

Sean E. Doris

Curriculum Vitae

1 Cyclotron Road, MS: 67-6110
Berkeley, CA 94720
United States

✉ sedoris@berkeley.edu
www.seandoris.com

Executive Summary

Materials chemist with extensive experience in electroanalytical chemistry, materials characterization, and battery component development. *Strong communication skills*, as evidenced by multiple publications and presentations in leading journals and conferences. Thrives in *highly collaborative, fast-paced work environments*. Skilled at *reducing challenging multi-disciplinary problems* into small, tractable questions that can be quickly answered. One of only 13 chemists nation-wide to receive the prestigious National Defense Science and Engineering Graduate Fellowship (NDSEG) in 2013.

Education

2012–Present **Ph.D. student in Physical Chemistry,**

University of California, Berkeley.

Co-advised by Dr. Brett A. Helms (LBNL) and Prof. Omar Yaghi (UC Berkeley). Coursework includes Statistical Mechanics, Materials Chemistry, and Surface Properties of Materials.

2008–2012 **Bachelor of Science in Chemistry with Highest Distinction,**

University of North Carolina at Chapel Hill.

Advised by Prof. Royce Murray. GPA: 3.92 cumulative, 3.95 chemistry. Coursework includes Electroanalytical Chemistry, Separations, and Mechanisms of Organic and Inorganic Reactions.

Projects

- **Nanocrystal Surface Chemistry:** Developed and studied the mechanism for a new class of reactions for removing ligands from nanocrystal surfaces while maintaining colloidal stability. This approach is the most versatile and lowest cost method for preparing ligand-stripped cationic nanocrystals with applications in catalysis, energy conversion, and energy storage.
- **Selective Membranes for Non-Aqueous Batteries:** Worked as part of a team to develop a class of size-selective membranes targeted for non-aqueous redox-flow and lithium-sulfur batteries. Developed an automated measurement and data processing platform for high-throughput, reproducible measurement of membrane selectivity. Studied the chemical stability of membranes in the presence of reactive active-species

and worked to improve membrane lifetime and stability under realistic operating conditions.

- **Redox Mediators for Electrochemical Energy Storage:** Worked as part of a team to develop and test redox-mediators for improving active-material utilization in lithium-sulfur batteries. Studied the effect of redox mediator on electrodeposition of lithium sulfide with electrochemical methods and electron microscopy.

Publications

7. Ward, A.L.; Doris, S.E.; Frischmann, P.D.; Qu, X.; Persson, K.A.; Helms, B.A. “In-situ Activation of Redox-Switchable Microporous Polymer Membranes Tailored for Lithium-Sulfur Batteries” *In Preparation*.
6. Doris, S.E.; Ward, A.L.; Frischmann, P.D.; Helms, B.A. “Chemical Evolution of Size-Selective Membranes Cast from Polymers of Intrinsic Microporosity” *In Preparation*.
5. Gerber, L.C.H.; Frischmann, P.D.; Fan, F.Y.; Doris, S.E.; Qu, X.; Scheuermann, A.M.; Persson, K.; Chiang, Y.-M.; Helms, B.A. “3-Dimensional Growth of Li₂S in Lithium-Sulfur Batteries Promoted by a Redox Mediator” *Nano Lett.* **2016**, *16* (1), pp. 549–554.
4. Frischmann, P.D.; Gerber, L.C.H.; Doris, S.E.; Tsai, E.Y.; Fan, F.Y.; Qu, X.; Jain, A.; Persson, K.A.; Chiang, Y.-M.; Helms, B.A. “Supramolecular Perylene Bisimide-Polysulfide Gel Networks as Nanostructured Redox Mediators in Dissolved Polysulfide Lithium-Sulfur Batteries” *Chem. Mater.* **2015**, *25* (19), pp. 6765–6770.
3. Li, C.; Ward, A.L.; Doris, S.E.; Pascal, T.A.; Prendergast, D.; Helms, B.A. “A Polysulfide-Blocking Microporous Polymer Membrane Tailored for Hybrid Li-Sulfur Flow Batteries” *Nano Lett.* **2015**, *15* (9), pp. 5724–5729.
2. Rosen, E.L.; Gilmore, K.; Sawvel, A.M.; Hammack, A.T.; Doris, S.E.; Aloni, S.; Altoe, V.; Nordlund, D.; Weng, T.-C.; Sokaras, D.; Cohen, B.E.; Urban, J.J.; Ogletree, D.F.; Milliron, D.J.; Prendergast, D.; Helms, B.A. “Chemically Directing d-Block Heterometallics to Nanocrystal Surfaces as Molecular Beacons of Surface Structure” *Chem. Sci.* **2015**, *6*, pp. 6295–6304.
1. Doris, S.E.; Lynch, J.J.; Li, C.; Wills, A.W.; Urban, J.J.; Helms, B.A. “Mechanistic Insight into the Formation of Cationic Naked Nanocrystals Generated under Equilibrium Control” *J. Am. Chem. Soc.* **2014**, *136* (44), pp. 15702–15710.

Patents

- Four patent applications encompassing the preparation and uses of ligand-stripped nanocrystals as well as battery membranes and electrolyte additives. Selected examples included below:

2. Helms, B.A.; Li, C.; Ward, A.L.; Doris, S.E. “Ion- and Size-Selective Membranes for Electrochemical Energy Storage Devices Based on Polymers with High Intrinsic Microporosity” Patent Application
1. Helms, B.A.; Doris, S.E.; Li, C. “Ionic Nanocrystalline Materials with High Surface Charge Density and Composites of the Same” Patent Application 61/981,668

Professional Presentations

8. Doris, S.E.; Gerber, L.C.H.; Frischmann, P.D.; Fan, F.; Qu, X.; Scheuermann, A.M.; Persson, K.; Chiang, Y.-M.; Helms, B.A. “Redox Mediators Control Electrodeposition of Li₂S in Lithium-Sulfur Batteries” Talk given at: 251st national meeting of the American Chemical Society; 2016 March 13–17; San Diego, CA. (*invited to appear in Sci-Mix poster session*)
7. Doris, S.E.; Ward, A.L.; Frischmann, P.D.; Helms, B.A. “Understanding Chemical Stability in Size-Selective Membranes Cast from Polymers of Intrinsic Microporosity” Talk given at: 251st national meeting of the American Chemical Society; 2016 March 13–17; San Diego, CA. (*invited to appear in Sci-Mix poster session*)
6. Doris, S.E.; Lynch, J.J.; Li, C.; Wills, A.W.; Urban, J.J.; Helms, B.A. “In Situ Analysis of the Formation of Cationic Naked Nanocrystals Generated under Equilibrium Control” Talk given at: 248th national meeting of the American Chemical Society; 2014 Aug 10 – 14; San Francisco, CA. (*invited to appear in Sci-Mix poster session*)
5. Doris, S.E.; Lynch, J.J.; Li, C.; Wills, A.W.; Urban, J.J.; Helms, B.A. “Naked Nanocrystal Inks for Solution-Processable Energy Devices” Talk given at: 2014 spring meeting of the Materials Research Society; 2014 April 21 – 25; San Francisco, CA.
4. Doris, S.E.; Helms, B.A. “Electron Transfer Across Electrode Interfaces in Lithium-Air Batteries” Poster presented at: 224th meeting of the Electrochemical Society; 2013 Oct 27 – Nov 1; San Francisco, CA.
3. Doris, S.E.; Helms, B.A. “A Building Block Approach to Architected Mesoporous Battery Electrodes” Talk given to: Graduate Research Conference (UC Berkeley Chemistry Department, in fulfillment of qualifying examination requirements); 2013 Oct 3; Berkeley, CA.
2. Doris, S.E.; Rosen, E.L.; Helms, B.A. “Surface Structural Analysis of Semiconductor Nanocrystals Using Hetero-Metallic Ligands” Poster presented at: Berkeley Energy & Resources Collaborative Symposium; 2012 Oct 18; Berkeley, CA.
1. Doris, S.E.; Horne, L.P.; Murray, R.W. “Carboxylate Ligand-Modified Glassy Carbon Electrode Interfaces For Anchoring 2 nm Diameter Iridium Oxide Nanoparticles To Investigate Water Oxidation Catalysis” Poster presented at: Pittcon 2012; 2012 March 11–15; Orlando, FL.

Laboratory Techniques

- Synthesis* Common organic, inorganic, and nanocrystal synthesis procedures, including oxygen and moisture-free atmosphere procedures (Schlenk and glove box techniques)
- Imaging* Experienced with Scanning Electron Microscopy (SEM), limited exposure to Transmission Electron Microscopy (TEM) and Atomic Force Microscopy (AFM)
- Spectroscopy* Experienced with Inductively Coupled Plasma Atomic Emission Spectroscopy (ICP-AES), UV-Vis, FT-IR, and NMR spectroscopies (including advanced 2D NMR techniques)
- Electroanalytical techniques* Cyclic voltammetry, chronoamperometry, rotating ring-disk electrode experiments, electrochemical impedance spectroscopy, and battery cycling (galvanostatic and potentiostatic)
- Separations* High pressure liquid chromatography (HPLC), capillary electrophoresis (CE), and gas chromatography-mass spectrometry (GC-MS)
- Materials Characterization* Thermogravimetric analysis, dynamic light scattering, zeta potential measurements, powder X-ray diffraction, Grazing Incidence Small Angle X-ray Scattering (GISAXS)
- Lab Management* Experience setting up new lab space and infrastructure, including glove box maintenance and equipment requisition and negotiation
- Computers and Electronics* Extensive experience with Microsoft Office products, Adobe Illustrator, Windows, and Mac OS X. Experience with assembling computers, diagnosing hardware and software problems, hardware configuration, and software installation/configuration. Some experience launching, designing, and running web sites. Developing familiarity with Python, Java, and Matlab.

Teaching Experience

- 2012–2015 **Organic Chemistry Laboratory (Chem 3AL).**
3 semesters, University of California, Berkeley
- 2010–2011 **Volunteer Chemistry Tutor, Chemistry Resource Center.**
2 semesters, University of North Carolina at Chapel Hill

Volunteering and Service

- 2013–Present **Berkeley Science Review.**
Assistant Web Director and Contributing Author
- 2012–2013 **Bay Area Science Festival.**
Science Demonstration Volunteer
- 2010–2012 **UNC Chemistry Department.**
High School Student Recruiting Representative
Chemistry Resource Center Tutor
Carolina Family Science Day Volunteer
- 2009–2010 **UNC Hospitals.**
Volunteer in Central Distribution and Outpatient Pharmacy

Awards and Honors

- National Defense Science and Engineering Graduate Fellowship (2013)
- Department of Energy Office of Science Graduate Fellowship Finalist (2012)
- National Science Foundation Fellowship Honorable Mention (2012)
- Carrie Largent Award for Research Excellence in Chemistry (2012)
- Carolina Research Scholar (2012)
- Jason D. Altom Memorial Award for Undergraduate Research (2011)
- DOE Science Undergraduate Laboratory Internship (2011)
- University of North Carolina Sophomore Chemist Award (2010)
- NSF Research Experience for Undergraduates Fellowship (UC Irvine) (2010)
- Carolina Southeast Asia Summer Program Scholarship (2009)
- Marine Corps Scholarship Foundation Scholarship (2009–2012)