

Brent C. Melot

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Research summary

Development of new materials with interesting magnetic, polar, and magnetoelectric properties through rational design. Understanding structure – composition – property relationships in polar and magnetic materials using state-of-the-art experimental probes and computational tools. Design, optimization, and detailed structural studies of electrode materials for applications in high performance Li-ion batteries.

Education:

2010–2012 Post-doctoral Research Fellow Laboratoire de Réactivité et Chimie des Solides Université de Picardie Jules Verne Advisor: Professor Jean-Marie Tarascon

2006–2010 PhD in Materials Engineering, Department of Materials, University of California, Santa Barbara. Thesis Title: *Competing Magnetic Interactions in Complex Oxides*. Advisor: Professor Ram Seshadri.

2002–2006 B.S. Chemical Engineering, Department of Chemical Engineering, University of California, Santa Barbara.

2002–2006 B.S. Chemistry, College of Creative Studies, University of California, Santa Barbara.

Employment:

November 2010–present Postdoctoral Research Associate with Jean-Marie Tarascon at the Université de Picardie Jules Verne in the Laboratoire de Réactivité et Chimie des Solides, Amiens, France: Synthesis and Structural Characterization of New Compounds for Positive Electrodes

Awards and recognitions:

Materials Research Laboratory Diversity Scholar, 2008

State Research Assistant Award, UCSB, 2006

Skills

Expertise in synthesis of functional inorganic materials including high temperature, sealed tube, solvothermal, and solution routes. Probes to study the physical properties of solids including the use of SQUID magnetometers, quasiadiabatic specific heat measurements, magnetodielectric measurements, DC and AC electrical transport measurements, and development of instrumentation thereof. Spectroscopy and diffraction for solid state materials, including neutron scattering (pair distributions and magnetism). Density functional calculations of the electronic structure of solids.

Teaching

Teaching Assistant (2007). Provided assistance which involved writing homework assignments, grading, and holding a weekly discussion section to supplement an introductory course for non-majors in materials engineering.

Mentoring

Extensive mentoring of undergraduate researchers, including Lucy Darago (UCSB), Stephanie Moffitt (UCSB), Jennifer Drewes (UCSB, now in graduate school in Cornell), Shemekia Braddock (Jackson State), Willie Wesley (Jackson State, summer of 2008 and 2009), Abby Goldman (Mount Holyoke), and Brian Paden (UCSB). Multiple publications with undergraduate authors. Also worked with RET teachers John Gonzalez and Keri Santos, summer 2008.

Professional activities

Member of the UCSB Materials Research Lab Student Advisory Committee, 2008-2010

Member of the American Physical Society (APS)

Member of the American Institute of Chemical Engineers (AIChE)

Member of the American Chemical Society (ACS)

Invited presentations

Total Scattering Group Seminar, Los Alamos National Laboratory, USA August 2011

Functional Materials Group Seminar, University of Kent, United Kingdom July 2010

Functional Inorganics and Hybrid Materials Group Seminar, University of Cambridge, United Kingdom July 2009

Conference presentations

American Physical Society Meeting March 2010, Portland, OR, USA

North American Solid State Chemistry Meeting June 2009, Columbus, OH, USA

American Physical Society Meeting March 2009, Pittsburgh, PA, USA

American Physical Society Meeting March 2008, New Orleans, LA, USA

Southern California ACS Undergraduate Research Symposium, April 2006 Santa Barbara, CA, USA

Publications within the Tarascon group:

10. B. C. Melot, D. O. Scanlon, M. Reynaud, G. Rouse, J.-N. Chotard, M. Henry, and J.-M. Tarascon Chemical and Structural Origins of Large Redox Potentials in Fe-Based Positive Electrode Materials (submitted for publication)
9. B. C. Melot and J.-M. Tarascon Design and Preparation of Materials for Advanced Electrochemical Storage *Acc. Chem. Res.* (submitted for publication)
8. M. Reynaud, M. Ati, B. C. Melot, M. T. Sougrati, G. Rouse, J.-N. Chotard, and J.-M. Tarascon $\text{Li}_2\text{Fe}(\text{SO}_4)_2$ as a 3.83 V positive electrode material *Electrochem. Comm.* (accepted for publication)

7. B. C. Melot, G. Rousse, J-N. Chotard, M. Ati, M. C. Kemei, and J-M. Tarascon Magnetic structure and properties of NaFeSO_4F and NaCoSO_4F *Phys. Rev. B* (2012) [doi]
6. M. Reynaud, P. Barpanda, G. Rousse, J-N. Chotard, B. C. Melot, N. Recham, and J-M. Tarascon Synthesis and crystal chemistry of the NaMSO_4F family (M = Mg, Fe, Co, Cu, Zn) *Solid State Sci.* **14** (2012) 15–20 [doi]
5. M. Ati, B. C. Melot, G. Rousse, J-N. Chotard, P. Barpanda, and J-M. Tarascon Structural and Electrochemical Diversity in the $\text{LiFe}_{1-\delta}\text{Zn}_\delta\text{SO}_4\text{F}$ solid solution: another 3.9V positive electrode based on Fe *Angew. Chem. Int. Ed.* **50** (2011) 10574–10577 [doi]
4. M. Ati, B. C. Melot, G. Rousse, J-N. Chotard, and J-M. Tarascon Synthesis and Electrochemical Properties of pure LiFeSO_4F in the triplite structure *Electrochem. Comm.* **13** (2011) 1280–1283 [doi]
3. P. Barpanda, M. Ati, B. C. Melot, G. Rousse, J-N. Chotard, M-L. Doublet, M. T. Sougrati, S. A. Corr, J-C. Jumas, and J-M. Tarascon A 3.9 V Fe-based fluorosulphate material for Li-ion batteries crystallizing in the triplite structure *Nat. Mater.* **10** (2011) 772–779 [doi]
2. B. C. Melot, J-N. Chotard, G. Rousse, M. Ati, M. Reynaud, and J-M. Tarascon, Synthesis, structure and magnetic properties of the $\text{NaCoXO}_4\text{F}\cdot 2\text{H}_2\text{O}$ phases where X = S and Se *Inorg. Chem.* **50** (2011) 7662–7668 [doi]
1. B. C. Melot, G. Rousse, J-N. Chotard, M. Ati, J. Rodríguez-Carvajal, M. C. Kemei, and J-M. Tarascon Magnetic structure and properties of the Li-ion battery materials FeSO_4F and LiFeSO_4F *Chem. Mater.* **23** (2011) 2922–2930 [doi]

Publications within the Seshadri group:

15. J. R. Neilson, D. E. Morse, B. C. Melot, D. P. Shoemaker, J. A. Kurzman, and R. Seshadri Understanding complex magnetic order through analyses of local atomic structure *Phys. Rev. B* **83** (2011) 094418 [doi]
14. B. C. Melot, L. E. Darago, R. Seshadri, A. Goldman, J. D. Furman, and E. E. Rodriguez Magnetic susceptibility and magnetodielectric phenomena in CoSeO_4 *J. Phys.: Condens. Matter* **22** (2010) 506003 [doi]
13. S.-H. Kim, P. S. Halasymani, B. C. Melot, R. Seshadri, M. Green, A. Sefat, and D. Mandrus, An experimental and computational investigation of the polar ferrimagnet VOSe_2O_5 *Chem. Mater.* **22** (2010) 50074–5083 [doi]
12. P. J. Saines, B. C. Melot, Ram Seshadri. and A. K. Cheetham, Synthesis, structure and magnetic phase transitions of the manganese succinate hybrid framework $[\text{Mn}(\text{C}_4\text{H}_4\text{O}_4)]$ *Chem.–Eur. J.* **16** (2010) 7579–7585 [doi]
11. K. I. Lilova, A. Navrotsky, B. C. Melot, and R. Seshadri, Thermodynamics of CoAl_2O_4 – CoGa_2O_4 solid solutions, *J. Sol. State Chem.* **83** (2010) 1266–1271 [doi]
10. B. C. Melot, B. Paden, R. Seshadri, A. Dixit, G. Lawes, and E. Suard, Magnetic structure and susceptibility of CoSe_2O_5 : A low dimensional antiferromagnet, *Phys. Rev. B* **82** (2010) 014411 [doi]
9. S. A. Corr, D. P. Shoemaker, B. C. Melot, R. Seshadri, Real space investigation of structural changes at the metal-insulator transition in VO_2 *Phys. Rev. Lett* **105** (2010) 056404 [doi]
8. B. C. Melot, K. Page, R. Seshadri, E. M. Stoudenmire, L. Balents, D. L. Bergman, and Th. Proffen, Magnetic frustration on the diamond lattice of the A-site magnetic spinels $\text{CoAl}_{2-x}\text{Ga}_x\text{O}_4$: The role of lattice expansion and site disorder, *Phys. Rev. B* **80** (2009) 104420(1-8) [doi]

7. B. C. Melot, R. Tackett, J. O'Brien, A. L. Hector, G. Lawes, R. Seshadri, A. P. Ramirez, Large low temperature specific heat in pyrochlore $\text{Bi}_2\text{Ti}_2\text{O}_7$, *Phys. Rev. B* (Editor's Suggestion) **79** (2009) 224111(1-5). [doi]
6. E. E. Rodriguez, A. Llobet, Th. Proffen, B. C. Melot, R. Seshadri, P. B. Littlewood, and A. K. Cheetham, The role of static disorder in negative thermal expansion in ReO_3 , *J. Appl. Phys.* **105** (2009) 114901. [doi]
5. B. C. Melot, J. E. Drewes, R. Seshadri, and A. P. Ramirez, Magnetic phase evolution in the spinel compounds $\text{Zn}_{1-x}\text{Co}_x\text{Cr}_2\text{O}_4$, *J. Phys.: Condens. Matter* **21** (2009) 216007(1-7). [doi]
4. S. A. Corr, M. Grossman, J. D. Furman, B. C. Melot, A. K. Cheetham, K. R. Heier, and R. Seshadri, Controlled reduction of vanadium oxide nanoscrolls: Crystal structure, morphology, and electrical properties. *Chem. Mater.* **20** (2008) 6396-6404. [doi]
3. R. Tackett, G. Lawes, B. C. Melot, M. Grossman, E. S. Toberer, and R. Seshadri, Magnetodielectric coupling in Mn_3O_4 , *Phys. Rev. B* **76** (2007) 024409(1-6). [doi]
2. G. Lawes, B. Melot, K. Page, C. Ederer, M. A. Hayward, Th. Proffen, and R. Seshadri, Dielectric anomalies and spiral magnetic order in CoCr_2O_4 , *Phys. Rev. B* **74** (2006) 024413(1-6). [doi]
1. B. Melot, E. Rodriguez, Th. Proffen, M. A. Hayward, and R. Seshadri, Displacive disorder in three high- k bismuth oxide pyrochlores, *Mater. Res. Bull.* **41** (2006) 961-966. [doi]

Publications from independent collaborations:

7. J. D. Furman, B. C. Melot, S. J. Treat, A. A. Mikhailovsky, and A. K. Cheetham Towards enhanced ligand-centered photoluminescence in inorganic-organic frameworks for solid state lighting *Phys. Chem. Chem. Phys.* **13** (2010) 7622-7629 [doi]
6. A. J. Hatt, B. C. Melot, and S. Narasimhan, Harmonic and anharmonic properties of Fe and Ni: Thermal expansion, exchange-correlation errors and magnetism, *Phys. Rev. B* **82** (2010) 134418 [doi]
5. Z. Hulvey, B. C. Melot, and A. K. Cheetham, Structure and magnetic field-induced transition in a one-dimensional hybrid inorganic-organic chain system, $\text{Co}_2(4,4'\text{-bpy})(\text{tfhba})_2 \cdot 4,4'\text{-bpy}$ (4,4'-bpy = 4,4'-bipyridine; tfhba = 2,3,5,6-tetrafluoro-4-hydroxybenzoate) *Inorg. Chem.* [doi]
4. E. S. Toberer, A. F. May, B. C. Melot, E. Flage-Larsen, and G. J. Snyder, Electronic structure and transport in thermoelectric compounds AZn_2Sb_2 (A=Sr,Ca,Yb,Eu), *Dalton Trans.* **39** (2010) 1046-1054 [doi]
3. S. Fortier, G. Wu, B. C. Melot, and T. W. Hayton, Synthesis and characterization of several homoleptic uranium(IV) alkyl complexes *J. Am. Chem. Soc.* **131** (2009) 15512-15521. [doi]
2. R. K. Feller, B. C. Melot, P. M. Forster, and A. K. Cheetham, Structure and magnetic properties of a hybrid cobalt disulfonate-hydroxide with a novel inorganic layer architecture, *J. Mater. Chem.* **19** (2009) 2604-2609. [doi]
1. A. Aravindh, A. Arkundato, S. Barman, S. Baroni, *et al.*, $\text{Si}_x\text{C}_{1-x}\text{O}_2$ alloys: A possible route to stabilize carbon-based silica-like solids?, *Solid State Commun.* **144** (2007) 273-276. [doi]

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