

Patrick Cappillino, Ph.D.
Chemistry and Biochemistry Department
285 Old Westport Rd.
North Dartmouth, MA 02747

Email: pcappillino@umassd.edu

Phone: (508) 910-6639

Education:

- 2010 **Ph.D., Chemistry**
Department of Chemistry, Boston University, Boston, MA, USA
Advisor: Professor John P. Caradonna
Dissertation: *Modeling the structure and reactivity of mono- and binuclear nonheme iron oxygenase enzymes*
- 1997 **B.A., Biology**, State University of New York at Albany, Albany, NY, USA

Research and Employment Experience:

- 2014-present **Assistant Professor**, Chemistry and Biochemistry Department, University of Massachusetts Dartmouth, North Dartmouth, MA, USA
- Instructor for:
 - Advanced Inorganic Chemistry (CHM 431)
 - Inorganic Chemistry Laboratory (CHM 433)
 - Graduate Research (CHM 600)
 - Graduate and undergraduate research mentor
- 2010-2014 **Postdoctoral Appointee**, Energy Nanomaterials, Sandia National Laboratories, Livermore, CA, USA
- Synthesized nanoporous and nanostructured palladium and palladium alloys for applications in hydrogen isotope storage
 - Measured hydrogen storage kinetic and thermodynamic properties and carried out nitrogen porosimetry and other fundamental materials characterization
 - Synthesized and characterized transition metal complexes containing redox non-innocent ligand sets for applications in flow battery systems
- 2009-2010 **Visiting Assistant Professor**, Department of Chemistry and Biochemistry, Worcester Polytechnic Institute, Worcester, MA USA
- Instructor for the following courses in the 2009/2010 Academic Year:
 - Experimental Chemistry I: Instrumental Analysis
 - Experimental Chemistry IV (Synthetic Inorganic Chemistry)
 - Principles of Inorganic Chemistry
 - Biochemistry II
 - Supervised independent research project with an undergraduate student involving the synthesis and characterization of Cu(I) complexes relevant to applications in dye-sensitized solar cells.
- 2003-2009 **Graduate Student**, Department of Chemistry, Boston University, Boston, MA
- Investigated biologically relevant structural rearrangement observed upon oxidation in a family of binuclear iron compounds
 - Synthesized and characterized a series of mononuclear iron compounds as structural and reactivity models of the active sites of mononuclear nonheme iron oxygenase enzymes
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Additional Teaching and Mentoring Experience:

- 2014 – present **M.S. thesis research mentor:**
- 2015 – present **Undergraduate research mentor**
- 2011 – 2014 **Principal Investigator** of Sandia-funded, Campus Executive Fellowship
- Mentored the research of Joshua Yee, a Ph.D. candidate at the University of California, Davis, who was supported by this fellowship
- 2003 – 2009 **Teaching Fellow**, Boston University Department of Chemistry
- 2006 – 2007 **Instructor** for Boston University Summer Challenge
- Prepared and taught lectures for high school students
 - Developed and administered new lab activities for students

Extramural Funding:

- 2015 – 2016 ECS/Toyota Young Investigator Fellowship
- 2016 – 2017 Army Research Office, Short-Term Innovative Research Grant
- 2017 – 2018 UMass Dartmouth OTCV Tech Dev Award
- 2017 – 2018 MassCEC Catalyst Award
- 2018 Mass-I-Corps Site grant

Publications/Patents:

1. Huang, H. B.; Howland, R.; Agar, E.; Nourani, M.; Golen, J. A.; **Cappillino, P. J.***, "Bioinspired, high-stability, nonaqueous redox flow battery electrolytes," *J Mater Chem A* (2017) 5 (23), 11586-11591.
2. Benson, D. M.; Tsang, C. F.; Sugar, J. D.; Jagannathan, K.; Robinson, D. B.; El Gabaly, F.; **Cappillino, P. J.**; Stickney, J. L., "Enhanced Kinetics of Electrochemical Hydrogen Uptake and Release by Palladium Powders Modified by Electrochemical Atomic Layer Deposition," *ACS Applied Materials and Interfaces* (2017) 9 (21), 18338-18345.
3. Vitale, S.; Sugar, J. D.; **Cappillino, P. J.**; Giannuzzi, L. A.; Robinson, D. B., "Site Specific Preparation of Powders for High-Resolution Analytical Electron Microscopy Using a Ga⁺ Focused Ion Beam," *Microscopy and Microanalysis* (2016) 22 (S3), 180-181.
4. Yang, N.; Yee, J. K.; Zhang, Z. H.; Kurmanaeva, L.; **Cappillino, P.**; Stavila, V.; Lavernia, E. J.; Marchi, C. S., "Hydrogen sorption characteristics of nanostructured Pd-10Rh processed by cryomilling," *Acta Materialia* (2015) 82, 41-50.
5. Sugar, J. D.; Homer, M.; Kotula, P. G.; Cappillino, P. J.; Ong, M.; Robinson, D. B., "Quantitative EDS of Surface Modified Pd Powders for Hydrogen Storage," *Microscopy and Microanalysis* (2015) 21 (S3), 1083-1084.
6. McCracken, J.; **Cappillino, P.J.**; McNally, J.S.; Kryzaniak, M.D.; Tarves, P.C.; Cardonna, J.P. "Characterization of Water Coordination to Ferrous Nitrosyl Complexes with *fac*-N₂O, *cis*-N₂O₂, and N₂O₃ Donor Ligands" *Inorganic Chemistry* (2015), 54 (13), 6486 – 6497
7. Yang, N.Y.; Yee, J.K.; Zhang, Z.; Kurmanaeva, L.; **Cappillino, P.J.**; Stavila, V.; Lavernia, E.J.; San Marchi, C. "Hydrogen sorption characteristics of nanostructured Pd-10Rh processed by cryomilling" *Acta Materialia* (2015), 82, 41-50.
8. **Cappillino, P.J.**; Pratt, H. D.; Hudak, N. S.; Tomson, N. C.; Anderson, T. M.; Anstey, M. R., "Application of Redox Non-Innocent Ligands to Non-aqueous Flow Battery Electrolytes." *Advanced Energy Materials* (2014), 4, 1300566.
9. **Cappillino, P.J.**; Sugar, J.D.; El Gabaly, F.; Cai, T.Y.; Liu, Z.; Stickney, J.L.; Robinson, D.B. "Atomic-Layer Electroless Deposition: A Scalable Approach to Surface-Modified Metal Powders." *Langmuir* (2014), 30, 4820-4829.

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10. Parent, L.; Robinson, D.B.; **Cappillino, P.J.**; Hartnett, R.J.; Abellan, P.; Evans, J.; Browning, N.; Arslan, I., "In Situ Observation of Directed Nanoparticle Aggregation During the Synthesis of Ordered Nanoporous Metal in Soft Templates", *Chemistry of Materials* (2014), 26 (3), 1426 – 1433.
 11. **Cappillino, P.J.**; Lavernia, E.J.; Ong, M.D.; Wolfer, W.G.; Yang, N.Y., "Plastic Deformation and Hysteresis for H₂ Storage in Pd-Rh Alloys," *Journal of Alloys and Compounds* (2014), 586, 59-65.
 12. Jones, C.G.; **Cappillino, P.J.**; Stavila, V.; Robinson, D.B., "Control of both particle and pore size in nanoporous palladium alloy powders" *Powder Technology* (2014), 267, 95-102
 13. Robinson, D.B.; **Cappillino, P.J.**; Sheridan, L.B.; Stickney, J.L.; "Electroless Atomic Layer Deposition," U.S. Appln. No. 61/778,153, Patent pend., Washington, D.C., *US Pat. and Trademark Office*.
 14. **Cappillino, P.J.**; Robinson, D.B., "Porous Metals from Sintering of Nanoparticles," US Appln. No. 13/917,762, Patent pend., Washington, D.C., *US Pat. and Trademark Office*.
 15. **Cappillino, P. J.**; Harnett, R.J.; Hekmaty, M.A.; Jacobs, B.W.; Hattar, K.M.; Clark, B.G.; Robinson, D.B., "Synthesis of mesoporous palladium with tunable porosity and demonstration of its thermal stability by *in situ* heating and environmental transmission electron microscopy." *Journal of Materials Chemistry A* (2013), 1, 602-610.
 16. **Cappillino, P.J.**; Sugar, J.D.; Hekmaty, M.A.; Jacobs, B.W.; Stavila, V.; Chames, J.; Yang, N.Y.; Robinson, D.B., "Nanoporous Pd alloys with compositionally tunable hydrogen storage properties prepared by nanoparticle consolidation," *Journal of Materials Chemistry*, (2012), 22, 14013-14022.
 17. Ong, M.D.; Jacobs, B.W.; Sugar, J.D.; Grass, M.E.; Liu, Z.; Buffleben, G.M.; Clift, W. M.; Langham, M.E.; **Cappillino, P. J.**; Robinson, D.B., "Effect of rhodium distribution on thermal stability of nanoporous palladium-rhodium powders", *Chemistry of Materials*, (2012), 24(6), 996-1004.
 18. **Cappillino, P. J.**; Miecznikowski, J. R.; Tyler, L. A.; Lo, W.; Krzyaniak, M. D.; McCracken, John L.; Armstrong, W. H.; Caradonna, John P., " Studies of iron(II) and iron(III) complexes with fac-N₂O, cis-N₂O₂ and N₂O₃ donor ligands: models for the 2-His 1-carboxylate motif of non-heme iron monooxygenases", *Dalton Transactions*, (2012), 41, 5662-5677.
 19. **Cappillino, P. J.**; McNally, Joshua S.; Wang, F.; Caradonna, J. P., "The effect of varying carboxylate ligation on the electronic environment of N₂O_x (x = 1-3) nonheme iron: A DFT analysis", *Dalton Transactions*, (2012), 41, 464-483.
 20. **Cappillino, P. J.**; Tarves, P. C.; Rowe, G. T.; Lewis, A. J.; Harvey, M.; Rogge, C.; Stassinopoulos, A.; Lo, W.; Armstrong, W. H.; Caradonna, J. P., "Synthesis and characterization of a family of binuclear non-heme iron monooxygenase model compounds: evidence for a "phenolate/amide carbonyl (PAC) shift" upon oxidation", *Inorganica Chimica Acta* (2009), 369, 2136-2150.
 21. Meyer, J.; Brown, S.; Kleiman, R.; Hill, J.; **Cappillino, P. J.**; Koritala, R., "A novel presentation of nonionic PEG surfactants' characteristics", *Cosmetics & Toiletries* (2004), 119(4), 61-64, 66, 68.
 22. **Cappillino, P. J.**; Kleiman, R.; Botti, C., "Composition of Chilean jojoba seeds", *Industrial Crops and Products* (2003), 17(3), 177-182.

Invited Talks

1. **Cappillino, P. J.** "Mushroom-Derived Flow Battery Electrolytes" Invited talk given at the Bridgewater State University Department of Math and Science, Bridgewater, MA, October, 14, 2016.
2. **Cappillino, P. J.** "Mushroom-Derived Flow Battery Electrolytes" Invited talk given at Toyota Motor Engineering & Manufacturing, Ann Arbor, MI, August, 18, 2016.
3. Cappillino, P. J. "Designing Coordination Compounds for Grid Energy Storage: Some Lessons from Nature" Invited talk given at the 39th Boston Regional Inorganic Colloquium, Clark University, Worcester, MA, February, 27, 2016.

Other Presentations:

1. **Cappillino, P. J.**; Huang, H.; Howland, R.; Agar, Ertan. "Bio-Inspired Active Materials for High-Stability Nonaqueous Redox Flow Batteries." Oral Presentation given at the International Society of Electrochemistry 68th Annual Conference in Providence, RI. August 31, 2017.

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2. **Cappillino, P. J.**; Huang, H.; Howland, R.; Agar, Ertan, "Flow Battery Active-Material Design – Natural Selection as a Molecular Toolkit." Oral Presentation given at the New England Energy Research Forum Worcester, MA. June 28, 2017.
 3. **Cappillino, P. J.**; Huang, H.; Howland, R. "Lessons from Nature on the Design of Nonaqueous Flow Battery Electrolytes" Oral Presentation given at the MRS National Meeting in Boston, MA. November 28, 2016.
 4. **Cappillino, P. J.**; Huang, H.; Wheeler, J.; Howland, R. "Mushroom-Derived Flow Battery Electrolytes" Oral Presentation given at the 229th ECS National Meeting in San Diego, CA. May 30, 2016.
 5. **Cappillino, P. J.**; Sugar, J.D.; El Gabaly, F.; Cai, T.; Liu, Z.; Stickney, J; Robinson, D.B., "Nanostructured, Bimetallic, Noble Metal Powders Prepared By Atomic Layer Electroless Deposition for Applications in Sensing and Catalysis" Oral Presentation given at the 228th ECS National Meeting in Phoenix, AZ, October 13, 2015.
 6. **Cappillino, P. J.**; Sugar, J.D.; El Gabaly, F.; Cai, T.; Stickney, J; Robinson, D.B., "Synthesis of nanostructured, bimetallic, noble metal powders using Atomic Layer Electroless Deposition" Oral Presentation given at the ACS National Meeting in Boston, MA. August, 2015.
 7. **Cappillino, P.J.**; Pratt, H.D.; Anstey, M.R.; Anderson, T.M.; Tomson, N.C., "Application of redox non-innocent ligands to non-aqueous flow battery electrolytes, " Oral Presentation given at the 247th National ACS Meeting in Dallas, TX, April, 2014.
 8. **Cappillino, P.J.**; Buffleben, G.M.; Salloum, M; Stickney, J.L.; Robinson, D.B. "Electroless approach to atomic layer deposition on noble metal powders, " Oral Presentation given at the 247th National ACS Meeting in Dallas, TX, April, 2014.
 9. **Cappillino, P.J.**; Jones, C.J.; Hattar, K.; Clark, B.C.; Hekmaty, M.A.; Jacobs, B.W.; B. Robinson, D.B., "Synthesis of Nanoporous Palladium Powder With Controlled Pore and Particle Size for Hydrogen Storage Applications," Oral Presentation given at the American Institute of Chemical Engineers (AIChE) 2013 Meeting in San Francisco, CA, November 2013.
 10. **Cappillino, P.J.**; Pratt, H.D.; Anstey, M.R.; Anderson, T.M.; Tomson, N.C., "Metal Complexes with Redox-active Ligands as High Energy Density Nonaqueous Redox Flow Battery Electrolytes," Oral Presentation given at the American Institute of Chemical Engineers (AIChE) 2013 Meeting in San Francisco, CA, November 2013.
 11. **Cappillino, P.J.**; Pratt, H.D.; Anstey, M.R.; Anderson, T.M.; Tomson, N.C., "Metal complexes with redox-active ligands as electrolytes for high-performance flow batteries," Poster presentation given at the 245th National ACS Meeting in New Orleans, LA, April, 2013.
 12. **Cappillino, P. J.**; Hekmaty, M.A.; Jacobs, B.W.; Hattar, K.; Clark, B.; Robinson, D.B., "Nanoporous Metals for Prevention of Helium Bubble Formation in Pd Tritides" Oral Presentation given at the Materials Research Society Meeting in Boston, MA. November, 2012.
 13. **Cappillino, P. J.**; Sheridan, L; Stickney, J; Robinson, D.B., "Electroless Atomic Layer Deposition: A Scalable Approach to Tailored Surface Structures" Oral Presentation given at the Materials Research Society Meeting in Boston, MA. November, 2012.
 14. **Cappillino, P. J.**; Stavila, V.; Yang, N.Y.; Zhang, Z.; Wolfer, W.; Yee, J.; Ong, M.; Lavernia, E., "Microstructural Evolution of Cryomilled Pd/Rh Alloy Powder and Its Correlation to Hydrogen Storage" Poster Presentation given at the 2012 International Hydrogen Conference, Jackson Hole, WY. September, 2012.
 15. **Cappillino, P. J.**; Parent, L.R.; Hekmaty, M.A.; Jacobs, B.W., Hartnett, R.J.; Arslan, I., Robinson, D.B., "Growth of Nanoporous Palladium Alloys in Soft Templates for Storage of Hydrogen at High Power Density, " Oral Presentation given at the 23rd Conference on Crystal Growth and Epitaxy, Stanford Sierra Camp, Fallen Leaf Lake, CA, April, 2012.
 16. **Cappillino, P. J.**; Hekmaty, Michelle A.; Robinson, David B., "Nanostructured, nanoporous palladium alloys from consolidation of dendrimer encapsulated nanoparticles for Hydrogen isotope separation and storage", Oral presentation given at the 242nd National ACS Meeting in Denver, CO, August 2011.
 17. **Cappillino, P. J.**; Miecznikowski, J. R.; Caradonna, J. P., "Iron compounds with *fac*-N₂O₁, *cis*-N₂O₂ and N₂O₃ donor ligands: Structural and reactivity models of mononuclear non-heme iron oxygenase active sites", Oral presentation given at the 10th Frühjahrssymposium of the GDCh Younger Chemists' Forum. **Awarded 3rd prize for the best oral presentation**, April 2008.

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18. **Cappillino, P. J.**; Miecznikowski, J. R.; Tyler, L.; Lo, W.; Armstrong, W. H.; Caradonna, J. P., "Synthesis and characterization of nonheme iron oxygenase model compounds with chelated *fac*-N₂O₁, *cis*-N₂O₂ and N₂O₃ donor ligands", Oral presentation given at the 234th National ACS Meeting in Boston, MA, August 2007.

Administration

- **Co-founder/organizer** of the BU Chemical Biology Seminar Series (2003-2008)
- **Session President**, 250th ACS National Meeting, Chemistry of Materials: Synthesis and Properties, Division of Inorganic Chemistry (August 15, 2015, Boston, MA)

Affiliations

- Electrochemical Society (2014 – present)
- Materials Research Society (2010 – present)
- American Chemical Society, Inorganic Section (2004 – present)
- Northeastern Section Younger Chemists Committee (Executive Committee, Webmaster, 2008)
- Boston University Younger Chemists Committee (Vice-president, 2007)

Awards

- Emerging Investigators, 2017, Journal of Materials Chemistry A
- 2015 recipient of ECS Toyota Young Investigator Fellowship
- NSYCC/NESACS German Exchange Program Awardee (2008)
- 3rd prize for best oral presentation, 10th Frühjahrssymposium of the GDCh Younger Chemists' Forum., April 2008
- Boston University Department of Chemistry Outstanding Teaching Fellow, 2006-2007