

Brad P. Carrow, Ph.D.

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PROFESSIONAL EXPERIENCE & EDUCATION

Assistant Professor of Chemistry, Princeton University	July 2013–present
Assistant Professor, Department of Chemistry and Biotechnology, University of Tokyo	Dec. 2011–June 2013
JSPS Global COE Postdoctoral Fellow, University of Tokyo	Feb. 2011–Nov. 2011
Ph.D., University of Illinois at Urbana-Champaign Advisor: John F. Hartwig	Aug. 2005–Jan. 2011
Research Scientist II, Brewer Science, Inc., Rolla, MO.	June 2004–June 2005
Visiting Scholar, Rensselaer Polytechnic Institute Advisors: Toh-Ming Lu and Jay Senkevich	Jan. 2003–June 2004
B.S., Chemistry, Missouri University of Science and Technology Advisor: Thomas P. Schuman	Sept. 2000–Dec. 2003

PUBLICATIONS

- Carrow, B.P.; Sampson, J.; Wang, L. "Base-Assisted C–H Bond Cleavage in Cross-Coupling: Recent Insights into Mechanism, Speciation, and Cooperativity" (invited, 2019 Wolf Prize special issue) *Israel J. Chem.* **2019** – in press
- Wang, L.; Carrow, B.P. "Oligothiophene Synthesis by a General C–H Activation Mechanism: Electrophilic Concerted Metalation-Deprotonation (eCMD)" *ACS Catal.* **2019**, 9, 6821-6836.
- McAlpine, N.J.; Wang, L.; Carrow, B.P. "A Diverted Aerobic Heck Reaction Enables Selective 1,3-Diene and 1,3,5-Triene Synthesis through C–C Bond Scission" *J. Am. Chem. Soc.* **2018**, 140, 13634–13639.
- Zhang, W.; Waddell, P.M.; Tiedemann, M.A.; Padilla, C.E.; Mei, J.; Chen, L.; Carrow, B.P. "Electron-Rich Metal Cations Enable Synthesis of High Molecular Weight, Linear Functional Polyethylenes" *J. Am. Chem. Soc.* **2018**, 140, 8841–8850.
- Chen, L.; Francis, H.; Carrow, B.P. "An 'On-Cycle' Precatalyst Enables Room-Temperature Polyfluoroarylation Using Sensitive Boronic Acids" *ACS Catal.* **2018**, 8, 2989–2994.
One of most downloaded articles in April 2018
- Mitsushige, Y.; Yasuda, H.; Carrow, B.P.; Ito, S.; Kobayashi, M.; Tayano, T.; Watanabe, Y.; Okuno, Y.; Hayashi, S.; Kuroda, J.; Okumura, Y.; Nozaki, K. "Methylene-Bridged Bisphosphine Monoxide Ligands for Palladium-Catalyzed Copolymerization of Ethylene and Polar Monomers" *ACS Macro Lett.* **2018**, 7, 305-311.

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- Chen, L.; Sanchez, D.R.; Zhang, B.; Carrow, B.P. "Cationic' Suzuki–Miyaura Coupling with Acutely Base-Sensitive Boronic Acids" *J. Am. Chem. Soc.* **2017**, *139*, 12418-12421.
- Gorsline, B.J.; Wang, L.; Ren, P.; Carrow, B.P. "C–H Alkenylation of Heteroarenes: Mechanism, Rate, and Selectivity Changes Enabled by Thioether Ligands" *J. Am. Chem. Soc.* **2017**, *139*, 9605-9614.
- Carrow, B.P.; Chen, L. "Tri(1-adamantyl)phosphine: Exceptional Catalytic Effects Enabled by the Synergy of Chemical Stability, Donicity, and Polarizability" (invited) *Synlett* **2017**, *28*, 280-288.
- Chen, L.; Ren, P.; Carrow, B.P. "Tri(1-adamantyl)phosphine: Expanding the Boundary of Electron-Releasing Character Available to Organophosphorus Compounds" *J. Am. Chem. Soc.* **2016**, *138*, 6392-6395.

Highlights: Chem. & Eng. News; Org. Process Res. Dev.

- Bui, P.B.; Oyama, S.T.; Takagaki, A.; Carrow, B.P.; Nozaki, K. "Reactions of 2-Methyltetrahydropyran on Silica-Supported Nickel Phosphide in Comparison with 2-Methyltetrahydrofuran" *ACS Catal.* **2016**, *6*, 4549–4558.
- Mitsushige, Y.; Carrow B.P.; Ito, S.; Nozaki, K. "Ligand-Controlled Insertion Regioselectivity Accelerates Copolymerization of Ethylene with Methyl Acrylate by Cationic Bisphosphine Monoxide–Palladium Catalysts" *Chem. Sci.* **2016**, *7*, 737-744.
- Carrow, B.P.; Nozaki, K. "Transition-Metal-Catalyzed Functional Polyolefin Synthesis: Effecting Control through Chelating Ancillary Ligand Design and Mechanistic Insights" (perspective) *Macromolecules* **2014**, *47*, 2541-2455.

One of most downloaded articles in May 2014

- Nakamura, N.; Kageyama, T.; Goto, H.; Ito, S.; Carrow, B.P.; Nozaki, K. "P-Chiral Phosphine–Sulfonate/Palladium-Catalyzed Asymmetric Copolymerization of Vinyl Acetate with Carbon Monoxide" *J. Am. Chem. Soc.* **2012**, *134*, 12366-12369.
- Carrow, B.P.; Nozaki, K. "Synthesis of Functional Polyolefins Using Cationic Bisphosphine Monoxide–Palladium Complexes" *J. Am. Chem. Soc.* **2012**, *134*, 8802-8805.

Pre-Independent Publications

- Carrow, B.P.; Hartwig, J.F. "Distinguishing Between Pathways for Transmetalation in Suzuki–Miyaura Reactions." *J. Am. Chem. Soc.* **2011**, *133*, 2116-2119.
- Carrow, B.P.; Hartwig, J.F. "Ligandless, Anionic, Arylpalladium Halide Intermediates in the Heck Reaction." *J. Am. Chem. Soc.* **2010**, *132*, 79-81.
- Barrios-Landeros, F.; Carrow, B.P.; Hartwig, J.F. "Effect of Ligand Steric Properties and Halide Identity on the Mechanism for Oxidative Addition of Haloarenes to Trialkylphosphine Pd(0) Complexes" *J. Am. Chem. Soc.* **2009**, *131*, 8141-8154.
- Barrios-Landeros, F.; Carrow, B.P.; Hartwig, J.F. "Autocatalytic Oxidative Addition of PhBr to Pd(P^tBu₃)₂ via Pd(P^tBu₃)₂(H)(Br)" *J. Am. Chem. Soc.* **2008**, *130*, 5842-5843.
- Senkevich, J.J.; Carrow, B.; Wang, P.-I. "Thermal and Dielectric Stability of Parylene X." *Mater. Res. Soc. Symp. Proc.* **2006**, *914*, 101-106.
- Senkevich, J.J.; Woods, B.W.; Carrow, B.P.; Geil, R.D.; Rogers, B.R. "Amorphous Highly Conjugated Chemical-Vapor-Deposited Polymer Thin Films." *Chem. Vapor Dep.* **2006**, *12*, 285-289.
- Carrow, B.P.; Bakhru, H.; Wang, P.-I.; Chen, Y.; Senkevich, J. J. "Dehydrohalogenation in Alpha-Functionalized Poly-*p*-xylylenes." *Chem. Vapor Dep.* **2006**, *12*, 239-244.
- Senkevich, J.J.; Carrow, B.P.; Woods, B.W.; Bae, D.-L.; Cale, T.S.; Wang, P.-I. "Molecular Caulk: Enabling Aspects for Ultra-Low κ Dielectric Integration." *Advanced Metallization Conference, Proceedings of the Conference*, **2006**, 375-379.

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24. Carrow, B.P.; Murray, R.E.; Woods, B.W.; Senkevich, J.J. "Poly(ethynyl-p-xylylene), an Advanced Molecular Caulk CVD Polymer" *Mater. Res. Soc. Symp. Proc.* **2005**, 863, 189-194.
25. Ye, D.-X.; Carrow, B.; Pimanpang, S.; Bakhr, H.; Ten Eyck, G. A.; Wang, G.-C.; Lu, T.-M. "Evaluation of a Novel Cu(I) Precursor for Chemical Vapor Deposition" *Electrochem. Solid-State Lett.* **2005**, 8, C85-C88.

SEMINARS

1. 4th International Symposium on Precisely Designed Catalysts with Customized Scaffolding, Nara, Japan Dec. 2019
2. University of Michigan, Ann Arbor, MI Oct. 2019
3. Iowa State University, Ames, IA Oct. 2019
4. University of Missouri, Columbia, MO Oct. 2019
5. Advances in Polyolefins 2019, Rohnert Park, CA Sept. 2019
6. International Conference on Catalysis and Organic Synthesis ICCOS-2019, Moscow, Russia Sept. 2019
7. University of California, Riverside, Riverside, CA June 2019
8. University of California, Los Angeles, Los Angeles, CA June 2019
9. University of California, Santa Barbara, Santa Barbara, CA May 2019
10. Cornell University, Ithaca, NY May 2019
11. Michigan State University, Lansing, MI Apr. 2019
12. ACS National Meeting, Orlando, FL Mar. 2019
13. University of Houston, Houston, TX Mar. 2019
14. Inorganic Reaction Mechanisms Gordon Research Conference, Galveston, TX Mar. 2019
15. University of Wisconsin - Madison, Madison, WI Feb. 2019
16. University of Minnesota, Minneapolis, MN Feb. 2019
17. University of California, Berkeley, Berkeley, CA Feb. 2019
18. University of North Carolina at Chapel Hill, Chapel Hill, NC Feb. 2019
19. The Ohio State University, Columbus, OH Feb. 2019
20. University of Pennsylvania, Philadelphia, PA Feb. 2019
21. University of Chicago, Chicago, IL Nov. 2018
22. Yale University, New Haven, CT Nov. 2018
23. RWTH Aachen University, Aachen, Germany Oct. 2018
24. Münster University, Münster, Germany Oct. 2018
25. Max-Planck-Institut für Kohlenforschung Oct. 2018
26. University of Cologne, Cologne, Germany Oct. 2018
27. University of Bristol, Bristol, England Oct. 2018
28. University of Oxford, Oxford, England Oct. 2018

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29. University of Cambridge, Cambridge, England	Oct. 2018
30. University of Edinburgh, Edinburgh, Scotland	Oct. 2018
31. Indiana University, Bloomington, IN	Oct. 2018
32. Seton Hall University, Seton Hall, NJ	Sept. 2018
33. SUNY Binghamton, Binghamton, NY	Aug. 2018
34. Organic Reactions & Processes Gordon Research Conference (short talk), Stonehill College, Easton, MA	July 2018
35. Organometallics Gordon Research Conference (short talk), Salve Regina University, Newport, RI	July 2018
36. ACS National Meeting, New Orleans	Mar. 2018
37. Boston University, Boston, MA	Jan. 2018
38. Celgene Research & Development, Summit, NJ	Dec. 2017
39. Syracuse University, Syracuse, NY	Oct. 2017
40. ACS National Meeting, Washington D.C.	Aug. 2017
41. ACS National Meeting, Washington D.C.	Aug. 2017
42. University of Tokyo, Tokyo, Japan	July 2017
43. ACS Mid-Atlantic Regional Meeting (MARM), Hershey, PA	June 2017
44. King Abdullah University of Science and Technology (KAUST), Thuwal, Saudi Arabia	Feb. 2017
45. ExxonMobil Research and Engineering, Baytown, TX	Sept. 2016
46. Drew University, Madison, NJ	Sept. 2016
47. CREST Base Metal Symposium, Princeton University, Princeton, NJ	Sept. 2016
48. PMSE Division, ACS Fall National Meeting, Philadelphia, PA	Aug. 2016
49. Philadelphia Inorganic Colloquium, The College of New Jersey, Trenton, NJ	Sept. 2015
50. ExxonMobil Central Research & Engineering, Annandale, NJ	Feb. 2015
51. International Symposium on Homogeneous Chemical Reactivity, Ibaraki University, Mito, Japan	June 2013
52. 59 th Symposium on Organometallic Chemistry, Osaka University, Osaka, Japan	Sept. 2012
53. Iowa State University, Ames, IA	Sept. 2012
54. 23 rd Annual Organic Area Allerton Conference, University of Illinois at Urbana-Champaign, Urbana, IL	Nov. 2009
55. Global Center of Excellence Program Summer School, Tohoku University, Sendai, Japan	Aug. 2009
56. Pines Travel Award Seminar, Missouri University of Science and Technology, Rolla, MO	Feb. 2009
57. Materials Research Society Conference, San Francisco, CA	Mar. 2005

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PATENTS

- Carrow, B.P.; Chen, L. "Tri(1-adamantyl)phosphine and Applications Thereof" WO 2017/075581 A1, May 4, 2017.
- Carrow, B.P.; Zhang, W. "Transition Metal Catalysts for Olefin Polymerization" WO 2015/200849 A2, December 30, 2015.
- Nozaki, K.; Carrow, B.; Okumura, Y.; Kuroda, J. "Catalyst for Synthesizing Polyolefins" WO 2013/168626 A1, November 11, 2013.

AWARDS & HONORS

NIH MIRA Award	2018
NSF CAREER Award	2017
Thieme Chemistry Journal Award	2017
Japan Society for the Promotion of Science (JSPS) Global COE Fellowship (U. Tokyo)	2011
Seemon H. Pines Travel Award, UIUC	2008
Carl S. Marvel Graduate Fellowship, UIUC	2008
University of Missouri, <i>Magna Cum Laude</i>	2003
University of Missouri Curators Scholarship	2000-2003
Missouri Bright Flight Scholar	2000-2003

FUNDING

Ongoing research support

Celgene Corporation	May 2019–May 2020
National Institutes of Health 1R35-GM128902 Project title: Aliphatic Effects in Transition Metal Catalysis	July 2018–June 2023
Princeton Catalysis Initiative Project title: Catalytic Strategies to Enable Next-Generation Recycling in the New Plastics Economy	July 2018–June 2020
National Science Foundation CHE-1654664 Project title: CAREER: Enabling Sustainable Polymer Synthesis through Design of New Catalysts	July 2016–June 2022

Completed research support

National Science Foundation MRSEC DMR-1420541 Project title: Nanostructured Copolymers with Semi-crystalline Hydrophobic Domains Prepared by Transition Metal Catalysis	Nov. 2015–March 2016
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PROFESSIONAL ACTIVITIES

External

Grant reviewer, National Science Foundation	
Grand reviewer, Department of Energy	
Grant reviewer, ACS Petroleum Research Fund	
Peer reviewer of ca. 100 manuscripts since Nov. 2014	
Consultant, Exxon Mobil, Central Research and Engineering, Clinton, NJ	Feb. 2015
Consultant, Exxon Mobil, Global Chemical Research, Baytown, TX	Sept. 2016
Consultant, Celgene, Process Chemistry, Summit, NJ	Dec. 2017
Consultant, Merck, Process Research, Rahway, NJ	Apr. 2019
Symposium organizer, PMSE division, ACS National Meeting	Mar. 2020
Member, American Chemical Society (ACS)	

Princeton University Service

Inorganic Seminar Series	2014–present
Graduate Admissions Committee, inorganic and materials subdivisions	2013–present
Department Retreat Organizing Committee	2015–present
Junior Undergraduate Colloquia series – introduction to research	2013, 2017
Reader for undergraduate organic and inorganic senior theses	2013–2014
Served on 21 doctoral general exam committees (including 8 students in my lab)	2014–present
Served on 19 FPO committees (including 3 students in my lab)	2014–present
Served as second reader for 5 Ph.D. dissertations	2013–present
Mentored 7 undergraduates for junior proposal research	2014–present
Mentored 8 undergraduates for senior thesis research (2 ongoing, 6 completed)	2014–present
Research adviser to 2 undergraduates in Leach Summer Scholars program	2014–present
Research adviser for undergraduate in International Student Internship Program	2017
Research adviser to 9 undergraduates in Summer Undergraduate Research Program in Diversity	2015–present

TEACHING

CHM 304 Organic Chemistry II: Foundations of Chemical Reactivity and Synthesis (undergraduate)	Spring 2018
CHM 521 Organometallic Chemistry (graduate)	Spring 2015, Spring 2016, Spring 2017, Spring 2019
CHM 532 Mechanistic & Physical Organic Chemistry (graduate)	Fall 2014, Fall 2015, Fall 2017
CHM 536 Topics in Organic Chemistry: Organic Chemistry and Catalysis (graduate)	Spring 2014
03-770010 Introductory Lectures in Chemistry and Biotechnology (undergraduate, U. Tokyo)	Fall 2012, Spring 2012

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RESEARCH COLLABORATIONS

Celgene Corporation (Summit, NJ) Topic: Develop Novel Base Metal Catalysts and Weak Base Methods for Coupling Reactions	June 2019–present
Prof. Barry Rand (Electrical Engineering, Princeton) Topic: Two-Dimensional Hybrid Organic/Inorganic Perovskites	Mar. 2018–present
Prof. Tom Ward (U. Basel) Topic: Biotinylated Thioether-Coordinated Complexes for Biocatalytic C–H Functionalization	Mar. 2018–present
Prof. Hao Chen (NJ Institute of Tech.) Topic: Mass Spectrometric Detection of Transient Organometallic Intermediates	Nov. 2017–present
Prof. Peng Liu (Pitt) Topic: Quantifying Contributions from Dispersion in Molecular Catalysis	Sept. 2017–present
Prof. Richard Register (Chemical and Biological Engineering, Princeton) Topic: Develop Functional Polyolefin Compatibilizers for Waste Plastics Upcycling	Nov. 2014–present

COWORKERS

Graduate Students

- Liye Chen** (Fall 2013–Aug. 2018) from Tsinghua University
Bristol-Myers Squibb Graduate Fellowship, Princeton University (2016)
Rathmann Fellowship, Princeton University (2013)
Ph.D. in June 2018, Princeton University
Thesis title: “*Ligand-Accelerated Cross-Coupling and Mechanistic Investigations*”
Current position: Postdoctoral Fellow, University of California Berkeley (Hartwig lab)
- Christian Padilla** (Fall 2013–Feb. 2016) from Carleton College
Graduate Research Fellowship, National Science Foundation (2013)
M.S. in Feb. 2019, Princeton University
Current position: ExxonMobil Research and Engineering, Clinton, NJ
- Neil McAlpine** (July 2016–Oct. 2018) from University of Glasgow
Ph.D. in October 2018
Thesis title: “*Design and Development of New Aerobic Boron Heck Reactions*”
Current position: Research Scientist, Medicinal Chemistry, Librede, Inc.
- Margaret (Tiedemann) Whalley** (Fall 2014–Feb. 2017) from Lafayette College
M.S. in Feb. 2019, Princeton University
Current position: Research Technician, ExxonMobil, Baytown, TX

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5. **Long Wang** (Fall 2014–June 2019) from Peking University
Nat C. Robertson *42 Graduate Fellowship in Chemistry (2015)
Ph.D. in June 2019, Princeton University
Thesis title: “*Thioether Ligand-Promoted Catalytic C–H Functionalization and Mechanistic Investigations*”
Current position: Research Scientist, BASF Shanghai
6. **Peter Waddell** (Fall 2015–present) from Rutgers University
Hubbell '47 3rd Year Seminar Prize, Princeton University (2018)
7. **Anthony Scavuzzo** (Fall 2016–present) from Clemson University
8. **William SiiHong Lau** (Fall 2017–present) from University of Illinois – Urbana, Champaign
9. **Daniel Sanchez** (Fall 2017–present) from Caltech

Postdoctoral Fellows

1. **Wei Zhang**, Ph.D. (Oct. 2013–July 2015) doctoral work with Weiping Tang (University of Wisconsin – Madison)
Current position: Scientist, Johnson & Johnson R&D, Spring House, PA
2. **Peng Ren**, Ph.D. (July 2014–July 2015) doctoral work with Xile Hu (Ecole Polytechnique Fédérale de Lausanne, Switzerland)
Current position: Associate Professor of Chemistry, Harbin Institute of Technology, Shenzhen, China
3. **Jiajun Mei**, Ph.D. (Dec. 2015–Dec. 2016) doctoral work with T. Brent Gunnoe (University of Virginia)
Current position: Aleon Pharma International
4. **Praveen Kilaru**, Ph.D. (Oct. 2018–June 2019) doctoral work with Pinjing Zhao (North Dakota State University)
Current position: J-Star Research
5. **Jason Brandt**, Ph.D. (May 2018–present) doctoral work with Laurel Schafer (University of British Columbia)
6. **Jessica Sampson**, Ph.D. (Feb. 2019–present) doctoral work with Theodor Agapie (Caltech)
7. **Peng Yu**, Ph.D. (Sept. 2019–present) doctoral work with Bill Morandi (Max Planck Institute, Mulheim)

Visiting Graduate Students

Lukas Lückemeier (Sept. 2019–Feb. 2020) Ph.D. student with Frank Glorius (University of Münster, Germany)

Undergraduate Students

Bradley Gorsline (Princeton '15)

Kiwoon Baeg (Princeton '16)

Chatarin Wangsanuwat (Princeton '16, Chem. & Bio. Eng.) – Leach Summer Scholars Program

Cecily O'Leary (Princeton '16)

Aileen Huang (Princeton '17)

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Madison Parry (Princeton '18, Chem. & Bio. Eng.) – Leach Summer Scholars Program

Nathan Park (Princeton '18)

Abhiram Kurappur (Princeton '19, Chem. & Bio. Eng.)

Nicodemo Ciccia (Princeton '20)

Lucy Wang (Princeton '21)

Marlon Simms (Massachusetts College of Pharmacy and Health Sciences University) – Summer Undergraduate Research Program in Diversity, Summer 2015

Cecilia Vollbrecht (Centre College) – Summer Undergraduate Research Program in Diversity, Summer 2016

Bufan Zhang (Vassar College)– Summer Undergraduate Research Program in Diversity, Summer 2016

Haydn Francis (Oxford) – International Summer Internship Program, Summer 2017

Linh Le (Colgate University) – Summer Undergraduate Research Program in Diversity, Summer 2017

Kathryn Goerl (Wellesley College)– Summer Undergraduate Research Program in Diversity, Summer 2017

Najla Fawwaz (New College of Florida) – Summer Undergraduate Research Program in Diversity, Summer 2017

Sojung Kim (Penn State University) – Summer Undergraduate Research Program in Diversity, Summer 2018

Roxanna Martinez (Skidmore College) – Summer Undergraduate Research Program in Diversity, Summer 2018

Jenny Hu (UNC–Chapel Hill) – Summer Undergraduate Research Program in Diversity, Summer 2019