BERLINGUETTE RESEARCH

CURTIS P. BERLINGUETTE

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Principal Investigator, Stewart Blusson Quantum Matter Institute (SBQMI)
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CONTACT INFORMATION

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METRICS, January 2021 *(over last 5 years)*

Total publications: 143 *(75)*
No. of citations: 9702 *(6137)*
h-index: 50 *(40)*

POST-SECONDARY EDUCATION

University or Institution	Program	Dates
Harvard University	Postdoctoral Associate	2004 – 2006
Texas A&M University	Ph.D.	2000 – 2004
University of Alberta	B.Sc.	1996 – 2000

EMPLOYMENT RECORD

University of British Columbia	Professor of Chemistry and Chemical and Biological Engineering	2017-present
Stewart Blusson Quantum Matter Institute (SBQMI)	Professor / Principal Investigator	2015-present
Canadian Institute for Advanced Research (CIFAR)	Co-Director (Bioinspired Solar Energy) Fellow	2020-present 2014-present
Miru Smart Technologies Corp. (formerly Click Materials)	CEO & Co-Founder	2016-present
University of British Columbia	Associate Professor of Chemistry and Chemical and Biological Engineering	2013-2017
École Polytechnique Fédérale de Lausanne, Switzerland	Visiting Scientist	2013
University of Calgary	Associate Professor	2011-2013
Centre for Advanced Solar Materials	Director	2011-2013
Institute for Sustainable Energy, Environment & Economy	Fellow	2006-2013
University of Calgary	Assistant Professor	2006-2011

SERVICE TO THE COMMUNITY

Editor, Journal of Materials Chemistry A (RSC Publication) | 2020-present
Schmidt Science Fellows Academic Reviewer | 2020
Rutherford Memorial Medal (Chemistry) Selection Committee, The Royal Society of Canada | 2019
Editorial Board, EnergyChem (Elsevier) | 2018-present
Editorial Advisory Board, Journal of Materials Chemistry A (RSC Publication) | 2017-2019
Participant, Mission Innovation Workshop on Carbon Capture and Utilization (Houston, TX, USA) | Sep 2017
Participant, Mission Innovation Workshop on Accelerated Materials Discovery (Mexico City, MX) | Sep 2017
IPS-22 International Organization Committee | 2016-2022
Canadian Institute for Advanced Research | 2015-present
Editorial Advisory Board, Chemistry of Materials (ACS Publications) | 2014-2020
Editorial Advisory Board, Inorganic Chemistry (ACS Publications) | 2012-2015

AWARDS AND DISTINCTIONS

CSC Award for Research Excellence in Materials Chemistry | 2020
CIFAR Co-Director (Bioinspired Solar Fuels) | 2020-2025
Fellow of the Royal Society of Chemistry (UK) | 2018
NSERC E.W.R. Steacie Memorial Fellowship | 2016
RSC Alex Rutherford Medal for Chemistry | 2016
Strem Chemicals Award for Pure and Inorganic Chemistry | 2016
CIFAR Fellow | 2014-present
International Conference for Coordination Chemistry “Rising Star” | 2014
Tier II Canada Research Chair in Solar Energy Conversion | 2014-2019
Top 40 Under 40, Avenue Magazine (Calgary) | 2012
Alfred P. Sloan Fellowship | 2011
Canadian National Committee for the IUPAC Travel Award | 2011
Tier II Canada Research Chair in Energy Conversion | 2008-2013
Alberta Ingenuity New Faculty Award | 2007
NATO-ASI Award, NATO | 2003
European Science Bursary, European Science Foundation | 2003
Outstanding Oral Presentation, Texas A&M IUCCP Symposium | 2003
Martell Travel Award, Texas A&M University | 2002
Dean’s Graduate Scholarship, College of Sciences, Texas A&M University | 2000

RESEARCH AND TEACHING INTERESTS

Accelerating Materials Discovery: Our program is connecting artificial intelligence with flexible automation to accelerate the rate of thin-film materials discovery and optimization. The first work product of this endeavor is the world’s first self-driving laboratory for thin films discovery (*Science Advances*, **2020**). Motivated by the fact that billions of dollars of private and public investment have failed to move the needle toward a cleaner energy economy, we are aiming to do science in fundamentally different ways by increasing the throughput for materials design and screening by >10-fold.

Advanced Solar Cells and Interfacial Electron Transfer: Thin film organic and perovskite solar cells can convert 20% of incident sunlight into electricity, but they still suffer from stability and manufacturing issues. This motivated our program to develop clear design principles for light-harvesting and conductive layers of organic solar cells (*Angewandte Chemie Int. Edition,* **2018**). The structure-property relationships we have developed led us to the recent discovery of the first dopant-free hole-transport material capable of hitting power conversion efficiencies of >20% in a perovskite solar cell *(Energy & Envir. Sci.,* **2019**). Additionally, our group has pioneered the development of high performance cyclometalated ruthenium dyes in the dye-sensitized solar cell *(Inorg. Chem.,* **2009**; *J. Am.*

Chem. Soc., **2010**). These dyes are characterized by tunable excited- and ground-state reduction potentials (*Angew. Chem. Int. Ed.,* **2011**). These dyes have provided a powerful platform for studying interfacial photophysical and photochemical processes at an unprecedented, atomic-orbital level of resolution (*Nature Commun.,* **2017**).

Energy Storage and CO_2 Utilization*:* The efficient conversion of sunlight into electricity is not the complete answer to the impending energy crisis - we need to be able to store and transport energy and mitigate the negative environmental impact of current energy production methods. Our group is interested in two processes that address these challenges: solar-driven water electrolysis to produce clean hydrogen fuel, and the electrolytic conversion of waste CO_2 into carbon-based fuels and chemicals. The mechanistic insights we gain on water splitting and CO_2 reduction are combined with our engineering expertise in pursuit of efficient, selective, stable electrolyzers that can be commercially deployed to disrupt the economics of clean energy technologies.

Low-Temperature Nuclear Fusion*:* My research group has played a leading role in a multi-disciplinary effort sponsored by Google seeking the conditions necessary to drive fusion reactions at lower temperatures (*Nature,* **2019**). Our contributions to this effort provided unprecedented insight into how hydrogen enters and exits palladium nanoparticulate films (*Nature Materials,* **2019**), and we have exploited these features to electrolytically drive hydrogenation chemistry using palladium films/membranes (*Nature Catalysis,* 2018; *J. Am. Chem. Soc.,* **2019**; *J. Mater. Chem. A,* **2019**).

Thin-Film Deposition*:* One of the defining contributions of our group is our "photodeposition" method for making conformal, defect-free metal oxide films (*Science,* **2013**; *Science Advances,* **2015**). We used this technique to make the most efficient heterogeneous oxygen evolution catalysts known (*J. Am. Chem. Soc.,* **2013**); indeed, I own the compositional patent to NiFeOx, which is widely studied in the literature. This versatile deposition technique can be used to make metal oxides containing almost any metal in the periodic table with acute control of relative metal content. The applications for the methodologies we have developed extend to consumer electronics and smart windows (*Chem*, **2018**).

FEATURED PUBLICATIONS

Kellett, C. W.; Kennepohl, P.; Berlinguette, C. P.* "π Covalency in the Halogen Bond." *Nat. Commun.* **2020**, *11,* 3310.
DOI: 10.1038/s41467-020-17122-7

Taherimakhsousi, N.; MacLeod, B. P.; Parlane, F. G. L.; Morrissey, T. D.; Booker, E. P.; Dettelbach, K. E.; Berlinguette, C. P.* "Quantifying Defects in Thin Films Using Machine Vision." *NPJ Comput. Mater.* **2020,** *6* (111).
DOI: 10.1038/s41524-020-00380-w

Kurimoto, A.; Sherbo, R. S.; Cao, Y.; Loo, N. W. X.; Berlinguette, C. P.* "Electrolytic Deuteration of Unsaturated Bonds Without Using D_2." *Nat. Catal.* **2020,** *3*, 719-726.
DOI: 10.1038/s41929-020-0488-z

Salvatore, D. A.; Berlinguette, C. P.* "Voltage Matters When Reducing CO_2 in an Electrochemical Flow Cell." *ACS Energy Lett.* **2020,** *5* (1)*,* 215-220.
DOI: 10.1021/acsenergylett.9b02356

MacLeod, B. P.; Parlane, F. G. L.; Morrissey, T. D.; Häse, F.; Roch, L.; Dettelbach, K. E.; Moreira, R.; Yunker, L. P. E.; Rooney, M. B.; Deeth, J. R.; Lai, V.; Ng, G. J.; Situ, H.; Zhang, R. H.; Elliott, M. S.; Haley, T. H.; Dvorak, D. J.; Aspuru-Guzik, A.*; Hein, J. E.*; Berlinguette, C. P.* "Self-Driving Laboratory for Accelerated Discovery of Thin-Film Materials." *Science Advances* **2020,** *6* (20), eaaz8867.
DOI: 10.1126/sciadv.aaz8867

Ren, S.; Joulié, D.; Salvatore, D. A.; Torbensen, K.; Wang, M.; Robert, M., Berlinguette, C. P.* "Molecular Electrocatalysts can Mediate Fast, Selective CO_2 Reduction in a Flow Cell." *Science* **2019,** *365* (6451), 367-369.

DOI: 10.1126/science.aax4608

Chiang, Y.-M.; Munday, J. N.; Schenkel, T.; Fork, D. K.; Koningstein, R.; Trevithick, M. D.; Berlinguette, C. P.* “Revisiting the Cold Case of Cold Fusion.” *Nature* **2019,** *570,* 45-51.
DOI:10.1038/s41586-019-1256-6

Johnson, N. J. J.; Lam, B.; MacLeod, B. P.; Sherbo, R. S.; Moreno-Gonzales, M.; Fork, D. K.; Berlinguette, C. P.* “Facets and Vertices Regulate Hydrogen Uptake and Release in Palladium Nanocrystals.” *Nat. Mater*. **2019**, *18*, 454-458.
DOI: 10.1038/s41563-019-0308-5

Kellett, C. W.; Swords, W. B.; Turlington, M. D.; Meyer, G. J.*; Berlinguette, C. P.* “Resolving Orbital Pathways for Intermolecular Electron Transfer.” *Nat. Commun.* **2018**, *9*, 4916.
DOI: 10.1038/s41467-018-07263-1

Sherbo, R. S.; Delima, R. S.; Chiykowski, V. A.; MacLeod, B. P.; Berlinguette, C. P.* "Complete Electron Economy by Pairing Electrolysis with Hydrogenation" *Nat. Catal*. **2018**, *1,* 501-507
DOI: 10.1038/s41929-018-0083-8

Weekes, D. M.; Salvatore, D. A.; Reyes, A.; Huang, A.; Berlinguette, C. P.* “Electrolytic CO_2 Reduction in a Flow Cell.” *Acc. Chem. Res.* **2018**, *51,* 910-918.
DOI: 10.1021/acs.accounts.8b00010

Cheng, W.; He, J.; Dettelbach, K. E.; Johnson, N.; Sherbo, R. S.; Berlinguette, C. P.* “Photodeposited Amorphous Oxide Films for Electrochromic Windows.” *Chem* **2018**, *4*, 821-832.
DOI: 10.1016/j.chempr.2017.12.030

Parlane, F.; Mustoe, C.; Kellett, C.; Simon, S. J. C.; Swords, W.; Meyer, G. J.; Kennepohl, P.; Berlinguette, C. P.* "Spectroscopic Detection of Halogen Bonding Resolves Dye Regeneration in the Dye-Sensitized Solar Cell." *Nat. Commun.* **2017**, *8,* 1761.
DOI: 10.1038/s41467-017-01726-7