

Eric McCalla

Chemistry Department, McGill University
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LANGUAGES English and French (fluent written and spoken)

CITIZENSHIP Canadian

EDUCATION

- 2010 – 2013** **Doctor of Philosophy (Physics)**
Supervisor: Jeff Dahn
Thesis: Structural and Electrochemical Studies of Positive Electrode Materials in the Li-Mn-Ni-O and Li-Co-Mn-O Systems for Lithium-ion Batteries.
Dalhousie University, Halifax, Nova Scotia.
- 2004 – 2005** **Bachelor of Education (Science/Mathematics)**
Memorial University of Newfoundland, St. John's, Newfoundland.
- 2000 – 2002** **Master of Science (Physics)**
Supervisor: Mark Sutton
Thesis: The Design of a High Temperature X-Ray Furnace.
McGill University, Montreal, Quebec.
- 1997 – 2000** **Bachelor of Science (First Class Honors in Physics)**
Recipient of the Physics Departmental Award and the University Leadership Certificate. Dean's List each term.
Mount Allison University, Sackville, New-Brunswick.

PROFESSIONAL EXPERIENCE**RESEARCH**

- Jan. 2018 -** **Assistant Professor**
Research activities: High-throughput synthesis and characterization of advanced functional materials for battery technologies.
McGill University – Department of Chemistry
- Nov. 2015 - 2017** **Post-Doctoral Fellow**
Supervisor: Chris Leighton
Research activity: The study of electronic and magnetic properties of oxide semiconductors and metals. These studies include electronic transport measurements, low temperature calorimetry and small

angle neutron scattering.

Chemical Engineering and Materials Science, University of Minnesota, Minneapolis, USA.

2014 - 2015

Post-Doctoral Fellow

Supervisor: Jean-Marie Tarascon

Research activity: Synthesis and characterization of lithium-rich layered materials in order to understand and improve the electrochemistry of positive electrode materials of interest for lithium-ion batteries. A novel method to make all solid-state-batteries was also developed. This post-doctoral work included two months at the National Institute of Chemistry in Slovenia, working with Dr. Robert Dominko.

Collège-de-France, Paris, France.

Doctoral Researcher

2010 – 2013

Research activity: Synthesis and characterization of combinatorial samples of oxide materials that are of high interest as potential positive electrode materials for Li-ion batteries.

Dalhousie University, Halifax, Nova Scotia, Canada.

2010 – 2010

Research Assistant

Research activity: Improved methodology and equipment to study electroless copper deposition with in-situ X-ray diffraction (XRD).

Mount Allison University, Sackville, New Brunswick, Canada.

2000 – 2002

Graduate Researcher

Research activity: Modeled and designed a high temperature furnace for in-situ XRD crystallization experiments. Participated in muon spin relaxation experiments performed at TRIUMF, studying spin glass transitions.

McGill University, Montreal, Quebec, Canada.

**1998 – 2000
(summers)**

Undergraduate Researcher

Research activity: Studied structural changes in oxide glasses with XRD, differential scanning calorimetry and reverse Monte Carlo simulations.

Mount Allison University, Sackville, New Brunswick, Canada.

COLLABORATIONS

- Jan. 2018 -** Current collaborators include Profs. Tomislav Frišćić (McGill University), Janine Mauzeroll (McGill University), Rustam Khaliullin (McGill University), and Chris Leighton (University of Minnesota).
- 2015 - 2017** Collaborated with John Mitchell at Argonne National Laboratory and Ram Seshadri at the University of California Santa Barbara.
- 2014 - 2015** Numerous industrial collaborations (including SAFT and TOTAL) within the context of ALISTORE – European Research Institute. Also collaborated with David Grosso (Collège-de-France), Moulay Sougrati (Institut Charles Gerhardt), Petr Novak (Paul Scherrer Institute), Marie-Liesse Doublet (Institut Charles Gerhardt), Danielle Gonbeau (Université de Pau) and Gustaaf Van Tendeloo (EMAT, University of Antwerp).
- 2010 – 2013** Industrial collaborations with 3M (USA) and Umicore (Belgium/Korea) both important developers of advanced battery materials. Also collaborated with Prof. Gerbrand Ceder from the Massachusetts Institute of Technology.
- 2010** Industrial collaboration with Atotech (Germany).

HQP TRAINING (AS PRINCIPAL INVESTIGATOR)**Master's student:**

- Karlie Potts (2018 -)

Undergraduate researchers:

- Jacqueline Yao (2018 -)
- Matthew Burigana (SURA scholarship, 2018 -)
- Shaun Anderson (SURA scholarship, 2018 -)

MENTORING (AS GRADUATE STUDENT OR POST-DOC)

Ph. D. student: Arnaud Perez (2014-2015), currently enrolled in his final year of his Ph.D. at the Collège de France.

Master's students: Colby Brown (2012-2013): now working at RIKEN (Japan) and Andrey Shevtsov (2014), now obtaining a doctoral degree at Moscow State University (begun in the fall of 2014).

Undergraduate researchers: Guy Cassuto (2016-2017): currently enrolled in the PhD program at the University of Maryland. Cody Watson (2013): now working for Chalk in Bedford, Canada. Cassandra Lowartz (2011-2012): now working for Maxxam Analytics in Calgary, Alberta, Canada.

PUBLICATIONS**BOOKS/CHAPTERS**

1. E. McCalla, "Electrical energy storage: batteries", in A. Stein, R. Dronskowski and S. Kikkawa (eds.), *Handbook of Solid State Chemistry: Volume 6*, Weinheim: Wiley-VCH (2017).
2. E. McCalla, *Consequences of Combinatorial Studies of Positive Electrodes for Li-ion Batteries*, New York: Springer (2014).

JOURNAL ARTICLES (google scholar citations on 1/4/2017: 466, h-index: 14, i10-index: 18)

29. E. McCalla, D. Phelan, M.J. Krogstad, B. Dabrowski, and Chris Leighton. *Electrical transport, magnetic, and thermodynamic properties of La-, Pr-, and Nd-doped BaSnO_{3-δ} single crystals*, submitted to Physical Review M (March, 2018).
28. M. Volk, E. McCalla, B. Voigt, M. Manno, C. Leighton, and J. Feinberg. *Changes in Physical Properties of 4C Pyrrhotite (Fe₇S₈) across the 32 K Besnus Transition*, submitted to American Mineralogist (February, 2018).
27. P. Pearce, A. Perez, G. Rousse, M. Saubanère, D. Batuk, D. Foix, E. McCalla, A. Abakumov, G. Van Tendeloo, M.-L. Doublet and J.-M. Tarascon. *Evidence for anionic redox activity in a tridimensional ordered Li-rich positive electrode β-Li₂IrO₃*, Nature Materials **16**, 580 (2017).
26. E. McCalla, J. Walter and C. Leighton. *A unified view of the substitution-dependent antiferrodistortive phase transition in SrTiO₃*, Chemistry of Materials **28**, 7973 (2016).
25. A. Perez, D. Batuk, M. Saubanère, G. Rousse, D. Foix, E. McCalla, E.J. Berg, R. Dugas, K. van den Bos, M.-L. Doublet, D. Gonbeau, A. Abakumov, G. Tendeloo, J.-M. Tarascon. *Strong oxygen participation in the redox governing the structural and electrochemical properties of Na-rich layered oxide Na₂IrO₃*, Chemistry of Materials **28**, 8278 (2016).
24. M. Saubanère, E. McCalla, J.-M. Tarascon and M.L. Doublet. *The Intriguing Question of Anionic Redox in High-Energy Cathodes for Li-ion Batteries*, Energy and Environmental Science **9**, 984 (2016).
23. D. Foix, S. Mariyappan, E. McCalla, J.-M. Tarascon, and D. Gonbeau. *X-ray photoemission spectroscopy study of cationic and anionic redox processes in high – capacity Li-ion battery layered-oxide electrodes*, Journal of Physical Chemistry C **120**, 862 (2016).

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22. E. McCalla, A.M. Abakumov, M. Saubanère, D. Foix, E.J. Berg, G. Rouse, M.-L. Doublet, D. Gonbeau, P. Novák, G. Van Tendeloo, R. Dominko and J.-M. Tarascon. *Visualization of O-O peroxo-like dimers in high-capacity layered oxides for Li-ion batteries*, *Science* **350**, 1516 (2015).
21. C.R. Brown, E. McCalla, C. Watson, and J.R. Dahn. *Combinatorial study of the Li-Ni-Mn-Co oxide pseudo-quaternary system for use in Li-ion batteries*. *ACS Combinatorial Science* **17** 381 (2015).
20. E. McCalla, A.S. Prakash, E. Berg, M. Saubanère, A.M. Abakumov, D. Foix, B. Klobes, M.-T. Sougrati, G. Rouse, F. Lepoivre, S. Mariyappan, M.-L. Doublet, D. Gonbeau, P. Novak, G. Van Tendeloo, R. Hermann and J.-M. Tarascon. *Reversible Li-intercalation Through Oxygen Reactivity in Li-rich Li-Fe-Te Oxide Materials*. *Journal of the Electrochemical Society* **162** A1341 (2015).
19. E. McCalla, M. Sougrati, A. Abakumov, G. Rouse, E. Berg, K. Ramesha, N. Resham, M. Sathiya, A.S. Prakash, B. Budic, A. Mahdoux, R. Dominko, G. Van Tendeloo, R.P. Hermann, P. Novak, and J.-M. Tarascon. *Understanding the roles of anionic redox and oxygen release in lithium-rich layered Li_4FeSbO_6* . *Journal of the American Chemical Society* **137** 4804 (2015).
18. E. McCalla, A. Abakumov, G. Rouse, M. Reynaud, M. Sougrati, B. Budic, A. Mahdoux, R. Dominko, G. Van Tendeloo, R.P. Hermann, and J.-M. Tarascon. *Novel complex stacking of fully ordered transition metal layers in Li_4FeSbO_6 materials*. *Chemistry of Materials* **27** 1699 (2015).
17. A.W. Rowe, J. Camardese, E. McCalla and J.R. Dahn, *High Precision Coulometry Studies of Single-Phase Layered Compositions in the Li-Mn-Ni-O System*, *Journal of the Electrochemical Society* **161** A1189 (2014).
16. J. Camardese, D. Abarbanel, E. McCalla and J.R. Dahn, *Synthesis of Spherical Core-Shell $Ni(OH)_2$ - $Ni_{1/2}Mn_{1/2}(OH)_2$ particles via a Continuously Stirred Tank Reactor*, *Journal of the Electrochemical Society* **161**, A890 (2014).
15. J. Camardese, E. McCalla, D. Abarbanel and J.R. Dahn, *Determination of Shell Thickness of Spherical Core-Shell $Ni_xMn_{(1-x)}(OH)_2$ Particles via Absorption Calculations of X-Ray Diffraction Patterns*, *Journal of the Electrochemical Society* **161**, A814 (2014).
14. E. McCalla, J. Li, A.W. Rowe, and J.R. Dahn, *The Negative Impact of Layered-Layered Composites on the Electrochemistry of Li-Mn-Ni-O Positive Electrodes for Lithium-Ion Batteries*, *Journal of the Electrochemical Society* **161**, A606 (2014).
13. C.R. Brown, E. McCalla, and J.R. Dahn, *Analysis of the cubic spinel region of the Li-Co-Mn oxide pseudo-ternary system*, *Solid State Ionics* **253**, 234 (2013).

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12. E. McCalla, A.W. Rowe, J. Camardese, and J.R. Dahn, *The role of metal site vacancies in promoting Li-Mn-Ni-O layered solid-solutions*, Chemistry of Materials **25**, 2716 (2013).
 11. E. McCalla, A.W. Rowe, C.R. Brown, L.R.P. Hacquebard and J.R. Dahn. *How phase transformations during cooling affect Li-Mn-Ni-O positive electrodes in lithium ion batteries*, Journal of the Electrochemical Society **160**, A1134 (2013).
 10. E. McCalla and J.R. Dahn, *The spinel and cubic rocksalt solid-solutions in the Li-Mn-Ni oxide pseudo-ternary system*, Solid State Ionics **242**, 1 (2013).
 9. E. McCalla, A.W. Rowe, R. Shunmugasundaram and J.R. Dahn, *A structural study of the Li-Mn-Ni oxide pseudo-ternary system of interest for positive electrodes of Li-ion batteries*, Chemistry of Materials **25**, 989 (2013).
 8. E. McCalla, C.M. Lowartz, C.R. Brown and J.R. Dahn, *The formation of layered-layered composites in the Li-Co-Mn oxide pseudo-ternary system during slow cooling*, Chemistry of Materials **25**, 912 (2013).
 7. E. McCalla, G.H. Carey and J.R. Dahn, *Lithium loss mechanisms during synthesis of layered $Li_xNi_{2-x}O_2$ for lithium ion batteries*, Solid State Ionics, **219**, 11 (2012).
 6. S. Amokrane, Y. Djaoued, B. Subramanian, J. Robichaud, E. McCalla, R. Brüning, A. Benrejda. *Synthesis and characterization of novel nanorod superstructures and twin octahedral morphologies of WO_3 by hydrothermal treatment*, Materials Chemistry and Physics **136**, 80 (2012).
 5. R. Brüning, B. Muir, E. McCalla, É. Lempereur, F. Brüning, J. Etzkomb. *Strain in electroless copper films monitored by X-ray diffraction during and after deposition and its dependence on bath chemistry*, Thin Solid Films **519**, 4377 (2011)
 4. K. Xia, D. Ferguson, Y. Djaoued, J. Robichaud, N. Tchoukanov, R. Brüning, E. McCalla. *Template-free synthesis and photocatalytic activity of hierarchical porous titania with controlled texture and crystalline structure*, Applied Catalysis A: General **387**, 231 (2010).
 3. J. van Lierop, H.S. Isaacs, D.H. Ryan, A. Beath, and E. McCalla. *Muon spin relaxation study of exchange biased Co/CoO*, Physical Review B **67**, 134430 (2003).
 2. D. H. Ryan, A.D. Beath, E. McCalla, J. van Lierop, and J.M. Cadogan. *Transverse spin freezing in $a-(Fe_{1-x}Mn_x)_{78}Si_{12}B_{10}$: A site-frustrated metallic glass*, Physical Review B **67**, 104404 (2003).
 1. E. McCalla and R. Brüning. *Amorphization of crystalline orthoboric acid on a vitreous B_2O_3 substrate*, Journal of Material Research **17**, 3098 (2002).

CONFERENCE PRESENTATIONS/POSTERS

12. E. McCalla. *Consequences of engaging oxygen in the redox of advanced lithium-ion battery positive electrodes*. Invited talk at the 2018 Quebec Centre for Advanced Materials annual meeting in Montreal, Canada.
11. E. McCalla. *High-throughput electrochemistry for accelerated screening of Li-ion battery electrodes*. Invited talk at the 2018 meeting of the Montreal student chapter of the Electrochemical Society.
10. E. McCalla, J. Walter and C. Leighton. *A unified view of the substitution-dependent antiferrodistortive phase transition in SrTiO₃*. Presented orally at the 2017 spring American Physical Society meeting in New Orleans, U.S.A.
9. E. McCalla and J.-M. Tarascon. *The Competing Roles of Oxygen in Li-Rich Layered Oxides for Li-Ion Batteries*. Presented orally at the 2015 Fall meeting of the Material Research Society in Boston, U.S.A.
8. E. McCalla, D. Gonbeau, D. Foix and J.-M. Tarascon. *Redox plateau decay in extended cycling of Li₂Ir_{1-x}Sn_xO₃ positive electrode materials*. Presented both orally and as a poster at the 2015 LIBD Conference in Arcachon, France.
7. E. McCalla, J. Li, A.W. Rowe and J.R. Dahn. *The Improved Electrochemistry of Single-Phase Layered Li-Mn-Ni-O Materials over That of Layered-Layered Nano-Composites*. Poster presented at the 2014 IMLB Conference in Como, Italy.
6. E. McCalla, A.W. Rowe, J. Camardese and J.R. Dahn. *The role of metal site vacancies in layered Li-Mn-Ni-O solid solutions*. Presented orally at the 2013 ECS Conference in San-Francisco, U.S.A.
5. E. McCalla, A.W. Rowe, J. Li and J.R. Dahn. *Consequences of the Li-Mn-Ni-O phase diagram on the synthesis of positive electrode materials*. Presented orally at the 2013 ECS Conference in San-Francisco, U.S.A.
4. A.W. Rowe, E. McCalla, L.R.P. Hacquebard, and J.R. Dahn. *Bulk sample phase diagrams of Li-Mn-Ni-O positive electrode materials*. Presented orally by E.M. at the 2013 ECS Conference in San-Francisco, U.S.A.
3. E. McCalla, A. Rowe, and J.R. Dahn. *Consequences of the Li-Mn-Ni-O phase diagram on the synthesis of positive electrode materials*. Presented both orally and as a poster at the 2013 LIBD Conference in Arcachon, France.
2. E. McCalla and J.R. Dahn. *Investigations of the Phase Diagram of the Lithium-Manganese-Nickel Oxide System obtained at 800°C*. Oral presentation given at the 2012 ECS/PRIME Conference in Honolulu, U.S.A.

1. E.McCalla, G.H. Carey, and J.R. Dahn. *A Solution-Based Combinatorial Approach Applied to the Lithium-Manganese-Nickel Oxide System*. Poster presented at the 2012 Solid State Chemistry Gordon Research Conference in New London, U.S.A. and at the 2012 Institute of Research Materials Symposium in Halifax, Canada.

CONFERENCE SESSIONS CHAIRED

1. *Lithium-Ion Batteries: Cathodes 3 – Manganese Spinel Oxides*. Session co-chaired at the 2013 ECS Conference in San-Francisco, U.S.A.

REFEREEING ACTIVITIES

Refereed over 15 articles for journals including Nature Communications, Nature Chemistry, ACS Energy, Chemistry of Materials, ACS Combinatorial Science, Proceedings of the Royal Society A and the Journal of Materials Chemistry A.

MEMBERSHIP AFFILIATIONS

2018 - Electrochemical Society Member.
2016 - American Chemical Society Member.
2016 - 2018 American Physical Society Member.
2012 - 2014 Electrochemical Society Student Member.

GRANTS/AWARDS RECEIVED

2018 - 2021 McGill start-up grant (\$150,000 CAD)

2016 - 2017 NSERC (Natural Sciences and Engineering Research Council of Canada) Post-Doctoral Fellowship Scholarship
\$45,000 CAD/year, held at the University of Minnesota, Minneapolis, MN.

2014 - 2016 FQRNT (Fonds de recherche du Québec – Nature et technologies) Post-Doctoral Fellowship Scholarship
\$32,500 CAD/year, held at the Collège-de-France, Paris, France and the University of Minnesota, Minneapolis, MN.

2010 - 2013 Dalhousie Research Grant for Ph.D. Program.
\$15,000 CAD/year, held at Dalhousie University.

2012 - 2013 Teaching Assistant Departmental Award, Dalhousie University.

2012 - 2013 Leiper Award (departmental award given to a graduate student), Dalhousie University.

- 2010 - 2011** Teaching Assistant Departmental Award, Dalhousie University.
- 2000 - 2002** NSERC CGS-M Graduate Student Scholarship.
\$17,000 CAD/year, held at McGill University.
- 2000** Physics Department Award and Leadership Certificate,
Mount Allison University.
- 1999** NSERC Summer Undergraduate Scholarship,
\$4,500 CAD, held at Mount Allison University.

TEACHING

- 2010-2013** **First Year Physics Teaching Assistant – Tutorials**
- 2005 – 2009** **High School Science and Mathematics Teacher**
Taught chemistry, physics and mathematics in English
Chaired a consultative committee at the school level and sat on the
governing board for two years (2007-8 and 2008-9).
Queen Elizabeth High School in Sept-Iles, Quebec, Canada.
- 2002-2004** **Computer Science Teacher**
Taught at Asimauttaq School in Kuujjuaraapik, Quebec in both
English and French.
- 2000-2002** **First Year Physics Laboratory Teaching Assistant**
McGill University, Montreal, Quebec, Canada.
- 1998-2000** **First and Second Year Physics Laboratory Teaching Assistant**
Mount Allison University, Sackville, New Brunswick, Canada.