxygen and Carbon Dioxide” Virtual Seminar, Department of Chemistry, Johns Hopkins University, March 16, 2021 (invited talk).
47. “Earth-Abundant Molecular Catalyst Systems for the Reduction of Dioxygen and Carbon Dioxide” Virtual Seminar, Department of Chemistry, Yale University, March 15, 2021 (invited talk).
46. “Earth-Abundant Molecular Catalyst Systems for the Reduction of Dioxygen and Carbon Dioxide” Virtual Seminar, Department of Chemistry, Stanford University, March 11, 2021 (invited talk).
45. “Earth-Abundant Molecular Catalyst Systems for the Reduction of Dioxygen and Carbon Dioxide” Virtual Seminar, Department of Chemistry, Purdue University, March 9, 2021 (invited talk).
44. “Earth-Abundant Molecular Catalyst Systems for the Reduction of Dioxygen and Carbon Dioxide” Virtual Seminar, Department of Chemistry, University of Chicago, March 5, 2021 (invited talk).
43. “Earth-Abundant Molecular Catalyst Systems for the Reduction of Dioxygen and Carbon Dioxide” Virtual Seminar, Department of Chemistry, Baylor University, February 26, 2021 (invited talk).
42. “Earth-Abundant Molecular Catalyst Systems for the Reduction of Dioxygen and Carbon Dioxide” Virtual Seminar, Department of Chemistry, Texas A&M University, February 25, 2021 (invited talk).
41. “Earth-Abundant Molecular Catalyst Systems for the Reduction of Dioxygen and Carbon Dioxide” Virtual Seminar, Department of Chemistry, University of Houston, February 23, 2021 (invited talk).
40. “Earth-Abundant Molecular Catalyst Systems for the Reduction of Dioxygen and Carbon Dioxide” Virtual Seminar, Department of Chemistry, Rice University, February 22, 2021 (invited talk).

39. “Earth-Abundant Molecular Catalyst Systems for the Reduction of Dioxygen and Carbon Dioxide” Virtual Seminar, Department of Chemistry, UNC–Chapel Hill, February 16, 2021 (invited talk).
38. “Earth-Abundant Molecular Catalyst Systems for the Reduction of Dioxygen and Carbon Dioxide” Virtual Seminar, Department of Chemistry, Fairfield University, February 12, 2021 (invited talk).
37. “Earth-Abundant Molecular Catalyst Systems for the Reduction of Dioxygen and Carbon Dioxide” Virtual Inorganic/Organic Seminar, Department of Chemistry and Biochemistry, The Ohio State University, February 10, 2021 (invited talk).
36. “Earth-Abundant Molecular Catalyst Systems for the Reduction of Dioxygen and Carbon Dioxide” Virtual Inorganic Seminar, Department of Chemistry, University of Rochester, February 1, 2021 (invited talk).
35. “Molecular Catalysts and Scalable Systems for Renewable Fuels” Virtual “Highlands in Chemistry” Seminar Series, Department of Chemistry, Virginia Tech University, November 20, 2020 (invited talk).
34. “Molecular Catalysts and Scalable Systems for Renewable Fuels” Virtual Inorganic Seminar, Department of Chemistry, Michigan State University, October 19, 2020 (invited talk).
33. “Molecular Catalysts and Scalable Systems for Renewable Fuels” Catalysis Webinar Series, AVS at UCF, June 14, 2020 (invited talk).
32. “Improving the Activity and Selectivity of Catalytic CO_2 and O_2 Reduction by Inorganic Complexes Using Mediators” ACS National Meeting, Philadelphia, PA, March 22-26, 2020 (invited talk, symposium co-organizer) – **CANCELED** due to COVID-19 Pandemic.
31. “First-Row Transition Metal Electrocatalysts for CO_2 Reduction and Scalable Electrolysis Systems” Pittcon 2020, March 5, 2020 (invited talk, symposium organizer).
30. “Earth-Abundant Molecular Electrocatalysts (and Mediators) Relevant to Solar Fuels” Chemistry Department Seminar, Colorado School of Mines, January 31, 2020 (invited talk).
29. “Earth-Abundant Molecular Electrocatalysts Relevant to Solar Fuels and Their Scalability” DOE National Renewable Energy Laboratory, January 30, 2020 (invited talk).
28. “Developing Molecular Electrocatalysts and Scalable Systems for Renewable Fuels” Chemistry Department Seminar, Rhodes College, September 13, 2019 (invited talk).
27. “Developing Molecular Electrocatalysts and Scalable Systems for Renewable Fuels” ACS National Meeting, San Diego, August 25-29, 2019 (invited talk).
26. “First-Row Transition Metal Complexes for the Electrocatalytic Reduction of CO_2 and O_2” Gordon Research Conference on Organometallics, Salve Regina, RI, July 7-12, 2019 (invited talk).
25. “Developing Molecular Catalysts and Scalable Systems for Renewable Fuels” 23rd Green Chemistry & Engineering Conference, Reston, VA, June 11-13, 2019 (invited talk).
24. “Improving the Activity of Molecular Electrocatalysts for Reactions Relevant to Solar Fuels” Pittcon 2019, March 19, 2019 (invited talk, symposium organizer).
23. “Electrocatalytic Reduction of Dioxygen to Hydrogen Peroxide by a Molecular Manganese Complex” Gordon Research Conference on Inorganic Reaction Mechanisms, Galveston, TX, March 10-14, 2019 (poster and selected for poster talk).

22. “Developing Molecular Electrocatalysts for Reactions Relevant to Renewable Fuels” University of Tennessee at Chattanooga, January 18, 2019 (invited talk).
21. “Developing Molecular Electrocatalysts for Reactions Relevant to Renewable Fuels” West Virginia Wesleyan College Chemistry Seminar, November 9, 2018 (invited talk).
20. “Developing Molecular Electrocatalysts for Reactions Relevant to Renewable Fuels” Haverford College Chemistry Seminar, November 2, 2018 (invited talk).
19. “Developing Molecular Electrocatalysts for Reactions Relevant to Renewable Fuels” Shippensburg University Chemistry Seminar, September 14, 2018 (invited talk).
18. “Developing Molecular Electrocatalysts for Reactions Relevant to Renewable Fuels” High Point University, NC Chemistry Seminar, September 7, 2018 (invited talk).
17. “Polypyridine-Based Molecular Electrocatalysts for Reactions Relevant to Solar Fuels” 43rd International Conference on Coordination Chemistry, Sendai, Japan, July 30-August 4, 2018 (invited talk).
16. “Reaction Parameters of Electrochemical O_2 Reduction by a Molecular Mn Catalyst” Gordon Research Conference: Organometallic Chemistry, Salve Regina, RI, July 8-13, 2018 (poster).
15. “PCET Reactions of Metal Complexes with Proton-Responsive Ligands in Small Molecule Activation” 3rd Annual International Conference on Proton-Coupled Electron Transfer, Blowing Rock, NC, June 10-14, 2018 (invited talk).
14. “Electrochemical Reactivity of Mn(V) Nitride Complexes with a bis(Phenolate)-Functionalized Bipyridine Ligand” 3rd Annual International Conference on Proton-Coupled Electron Transfer, Blowing Rock, NC, June 10-14, 2018 (poster).
13. “Earth-Abundant Molecular Electrocatalysts for the Reduction of CO_2 and O_2” Symposium for the ACS Harry Gray Award for Creative Work in Inorganic Chemistry by a Young Investigator in honor of Dwight Seferos, 255th ACS National Meeting, New Orleans, LA, March 20, 2018 (invited talk).
12. “Polypyridyl Electrocatalysts for the Reduction of CO_2” Symposium for the ACS Award in Organometallic Chemistry in honor of Clifford P. Kubiak, 255th ACS National Meeting, New Orleans, LA, March 18, 2018 (invited talk).
11. “Developing Molecular Electrocatalysts for Reactions Relevant to Renewable Fuels” Juniata College Chemistry Seminar, March 6, 2018 (invited talk).
10. “Developing Molecular Electrocatalysts for Reactions Relevant to Renewable Fuels” Southern Methodist University Chemistry Seminar, February 23, 2018 (invited talk).
9. “Developing Molecular Electrocatalysts for Reactions Relevant to Renewable Fuels” Hampton University Chemistry Seminar, January 25, 2018 (invited talk).
8. “Developing Molecular Electrocatalysts Relevant to Solar Fuels” Solar Energy Research Conference at the Southeast Regional Meeting of the ACS, November 9, 2017 (invited talk).
7. “Metal-Organic Frameworks as Template Shells for Enhanced Electrocatalyst Performance” 3rd MAXNET Energy Workshop, October 26-27, 2017 (talk and poster).
6. “Earth-Abundant Molecular Electrocatalysts for the Reduction of CO_2 and O_2” 254th ACS National Meeting, Washington, DC, August 24, 2017 (talk).
5. “Developing Molecular Electrocatalysts Relevant to Solar Fuels” International Solar Fuels Conference: ISF2, San Diego, CA, July 6-10, 2017 (invited talk).

4. “Developing Molecular Electrocatalysts Relevant to Solar Fuels” Gordon Research Conference on Inorganic Reaction Mechanisms, Galveston, TX, March 5-10, 2017 (poster).
3. “Bioinspired Molecular Electrocatalysts for the Reduction of CO_2” International Conference on Artificial Photosynthesis 2017, Kyoto, Japan, March 3, 2017 (invited talk).
2. “Bio-inspired CO_2 reduction by a rhenium tricarbonyl bipyridine-based catalyst appended to amino acids and peptidic platforms: incorporating proton relays and hydrogen-bonding functional groups” Faraday Discussions: Artificial Photosynthesis, Kyoto, Japan, March 2, 2017 (invited talk).
1. “Developing Molecular Electrocatalysts and Materials for Reactions Relevant to Solar Fuels” Davidson College Chemistry Colloquium, January 27, 2017 (invited talk).

Service

Professional Affiliations

American Chemical Society (2009 – Present)

Delta Phi Alpha, German Honors Society (2007 – Present)

Alpha Chi Sigma, Chemistry Honors Fraternity (2007 – Present)

Phi Delta Theta (2007 – Present)

Professional Service

Journal Reviewer	*Dalton Transactions*, *Journal of the American Chemical Society*, *ACS Catalysis*, *ACS Central Science*, *Chemical Science*, *Chemical Reviews*, *Organometallics*, *Inorganic Chemistry, ACS Applied Material & Interfaces, Coordination Chemistry Reviews, Angewandte Chemie International Edition, Electrochimica Acta, Journal of CO_2 Utilization, ACS Sustainable Chemistry & Engineering, Sustainable Energy & Fuels, Chemical Communications, ACS Applied Energy Materials, Chemical Society Reviews, Nature Catalysis, Chemistry – A European Journal, ChemElectroChem, Accounts of Chemical Research*
Grant Reviewer	ACS PRF (2023); NSF MPS (2023); FONDECYT (Chilean Research Fund, 2023); FRS-FNSF (Belgian Research Foundation, 2022); DOE BES (2022); ACS PRF (2022); ISF (2022); SNSF (Swiss National Science Foundation 2022); NIH MSFA Guest Reviewer (2021); NSF BMAT (2021); U.S.-Israel BSF (Binational Science Foundation, 2021); NSF EPSCoR (2021); ISF (Israel Science Foundation, 2021); DOE BES (2021); ARPA-E (2020); DOE BES (2020); DOE BETO (2020); ACS PRF (2020); DOE SBIR (2019); ACS PRF (2019); DOE BES (2018); DOE SBIR (2018); ACS PRF (2018); DFG (German Research Foundation, 2018); ACS PRF (2017); NSF CBET (2016)
Guest Editor	*Frontiers in Chemistry* (2019 - Molecular Catalysts for CO_2 Fixation/ Reduction)
Organizer	‘Molecules and Materials for Solar Fuels’ Symposium, Pittcon 2020; ‘Molecular Catalysis of Carbon Dioxide Reduction from Renewable Energy’ Symposium, Pittcon 2019
Co-Organizer	Symposium Co-organizer ‘Emerging Areas in Inorganic Chemistry’ Fall 2022 ACS National Meeting Chicago; Symposium Co-organizer ‘Emerging Areas in Inorganic Chemistry’ Spring 2020 ACS National Meeting

	Philadelphia, PA – *Canceled*; 'Molecular Catalysts for CO_2 Fixation/Reduction' 43rd ICCC, Sendai, Japan (2018)
Poster Judge	Virginia State Science and Engineering Fair (2021)
Participant	Cyclic Voltammetry International School (2019); CENTC Summer School on Catalysis (2015)

Departmental and University Service

Faculty Mentor	UVA L.E.A.D., Learning through Experimentation, Awareness and Demonstration (2019 – present). The L.E.A.D. program is dedicated to promoting chemistry through science education and awareness at the local level, through programs at the University of Virginia, as well as within classrooms across the Commonwealth of Virginia. Graduate and undergraduate students perform exciting demonstrations and facilitating classroom science experiments for elementary and middle school students through hands-on, inquiry-based activities.
Faculty Mentor	Mentoring Institute, The Office of Diversity Programs, University of Virginia (2020 – present).

Research Program

Current Support

DOE Office of Science — Machan (co-PI) — 09/01/2022 – 08/31/2025
Basic Energy Sciences *pending* — $483,066
Fundamental Studies of Catalytic Sites and Catalyst/Membrane Integrations for Advanced Hydroxide Exchange Membrane Electrolyzers

NSF Division of Chemistry — Machan (PI) — 05/01/2021 – 04/30/2024
Catalysis CHE-2102156 — $475,000
Developing Homogeneous Mn Catalyst Systems for the Oxygen Reduction Reaction

DOE Basic Energy Sciences — Machan (PI) — 09/01/2021 – 08/31/2024
Catalysis DE-SC0022219 — $455,631
Molecular Co-Electrocatalytic CO_2 reduction with Redox Mediators

Past Research Support

Research Agreement — Machan (PI) — 10/01/2017 – 12/31/2020
ExxonMobil — $1,000,000
Testing the Industrial Scalability of Molecular CO_2 Electrocatalysts under Electrochemical Flow Reactor Conditions

New Directions Grant — Machan (PI) — 09/01/2020 – 08/31/2022
ACS Petroleum Research Fund 61430-ND3 — $110,000
Activation of Hydrocarbons Using Dioxygen-Derived Metal Oxidants

Current Graduate Students

6. Mary Jo McCormick, Department of Chemistry 11/2022 – present
5. Elizabeth Johnson, Department of Chemistry 11/2022 – present
4. Mollie Morrow, Department of Chemistry 11/2022 – present
3. Megan Moberg, Department of Chemistry, 11/2021 – present
2. Amelia G. Reid, Department of Chemistry, 11/2019 – present
1. Emma Cook, Department of Chemistry, 11/2019 – present

M.S./M.A. Graduates

7. Kolton A. Kitterman, M.A. 2020
6. Joseph S. Kuehner, M.A. 2020
5. Tie Ling, M.S. 2020
4. Lauren E. Lieske, M.S. 2020
3. Jillian Turner, M.A. 2020
2. Diego Barahona, M.A. 2019
1. Connor Geraghty, M.A. 2019

Ph.D. Graduates

2. Shelby L. Hooe, Department of Chemistry, 11/2016 – 06/2021
1. Asa W. Nichols, Department of Chemistry, 11/2016 – 05/2021

Undergraduate Students

15. Ethan Zelenke 2022-present (University of Virginia 2023)
14. Ian Courter, 2022-present (University of Virginia 2023
13. Andy Chen, 2021-present (University of Virginia 2025)
12. Evan Wade, 2021-2021 (University of Virginia 2022)
11. Alex Adatsi, 2021-2022 (University of Virginia 2022)
10. James Sappington, 2021-present (University of Virginia 2023)
9. Adam Lee, 2021-2022 (University of Virginia 2022)
8. Lauren Santucci, 2018-2020 (University of Virginia 2021)
7. Kira Baugh, 2019-2021 (University of Virginia 2021)
6. Peter Miedaner, 2017-2021 (University of Virginia 2021)
5. Julia Dressel, 2017-2021 (University of Virginia 2021) NSF - GRFP
4. Erin Morrisroe, 2017-2020 (University of Virginia 2021)
3. Daniel Kemp, 2018-2019 (University of Virginia 2019)
2. Brittany Huffman, 2016-2018 (University of Virginia 2018) NSF - GRFP
1. Kelly Rudman, 2016-2017 (University of Virginia 2017)

Postdoctoral Associates

5. Connor A. Koellner, Ph.D. 2022-present
4. Mahdi Boroujeni, Ph.D. 2021-2022
3. Juan-José Moreno-Díaz, Ph.D. 2019-2021
2. Changcheng ‘CC’ Jiang, Ph.D. 2017-2019
1. Sayanti Chatterjee, Ph.D. 2017-2018

Teaching

University of Virginia
CHEM 4320: Inorganic Chemistry (F 2017, F 2018, F 2019, F 2020, F 2021, F 2022)
CHEM 5330: Group Theory and Structural Inorganic Chemistry (F 2016, Sp 2018, Sp 2019, Sp 2020, Sp 2022, Sp 2023)