Shrayesh N. Patel, Ph.D. Curriculum Vitae

Postdoctoral Research Scientist
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Education and Research Positions

Postdoctoral Research Scientist **5/2013 - Present**
University of California, Santa Barbara - Materials Research Laboratory
Advisors: Profs. Edward J. Kramer and Michael L. Chabinyc
Charge transport phenomena and morphology of semiconducting polymers for thin film transistors and thermoelectrics.

University of California, Berkeley **8/2007 – 5/2013**
Ph.D. Degree - Chemical Engineering
Thesis Advisor – Prof. Nitash P. Balsara
Thesis Title – *Simultaneous Electronic and Ionic Conducting Block Copolymers for Lithium Battery Electrodes*

Georgia Institute of Technology **8/2004 – 5/2007**
Bachelor of Science in Chemical and Biomolecular Engineering (ChBE)
Highest Honors
Undergraduate Research Advisors – Profs. Tom Fuller and Rachel Chen - *Designing and testing Microbial Fuel Cells*

Research Interests

My research interests focus on conducting polymers for energy applications related to batteries and low-grade thermal energy harvesting (thermoelectric generators/coolers, and thermo-electrochemical cells). My future research direction will build upon my experience in polymer science, polymer synthesis, electrochemistry, and organic electronics. In particular, I am interested in developing novel lab-scale film coating methods for polymer-based thermoelectrics. Not only can we develop printable thermoelectric devices, but also perform *in-situ* characterization experiments such X-ray scattering to study the structure-property relationships. In addition, my research will focus on developing and optimizing inhomogeneous polymer-based thermoelectrics through gradient chemical doping in order to improve efficiency. Lastly, I am interested in studying organic redox couples and polymer electrolyte/ionic liquid membranes for next the generation thermo-electrochemical cells.

Publications

Postdoctoral Research – University of California, Santa Barbara

1. **Patel, S.N.**; Su, G.M.; Luo, C.; Wang M.; Perez, L.A.; Fischer, D.A.; Heeger, A.J.; Bazan, G.C.; Chabinyc, M. L.; Kramer, E.J., "NEXAFS Spectroscopy to Probe the Molecular Orientation of a Pyridal[2,1,3]thiadiazole-containing Conjugated Copolymer coated Nanogrooved Substrates," Preparing for Submission **2014**. (available upon request)
2. Glaudell, A.M.; Cochran J.E.; **Patel, S.N.**; Chabinyc M.L., "Impact of Doping Method on Conductivity and Thermopower in Semiconducting Polythiophenes," ***Adv. Energy Mater***. **2014**. DOI: 10.1002/aenm.201401072
3. Luo C.; Kyaw, K.; Perez, L.A.; **Patel, S.N.**; Wang M.; Grimm, B.; Ying, L.;Bazan, G.C.; Kramer, E.J.; Heeger, A.J., "General Strategy for Self-assembly of Highly Oriented Nanocrystalline Semiconducting Polymers with High Mobility," ***Nano Letters*** **2014**, *14 (5)*, 2764–2771. DOI: 10.1021/nl500758w
4. Russ, B.; Robb, M.J.; Brunetti, F.G.; Miller, P.L., Perry, E.; **Patel, S.N.**; Ho, V.; Chang C.B; Urban J.J.; Chabinyc, M.L.; Hawker, C.J.; Segalman, R.A., "Power Factor Enhancement in Solution-processed Organic n-type Thermoelectrics Through Molecular Design," ***Advanced Materials*** **2014**, *26*, 3473–3477. DOI: 10.1002/adma.201306116
5. Tseng, H.; Hung, P.; Luo C.; Wang M.; Perez L.A.; **Patel, S.N.**; Ying, L.; Kramer, E.J.; Nguyen, T.; Bazan, G.C.; Heeger, A.J., "High Mobility Field Effect Transistors Fabricated with Macroscopic Aligned Semiconducting Polymers," ***Advanced Materials*** **2014**, *26*, 2993–2998. DOI: 10.1002/adma.201305084

Doctoral Research – University of California, Berkeley

6. Thelen, J.L.; Javier, A.E.; Wu, SL.; Balsara, N.P., **Patel, S.N.***, "Electrochemical Doping of Poly(3-hexylthiophene) in the Solid-State: Relationship Between Electronic Properties and Crystalline Lattice Strain," *In Preparation*, **2014**.*corresponding author.
7. **Patel, S.N.**, Javier, A.E.; Balsara, N.P., "Simultaneous Electronic and Ionic Charge Transport of Block Copolymers: Electrochemically Oxidized in the Solid-State," ***ACS Nano*** **2013**, *7* (7), 6056-6068. DOI: 10.1021/nn4018685

8. Ameloot, R.; Aubrey, M.; Wiers, B.; Gomora-Figueroa, A.; **Patel, S.N.**; Balsara, N.P.; Long, J.R., "Ionic Conductivity in the Metal-Organic Framework UiO-66 by Dehydration and Insertion of Lithium *tert*-butoxide," ***Chemistry – A European Journal*** **2013**. DOI: 10.1002/chem.201300326
9. **Patel, S.N.**, Javier, A.E.; Beers K.M.; Pople J.A.; Ho, V; Segalman, R.A.; Balsara, N.P., "Morphology and Thermodynamic Properties of a Copolymer with an Electronically Conducting Block: Poly(3-ethylhexylthiophene)-*block*-Poly(ethylene oxide)," ***Nano Letters*** **2012,** *12* (9), 4901-4906. DOI: 10.1021/nl302454c
10. **Patel, S.N.**; Javier, A.E.; Stone, G.M.; Mullin, S.A.; Balsara, N.P., "Simultaneous Conduction of Electronic Charge and Lithium Ions in Block Copolymers," ***ACS Nano*** **2012**, *6* (2), 1589-1600. DOI: 10.1021/nn2045664
11. Javier, A. E.; **Patel, S. N.;** Hallinan, D. T.; Srinivasan, V.; Balsara, N. P., "Simultaneous Electronic and Ionic in a Block Copolymer: Application in Lithium Battery Electrodes," ***Angewandte Chemie International Edition*** **2011,** *50* (42), 9848-9851. DOI: 10.1002/anie.201102953

Conference Presentations

Patel, S.N., Luo, C.; Wang M.; Tseng, H..; Heeger, A.J.; Bazan, G.C.; Kramer, E.J., "Structural Characterization of Exceptionally Aligned Regioregular CDT-PT Based Copolymer with High Field-Effect Mobility," American Institute of Chemical Engineers (AIChE) Annual Meeting; Atlanta, GA; Nov. 2014

Patel, S.N., Luo, C.; Wang M.; Tseng H.; Phan, H; Nguyen, T.; Heeger, A.J.; Bazan, G.C..; Kramer, E.J., "Structural Characterization of an Aligned High Mobility Semiconducting Polymer," Polymer Physics Gordon Research Conference; South Hadley, MA; July 2014 (Poster)

Patel, S.N., Javier, A.E.; Balsara, N.P., "Electronic Charge Transport Properties of Electrochemically Oxidized Block Copolymers – Lithium Battery Application," American Institute of Chemical Engineers (AIChE) Annual Meeting; San Francisco, CA; Nov. 2013

Patel, S.N., Javier, A.E.; Balsara, N.P., "Charge Transport Properties of P3HT-PEO block copolymers that are Electrochemically Oxidized in the Solid-State," American Physical Society; Baltimore, MD; March 2013

Patel, S.N., Javier, A.E.; Balsara, N.P., "Simultaneous Electronic and Ionic Charge Transport In an Electrochemically Oxidize Block Copolymer," *Session: Emerging Areas in Polymer Science and Engineering*; American Institute of Chemical Engineers (AIChE) Annual Meeting; Pittsburgh, PA; October 2012 **(Invited)**

Patel, S.N., Javier, A.E.; Balsara, N.P., "Conductivity of Electronic and Ionic Conducting Block Copolymer Electrolytes through Electrochemical Doping in the Solid-State," The Electrochemical Society; Honolulu, HI; October 2012

Patel, S.N.; Javier, A.E.; Stone, G.M.; Mullin, S.A.; Balsara, N.P., "Block Copolymer Exhibiting Simultaneous Electronic and Ionic Conduction," (Poster) American Physical Society; Boston, MA; Feb 2012

Patel, S.N.; Javier, A.E.; Hallinan, D.T.; Balsara, N.P., "Simultaneous Electronic and Ionic Charge Transport in Poly(3-hexylthiophene)-*block*-Poly(ethylene oxide)," American Physical Society; Dallas, TX; March 2011

Patent

A. E. Javier, **S. N. Patel**, D. T. Hallinan, N. P. Balsara. "Block Copolymer with Simultaneous Electric and Ionic Conduction for Use in Lithium Batteries," filed by the Regents of the University of California, March 22, 2012. Published as US Patent No. 8552144 B2 on October 8, 2013

Teaching Experience and Mentorship

Undergraduate Student Researcher Mentor

David Kiefer - Cooperative International Science and Engineering Internship (CISEI) June 2014 – Aug. 2014

- Thermoelectric properties of PBTTT films *p*-doped with 4-ethylbenzenesulfonic acid

Naveen Venkatensan – Chemical and Biomolecular Engineering, UC Berkeley May 2012 – May 2013

- Conductivity sample preparation and measurement via ac impedance spectroscopy

Graduate Student Instructor (GSI) 8/2008 – 12/2008 & 1/2011-5/2011

School: University of California, Berkeley
Course: Introduction to Polymer Chemistry
Instructor: Rachel Segalman

- Created homework solutions, exam problem, and tutored students on homework assignments and exam preparations.
- Gave lectures on polymer synthesis, characterization, and thermodynamics when instructor was not available.
- Setup and directed six laboratory experiments related to topics covered in the lecture portion of the course.

Honors, Awards, and Scholarships

Selected as a speaker for the AIChE Conference - Emerging Areas in Polymer Science and Engineering Symposium	10/2012
Faculty Honors and Dean's List at Georgia Institute of Technology	8/2004 - 5/2007
Tau Beta Pi Engineering Honors Society	11/2005 - Present
Robert and Irene Edwards Scholarship	8/2005 – 5/2006
BP Chemical Engineering Scholarship	8/2005 – 12/2005
Chevron Chemical Engineering Minority Scholarship	8/2004 – 8/2005
Gorgas Scholarship	8/2004 – 5/2005
International Baccalaureate Diploma	5/2004

References

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