

# KELSEY BRIDGET HATZELL

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484-557-5306

## EDUCATION

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| <b>Drexel University</b><br><i>Ph.D. Candidate in Material Science and Engineering</i>                         | Philadelphia, PA<br><i>June 2012-Present</i>   |
| <b>Pennsylvania State University</b><br><i>Master of Science in Mechanical Engineering</i>                     | State College, PA<br><i>Aug. 2010-May 2012</i> |
| <b>Swarthmore College</b><br><i>Bachelor of Science in Engineering</i><br><i>Bachelor of Arts in Economics</i> | Swarthmore, PA<br><i>Aug. 2005-May 2009</i>    |

## RESEARCH APPOINTMENTS

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|--|---|
| <b>Nano Materials Group, Drexel University</b><br>▪ <i>Graduate Research Assistant</i>   | Philadelphia, PA<br><i>June 2012 – Present</i>    |
| <b>A.J. Drexel Nanomaterials Institute</b><br><b>Advisor:</b> Professor Yury Gogotsi <ul style="list-style-type: none"><li>– Electrochemical characterization of suspension electrodes for the grid energy storage and desalination applications.</li><li>– Examined redox-active aqueous electrolytes for pseudocapacitive suspension electrodes in the electrochemical flow capacitor</li><li>– Studied expanded voltage windows via the use of ionic liquid electrolytes in organic electrolyte solvents</li><li>– Hydrothermal synthesis of nanostructured manganese oxide for a high voltage asymmetric flowable supercapacitor.</li><li>– Material synthesis, design, and optimization of electrodes for capacitive deionization applications.</li></ul> |   |
| <b>Control Optimization Laboratory, Penn State University</b><br>▪ <i>Graduate Research Assistant</i>  | State College, PA<br><i>Aug. 2010 – May. 2012</i> |
| <ul style="list-style-type: none"><li>– <b>Thesis:</b> <i>Optimal charging protocols for LiFePO4 batteries via Deterministic Dynamic Programming</i></li><li>– Electrochemistry-physics based modeling for Lithium Ion batteries incorporating battery health dynamics and temperature dependent parameters; Applied orthogonal polynomials and Pade approximations to reduce spherical diffusion sub-model.</li><li>– Experimental Parameter and State of Health Estimation for battery control algorithms.</li></ul>   |   |
| <b>Swarthmore College</b><br>▪ <i>Undergraduate Thesis</i>   | Swarthmore, PA<br><i>Oct. 2008 – April 2009</i>   |
| <ul style="list-style-type: none"><li>– <b>Thesis:</b> <i>LEED Heating, Ventilating and Cooling Design and Modeling: Lamb-Miller Field House</i></li></ul>   |   |

## COLLABORATIVE RESEARCH PROJECTS

- |  |                                  |
|--|----------------------------------|
| <b>CIRAMAT Laboratory, Université Paul Sabatier III</b><br>▪ <i>Visiting Researcher</i>  | Toulouse, FR<br><i>June 2013</i> |
| <b>Primary Collaborator:</b> Professor Patrice Simon <ul style="list-style-type: none"><li>– Performed flow desalination experiments and electrochemically characterized flowable electrodes</li><li>– Work resulted in EU Patent, and Publication</li></ul> |                                  |

## WORK EXPERIENCE

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|---|--|
| <b>Skanska USA Civil</b><br>▪ <i>Core Competency Rotational Program</i>   | New York, NY<br><i>June 2009 – June 2010</i> |
| <ul style="list-style-type: none"><li>– Rotational Program: Safety Engineer, Mechanical Estimator, Assistant Superintendent at Bowery Bay and Newtown Creek Wastewater Treatment Plants</li></ul> |  |

## FELLOWSHIPS AND AWARDS

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|--|-----------|
| <b>National Science Foundation Graduate Research Fellowship</b><br><i>Funding Awarded: \$144,000</i> | 2012-2015 |
| <b>Drexel Provost Fellowship</b>   | 2013-2015 |
| <b>Drexel Dean's Fellowship</b><br><i>Merit Based Fellowship for Academic Excellence</i>             | 2012-2014 |

<b>International Travel Award from the Office of International Programs at Drexel</b> <i>IAP Conference</i>	Spring 2014 <i>Leeuwarden, The Netherlands</i>
<b>American Society of Metals 2nd Place in Poster Competition</b> Capacitive deionization - new materials and a novel scalable flow system design	Spring 2014 <i>Langhorne, PA</i>
<b>Best Poster Award (1st Place in Electrochemistry Section)</b> <i>Electrochemistry Society Meeting</i>	Fall 2013 <i>San Francisco, CA</i>
<b>Drexel Office of Graduate Study Travel Award</b> <i>ECS Chapter Meeting: \$1000</i>	Fall 2013 <i>San Francisco, CA</i>
<b>MRS Student Energy Forum</b> <i>Travel Award: \$1000</i>	2013 <i>San Francisco, CA</i>
<b>NSF Joint US-Africa Materials Initiative Fellowship Recipient</b> <i>Materials Research School</i>	2012 <i>Addis Ababa, Ethiopia</i>
<b>NSF Workshop for Developing Productive Graduate Research Groups</b> <i>NSF Travel Award</i>	July 2011 <i>Arlington, VA</i>
<b>Starr Foundation Scholarship</b> <i>Merit Based Scholarship of \$60,000 over four years</i>	2005-2009
<b>W.W. Smith Merit Scholarship</b>	2005-2009

## PATENT/INVENTION DISCLOSURES

1. B. Daffos, E. Iwama, P.L. Taberna, T. Tzedakis, **K. B. Hatzell**, A. Gogotsi, P. Simon, Y. Gogotsi, "Method and device to remove ions from an electrolytic media, such as water desalination using suspension divided materials in a flow capacitor," EU Patent Filed.

## BOOK CHAPTERS

- **K. B. Hatzell**, Y. Gogotsi, "Suspension Electrodes for Flowable Large-Scale Energy Storage," in *Nanomaterials in Electrochemical Energy Systems: Advanced Batteries and Supercapacitors*, Springer, 2015

## PUBLICATIONS AND PROCEEDINGS

1. M. Boota, **K.B. Hatzell**, M. Beidaghi, E.C. Kumbur, Y. Gogotsi. "Towards high energy density pseudocapacitive flowable electrodes via incorporation of organic redox molecules". *submitted* (2014)
2. **K.B. Hatzell**, M.C. Hatzell, K.M. Cook, M.Boota, G.M. Housel, A.J. McBride, E.C. Kumbur, B. Logan, Y. Gogotsi. "Enhanced rheological properties for a high-mass loaded flowable electrode for desalination and grid energy storage". *Submitted* (2014)
3. C. Zhang, **K.B. Hatzell**, M. Boota, B. Dyatkin, M. Beidaghi, D. Long, W. Qiao, E.C. Kumbur, Y. Gogotsi. "Highly porous carbon spheres for electrochemical capacitors and capacitive suspension electrodes". *Carbon* (2014)
4. M. Boota, **K.B. Hatzell**, M. Beidaghi, C.R. Dennison, E.C. Kumbur, Y. Gogotsi. "Activated carbon spheres as a flowable electrode in electrochemical flow capacitors". *Journal of Electrochemical Society* (2014)
5. **K.B. Hatzell**, L. Fan, M. Beidaghi, M. Boota, E. Pomerantseva, E.C. Kumbur, Y. Gogotsi. "Composite Manganese Oxide Percolating Networks as a Suspension Electrode for an Asymmetric Flow Capacitor". *ACS Applied Materials Interfaces* (2014)
6. **K.B. Hatzell**, E. Iwama, A. Ferris, K. Urita, B. Daffos, P.L. Taberna, T.Tzadakis, P.Simon, Y. Gogotsi. "Capacitive Deionization concept based on suspension electrodes without ion exchange membranes". *Electrochemistry Communications* (2014) 10.1016/j.elecom.2014.03.003
7. C.R. Dennison, M. Beidaghi, **K.B. Hatzell**, J. Campos, V. Presser, E.C. Kumbur, and Y. Gogotsi "Effects of Flow Cell Design on Charge Transfer and Storage in the Carbon Slurry Electrodes of Electrochemical Flow Capacitors", *Journal of Power Sources* 247, (2014) 489-496.

8. **K.B. Hatzell**, M. Beidaghi, J. Campos, C.R. Dennison, V. Presser, E.C. Kumbur, and Y. Gogotsi "A High Performance Pseudocapacitive Flowable Electrode for the Electrochemical Flow Capacitor", *Electrochimica Acta* 111 (2013) 888-897.
9. J. Campos, M. Beidaghi, **K.B. Hatzell**, C.R. Dennison, V. Presser, E.C. Kumbur, and Y. Gogotsi . "Investigation of Carbon Materials for the Flowable Electrode in the Electrochemical Flow Capacitor ". *Electrochimica Acta*, 98 (2013) 123-130.
10. **K.B. Hatzell**, A. Sharma, H.K. Fathy. "A Survey of Long-Term Health Modeling, Estimation, Control Challenges and Opportunities for Lithium-Ion Batteries", in *American Control Conference, 2012* . Montreal, QC. **Invited Paper**.

## PEDAGOGY BASED PUBLICATIONS

1. **K.B. Hatzell**, M.C. Hatzell, M.Y. Pack, J.G. Hatzell, S.N. Patel, T.L. Sulewski, A.L. Freeman and K. Mehta, "Overview of the First Year of an Innovative Science Education and Entrepreneurship Venture", in *American Society of Engineering Education, 2012* . San Antonio, TX.

## INVITED TALKS/KEYNOTE LECTURES

- **K.B. Hatzell**. "Capacitive deionization based on flowable electrodes". *Interfaces in Water and Environmental Science Conference, 2014*, Leeuwarden, The Netherlands [ **Keynote Lecture** ]
- **K.B. Hatzell**. "Capacitive Techniques for Large Scale Infrastructure Challenges: The Water-Energy Nexus". *Villanova College of Engineering Invited Speaker Series, 2013*, Villanova, PA. [ **Invited Talk** ]

## PRESENTATIONS AND POSTERS

1. **K.B. Hatzell**, M. Boota, Y. Gogotsi. "Capacitive suspension electrodes: An overview of the physical and chemical properties governing energy storage performance ". *Materials Research Society Meeting 2014*, Boston, Ma.
2. **K.B. Hatzell**, K.M. Cook, M. Boota, G. Housel, A. McBrid, E.C. Kumbur, Y. Gogotsi. "Influence of Surface Chemistry on Rheological and Electrochemical Properties in Flowable Electrodes". *Electrochemistry Society Meeting 2014*, Cancun, MX. [ **Presentation** ]
3. **K.B. Hatzell**, E.C. Kumbur, Y. Gogotsi. "Flowable Electrodes: a Review of the Material Aspects of Capacitive Suspension Electrodes for Grid Energy Storage and Desalination Applications". *Electrochemistry Society Meeting 2014*, Cancun, MX. [ **Poster** ]
4. **K.B. Hatzell**, L. Fan, M. Beidaghi, M. Boota, E. Pomerantseva, E.C. Kumbur, Y. Gogotsi. "Expanded voltage window in an aqueous-based asymmetric manganese-dioxide/activated carbon suspension electrode system". *Materials Research Society Meeting 2014*, San Francisco, CA. [ **Presentation** ]
5. G. Housel\*, **K.B. Hatzell**, Y. Gogotsi. "Influence of surface chemistry on rheological and electrochemical properties in capacitive suspension electrodes". *Colonial Academic Alliance Undergraduate Research Conference, 2014*, Towson, Md. [ **Poster** ] \*First author supervised by candidate
6. A. McBride\*, **K.B. Hatzell**, Y. Gogotsi. "Investigating Ionic Liquid electrolytes for the electrochemical flow capacitor". *Drexel Research Day, 2014*, Philadelphia, PA. [ **Poster** ] \*First author supervised by candidate
7. M. Beidaghi, **K.B. Hatzell**, C.R. Dennison, M. Boota, E.C. Kumbur, and Y. Gogotsi . "Recent advances toward improvement of the Electrochemical Flow Capacitors (EFCs)". *TMS Conference, 2014*, San Diego, CA. [ **Presentation** ]
8. **K.B. Hatzell**, Y. Gogotsi. "Capacitive deionization - new materials and a novel scalable flow system design". *Electrochemical Society, Electrochemical Energy Summit, Energy Research Showcase, 2013*, San Francisco, CA. [ **Poster** ]
9. **K.B. Hatzell**, E. Iwama, B. Daffos, P.L. Taberna, T. Tzedakis, A. Gogotsi, P. Simon, and Y. Gogotsi "High Electrode Capacity Electrodes for Capacitive Deionization". *224th Meeting of the Electrochemical Society, 2013*, San Francisco, Ca. [ **Presentation** ]
10. **K.B. Hatzell**, M. Boota, M. Beidaghi, C.R. Dennison, E.C. Kumbur, and Y. Gogotsi. "Methods for enhancing the flowable electrode capacitance in the electrochemical flow capacitor". *224th Meeting of the Electrochemical Society, 2013*, San Francisco, Ca. [ **Presentation** ]
11. M. Boota, **K.B. Hatzell**, M. Beidaghi, C.R. Dennison, E.C. Kumbur, and Y. Gogotsi. "Optimization of the Flowable Electrode for the Electrochemical Flow Capacitor". *224th Meeting of the Electrochemical Society, 2013*, San Francisco, Ca. [ **Poster** ]
12. C.R. Dennison, M. Beidaghi, **K.B. Hatzell**, J.W. Campos, Y. Gogotsi, E.C. Kumbur. "Charge Transfer and Storage in the Electrochemical Flow Capacitor- A New Concept for Grid Scale Energy Storage". *224th Meeting of the Electrochemical Society, 2013*, San Francisco, Ca. [ **Presentation** ]

13. **K.B. Hatzell**, Y. Gogotsi. "Capacitive deionization - new materials and a novel scalable flow system design". *Drexel University Energy and Environmental Council*, 2013, Philadelphia, PA. [ **Poster** ]
14. C.R. Dennison, **K.B. Hatzell**, M. Beidaghi, E.C. Kumbur, Y. Gogotsi. " Electrochemical Flow Capacitor: A new concept for grid-scale capacitive energy storage". *Advanced Automotive Battery Conference, ECCAP Symposium*, 2013, Strasbourg, France. [ **Presentation** ]
15. C.R. Dennison, M. Beidaghi, **K.B. Hatzell**, Y. Gogotsi, E.C. Kumbur. "The Electrochemical Flow Capacitor: Grid-Scale Capacitive Energy Storage". *ECI Massive Energy Storage*, 2013, Newport Beach, Ca. [ **Presentation** ]
16. **K.B. Hatzell**. "The Water-Energy Nexus and the role of capacitive techniques". *Books and Bagels: Drexel Graduate School Association presentation*, 2013, Philadelphia, Pa.[ **Presentation** ]
17. **K.B. Hatzell**, M. Beidaghi, J. Campos, C.R. Dennison, E.C. Kumbur, and Y. Gogotsi. "A High Performance Pseudocapacitive Flowable Electrode for the Electrochemical Flow Capacitor". *ASM Meeting*, 2013, Willow Grove, PA. [ **Poster** ]
18. **K.B. Hatzell**, J. Campos, M. Beidaghi, C.R. Dennison, E.C. Kumbur, and Y. Gogotsi. "Investigation of Carbon Materials Performance for the Flowable Electrode in the Electrochemical Flow Capacitor". *MRS Student-Run Energy Forum*, 2013, San Francisco, CA. [ **Poster** ]
19. **K.B. Hatzell**, J. Campos, M. Beidaghi, C.R. Dennison, E.C. Kumbur, and Y. Gogotsi. "Investigation of Carbon Materials Performance for the Flowable Electrode in the Electrochemical Flow Capacitor". *MRS Conference*, 2013, San Francisco, CA.[ **Presentation** ]
20. **K.B. Hatzell**, M. Beidaghi, J. Campos, C.R. Dennison, E.C. Kumbur, and Y. Gogotsi . "The Electrochemical Flow Capacitor for Efficient Grid-Scale Energy Storage". *TMS Conference*, 2013, San Antonio, TX.[ **Presentation** ]
21. C.R. Dennison, V. Presser, J. Campos, **K.B. Hatzell**, K.W. Knehr, M. Beidaghi, E.C. Kumbur, and Y. Gogotsi . " Electrochemical Flow Capacitors: A New Technology for Grid-Scale Energy Storage." *222nd Meeting of the Electrochemical Society*, 2012, Honolulu, HI.[ **Presentation** ]
22. J. Campos, M. Beidaghi, C.R. Dennison, **K.B. Hatzell**, E.C. Kumbur, and Y. Gogotsi . "The Electrochemical Flow Capacitor: A New Technology for Stationary Storage of Electrical Energy." *American Chemical Society Conference*, 2012, Philadelphia, PA.[ **Poster** ]
23. **K.B. Hatzell**, H.K. Fathy "Optimal Control Strategies for Batteries in Electric Vehicles." *Electrochemical Society Drexel Student Chapter Poster Session*, 2012, Philadelphia, PA.[ **Poster** ]
24. **K.B. Hatzell**, A. Sharma, H.K. Fathy. "A Survey of Long-Term Health Modeling, Estimation, Control Challenges and Opportunities for Lithium-Ion Batteries", in *American Control Conference, 2012* . Montreal, QC.[ **Presentation** ]
25. **K.B. Hatzell**, et. al "Overview of the First Year of an Innovative Science Education and Entrepreneurship Venture." *ASEE Conference, Community Engagement Division*, 2012, San Antonio, TX. [ **Presentation** ]
26. **K.B. Hatzell** . "Optimal Charging Strategies for Lithium Ion Batteries." *CERS Research Symposium*, 2012, State College, PA.
27. R. Patil, H.K. Fathy, **K.B. Hatzell**. "A Multi-Scale Control Framework for Dynamically Coupled Sustainable and Resilient Infrastructures, with Applications to Vehicle-to-Grid Integration." *NSF EFRI Grantee Meeting*, 2011, Washington, DC. [ **Poster** ]
28. **K.B. Hatzell** . "Mathematical Modeling of Lithium Ion Batteries." *CERS Research Symposium*, 2011, State College, PA.
29. H.K. Fathy, **K.B. Hatzell**. "Battery health-conscious optimal power management for sustainable vehicle-to-grid integration: An overview of Research at the Control Optimization Laboratory." *Battery and Energy Storage Technology Day*, 2011, State College, PA. [ **Poster** ]

## PROFESSIONAL SERVICE

- **Peer Reviewer**

- *Journal and Conference Proceedings*

*Ongoing*

Carbon, ChemPlusChem, American Controls Conference 2012, American Society of Engineering Education Conference.

- **Drexel Electrochemical Society Student Chapter**

- *President*

*October 2013-Present*

- **Drexel Material Research Society Student Chapter**

- *Executive Board, Liason to National Chapter*

*May 2013-Present*

## **Drexel Graduate Women in Science and Engineering**

- *Executive Board, K-12 Student Outreach Coordinator*

May 2013-Present

## **Research Mentor to Undergraduates**

- *Drexel University Material Science*

2012-Present.

Philadelphia, PA.

Katie Brubaker (Nov. 2012-May 2013) *Active material utilization in thick electrodes*

Gabrielle Housel (Jan.2012-Present) *The role of surface chemistry on kinetic, electrochemical, and rheological properties in capacitive suspension electrodes*

Alex McBride (Sept. 2013-Present) *An Investigation of ionic liquids in capacitive suspension electrodes*

Conrad Schmidt (Dec. 2013-Present) *Percolation thresholds formed in flowable wire-like electrodes*

[E-mail addresses available upon request]

- **Siemens ‘We can Change the World Challenge’**

2012,2013

### *Judge*

- Judged approximately 30 projects
- Challenge open to K-12 students to evaluate environmental problems in communities around the world and develop sustainable solutions.

- **Penn State Mechanical and Nuclear Engineering Graduate Society**

2010-2012

- *Vice-President*

## **LEADERSHIP IN EDUCATIONAL OUTREACH**

- **Engineering 220: Fundamentals of Materials**

Instructor

*Led discussion and problem oriented recitations (4 hr/wk)*

March- June 2014

- **Drexel Experience in Materials Outreach (D.E.M.O)**

Founding Member

*Group leading STEM K-12 outreach activities in Philadelphia*

October 2013-Present

- **Our Mother of Sorrows Science Club Coordinator**

March 2013 – Present

*K-12 Science Education Program*

West Philadelphia, PA.

- 10 week afterschool program for middle school students
- Led and coordinated science related science lessons/activities

- **Battery and Energy Storage Technology Club**

Oct. 2010 – May 2012

*Founder and President*

State College, PA.

- Outreach group that focuses on K-12 outreach in energy storage devices.
- Activities to date have involved over 500 students in central PA.

- **iSPACES: Rethinking Science Education + Design of Innovation Space**

Jan. 2011 – June 2012

*Humanitarian Engineering and Social Entrepreneurship Program*

State College, Pa.

Mentored a group of undergraduate engineers in a cross-national project to develop a Bachelors of Education in Science degree program at the University of Tumaini in Tanzania. The emphasis of this multi-year collaboration is in implementing experimental lesson plans, integrating design into primary and secondary education, and the infusion of the cultures indigenous knowledge into the curriculum.

- **Graduate Women in Science**

Sep. 2010 – May 2012

*Group Leader*

State College, Pa.

- Girl scout saturday leader and organizer
- Developed activities that demonstrate different science disciplines for girls ages 10-15

## **PROFESSIONAL SKILLS AND TRAINING**

- **Certificate in University Teaching Program**

May 2013-Aug 2013

*Drexel Graduate Student Association*

Philadelphia, PA.

- Attended series of workshops on teaching
- Developed a peer and faculty reviewed teaching portfolio

- **Professional Memberships**

Materials Research Society, The Electrochemical Society, American Society of Engineering Education, ASEE Community Engagement division member, American Society of Mechanical Engineers.

- **The Fundamentals of Engineering (FE) exam**

Passed 2005

[COMPUTER SKILLS]

**Languages:** Experience in Python, C, and fortran.

**Software:** MATLAB, Maple, Mathematica, L<sup>A</sup>T<sub>E</sub>X, VESTA, ChemDraw, SolidWorks, Adobe Photoshop, Adobe Illustrator, COMSOL, EC-Lab, MITS Pro, Microsoft Office Suite, SketchUp, EnergyPlus, Origin, CASA XPS.

[LABORATORY SKILLS]

**Material Characterization:** Trained in Scanning Electron Microscopy, X-ray photoelectron spectroscopy, Gas Sorption, UV-Vis spectroscopy, Potentiometric/Boehm titration

**Rheology:** Experienced and trained with AR 2000 rehometer [TA Instruments, USA]

**Electrochemical Characterization:** Galvanostatic Cycling, Electrochemical Impedance Spectroscopy, Cyclic Voltammetry, Chronoamperometry, PITT, GITT, Potentiodynamic Polarization.

**Synthesis and Sample Preparation:** Hydrothermal Synthesis Methods, Coprecipitation, Microwave Deposition, Electrochemical Deposition, Film Electrodes, Slurry Electrolytes; Redox-Active, Aqueous, Organic and Ionic Liquid Electrolytes.

**Experimental Design:** Static Cells for Slurry Testing, Capacitive Deionization Cells, Capacitive Mixing and Membrane Capacitive Mixing Systems, Two and Three electrode Experimental Set-ups [Planar orientations and Swagelok]. Proficient with Arduino microcontrollers.