NATHANIEL A. LYND, PH. D.

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Research vision

Develop a polymer system that in 10 years will be in widespread use across academia and industry. This will be accomplished by developing simple and versatile practical and conceptual synthetic tools, breaking down barriers of perceived synthetic difficulty, and developing materials concepts toward "killer apps" that highlight the most favorable properties of our developmental polymeric materials. Widespread access to new materials will enable the discovery of new concepts in polymer physics and ultimately new technologies.

Education:

2007–2010 Postdoc in Materials, University of California, Santa Barbara, CA (with Craig J. Hawker, Glenn H. Fredrickson, and Edward J. Kramer).

2002–2007 Ph. D. in Chemistry, University of Minnesota, Minneapolis, MN (with Marc A. Hillmyer). Ph. D. thesis titled *Effects of Polydispersity on Block Copolymer Self-Assembly*.

1997–2002 B. S. Chemistry, B. A. German, Michigan State University, East Lansing, MI

Employment:

2015–present Assistant Professor, McKetta Department of Chemical Engineering, University of Texas at Austin, Austin, TX

2015 Visiting Professor, Eindhoven University of Technology, Eindhoven, North Brabant, The Netherlands

2013–2015 Staff Scientist, Materials Sciences Division, Lawrence Berkeley National Laboratory, Berkeley, CA

2010–2013 Project Scientist, Materials Research Laboratory, University of California, Santa Barbara, CA

Research contributions:

Research in the group couples new polymer synthesis to physical characterization. Past contributions have advanced the understanding of ring-opening polymerization of functional epoxide monomers. New practical, and conceptual tools were developed that created a new mechanistic understanding of epoxide (co)polymerization. The consequences of those advances have proven to be insightful for the compositional control of structure-property relationships of polymer materials within the context of ion-transport, cryopreservation, and self-assembly.

Service and recognition:

2016 Member, Women in Engineering Committee

2016 Chair, Departmental Safety Committee

2015 Member, Computing in the Undergraduate Chemical Engineering Curriculum

2015 ACS–PRF Doctoral New Investigator

2006 Doctoral Dissertation Fellowship, University of Minnesota

2004 Beaker and Bunsen Award, University of Minnesota

Former graduate students (with current location):

Bongjae F. Lee (w. Craig J. Hawker)	Samsung Cheil Industries, South Korea
Gabriel J. Sanoja (w. Rachel Segalman)	University of California, Santa Barbara

Former post-doctoral fellows (with current location):

Bryan Beckingham	Assistant Professor	Auburn University
Daniel J. Miller	Staff Scientist	Lawrence Berkeley National Laboratory

Current graduate students:

Aaron A. Burkey (Ohio University), Malgorzata Chwatko (Univ. of Connecticut), Caitlin Donovan (Rochester Inst. of Tech.), Gang Fan (Tianjin University), Alysha Helenic (Rochester Inst. of Tech.), Jennifer Imbrogno (SUNY at Stony Brook), Jai Hyun Koh (Seoul National Univ.), Paul W. Meyer (Texas Tech), Christina G. Rodriguez (Univ. of California–Santa Barbara), Bill K. Wheatle (Cornell Univ.), Qingjun Zhu (Zhejiang Univ.)

Current post-doctoral fellows:

Robert C. Ferrier (Ph. D., University of Pennsylvania)

Invited Presentations:

2017 International Symposium on Ionic Polymerization, Durham University, UK, September 17th–22nd, 2017.

Seminar, Waseda University, Tokyo, Japan, March 6th–10th, 2017.

Seminar, University of Washington, Seattle, March 4th, 2017.

2016 Army Research Laboratory, April 21st, 2016.

Nagoya University, January 29th, 2016.

Institute for Materials Chemistry and Engineering International Symposium, Kyushu University, Japan, January 27th, 2016.

2015 Eindhoven Technical University, Colloquium, July 6th, 2015.

DSM (Netherlands), Geleen, Netherlands, June 10th, 2015.

Department of Chemical and Biological Engineering, Colorado State University, Fort Collins, CO, April 24th, 2015.

2014 McKetta Department of Chemical Engineering, University of Texas, Austin, TX, March 4th, 2014.

Institute for Molecular Engineering, University of Chicago, January 23rd, 2014.

2013 IUPAC International Meeting on Ionic Polymerization 2013, Awaji-Island, Japan, September 22–28th, 2013.

Los Angeles Venture Association: First Look LA, June 12th, 2013.

Seminar, Department of Chemistry and Biochemistry, University of South Carolina, January 17th, 2013.

2012 IUPAC World Polymer Congress, June 26, 2012, Blacksburg, VA.

WPI-AIMR workshop, California NanoSystems Institute (UCSB), January 10th, 2012.

2011 Seminar, Nagoya University, Nagoya, Japan, November 17th, 2011.

Seminar, Waseda University, Tokyo, Japan, November 16th, 2011.

Carl S. Marvel Award Symposium in Honor of Marc A. Hillmyer at the ACS National Meeting in Anaheim, CA. March 25th, 2011.

Materials Research Outreach Program (UCSB), February, 2nd, 2011.

2007 Seminar, University of Osaka, Osaka, Japan, June, 2007.

Publications (peer-reviewed):

Number of papers published: 54; Total citations: 1736; h-index: 23; [Google Scholar]

2017 Controlled co-solvent vapor annealing and the importance of quenching conditions in thin-film block copolymer self-assembly. Stahl, B. C.; Kramer, E. J.; Hawker, C. J.; Lynd, N. A. **2017**, *Accepted.* [10.1002/polb.24366]

Ring-opening polymerization of epoxides: Facile pathway to functional polyethers via a versatile organoaluminum initiator. Rodriguez, C. G.; Ferrier, R. C.; Helenic, A.; Lynd, N. A. *Macromolecules* **2017**, *Accepted.* [doi]

Statistical copolymerization of lactones and epoxides to high molecular weight. Chwatko, M.; Lynd, N. A. *Macromolecules* **2017**, ASAP. [doi]

Nonaqueous polyelectrolyte solutions as liquid electrolytes with high lithium ion transference number and conductivity. Buss, H. G.; Chan, S. Y.; Lynd, N. A.; McCloskey, B. D. *ACS Macro Lett.* **2017**. [doi]

2016 Structure-conductivity relationships of block copolymer membranes based on hydrated protic polymerized ionic liquids: Effect of domain spacing. Sanoja, G. E.; Popere, B. C.; Beckingham, B. S.; Evans, C. M.; Lynd, N. A.; Segalman, R. A. *Macromolecules* **2016**, *49*, 2216–2223. [doi]

Mussel-inspired anchoring of polymer loops that provide superior surface lubrication and antifouling properties. Taegon, K.; Banquy, X.; Heo, J.; Lim, C.; Lynd, N. A.; Lundberg, P.; Oh, D. X.; Lee, H. K.; Hong, Y.-K.; Hwang, D. S.; Waite, J. H.; Israelachvili, J. N.; Hawker, C. J. *ACS Nano* **2016,** 10, 930–937. [doi]

Morphology re-entry in asymmetric PS-PI-PS' triblock copolymer and PS homopolymer blends. Shi, W.; Li. W.; Delaney, K. T.; Fredrickson, G. H.; Kramer, E. J.; Ntaras, C.; Avgeropoulos, A.; Lynd, N. A. *J. Polym. Sci. Part B: Polym. Phys.* **2016**, *54*, 169–179. [doi]

2015 A facile synthesis of catechol-functionalized poly(ethylene oxide) block and random copolymers. Matron, K. M.; Latimer, A. A.; McGrath, A. J.; Lynd, N. A.; Lundberg, P.; Hudson, Z. M.; Hawker, C. J. *J. Polym. Sci. Part A: Polym. Chem.* **2015**, *53*, 2685–2692. [doi]

Simple and accurate determination of reactivity ratios using a non-terminal model of chain copolymerization. Beckingham, B. S.; Sanoja, G. E.; Lynd, N. A. *Macromolecules* **2015**, *48*, 6922-6930. [doi]

Probing the effect of molecular non-uniformity in directed self-assembly of diblock copolymers in nano-confined space. Pitet. L. M.; Alexander-Moonen, E.; Peeters, E.; Lynd, N. A.; Druzhinina, T.; Weister, S. F.; Meijer, E. W. *ACS Nano* **2015**, *9,* 9594–9602. [doi]

Aperiodic "bricks and mortar" mesophase: A new equilibrium state of soft matter and application as a stiff thermoplastic elastomer. Shi, W.; Hamilton, A. L.; Delaney, K. T.; Fredrickson, G. H.; Kramer, E. J.; Ntaras, C.; Avgeropoulos, A.; Lynd, N. A. *Macromolecules* **2015**, *48*, 5378–5384. [doi]

Cooperative and sequential phase transitions in *it*-poly(propylene oxide)-b-poly(ethylene oxide)-b-*it*-poly(propylene oxide) triblock copolymers. Shi, W.; McGrath, A. J.; Li, Y.; Lynd, N. A.; Hawker, C. J.; Fredrickson, G. H.; Kramer, E. J. *Macromolecules* **2015**, *48*, 3069–3079. [doi]

Creating extremely asymmetric lamellar structures *via* fluctuation-assisted unbinding of miktoarm star block copolymer alloys. Shi, W.; Hamilton, A. L.; Delaney, K. T.; Fredrickson, G. H.; Kramer, E. J.; Ntaras, C.; Avgeropoulos, A.; Lynd, N. A. *J. Am. Chem. Soc.* **2015**, *137*, 6160–6163. [doi]

Improving the gas barrier properties of Nation via thermal annealing: Evidence for diffusion through hydrophilic channels and matrix. Evans, C. M.; Singh, M. R.; Lynd, N. A.; Segalman, R. A. *Macromolecules* **2015**, *48*, 3303–3309. [doi]

Synthetic strategy for preparing chiral double-semicrystalline polyether block copolymers. McGrath, A.; Rodriguez, C. G.; Kramer, E. J.; Hawker, C. J.; Lynd, N. A. *Polym. Chem.* **2015**, *6*, 1465–1473. [doi]

A synthetic strategy for the preparation of sub-100 nm functional polymer particles of uniform diameter. Killops, K. L.; Rodriguez, C. G.; Lundberg, P.; Hawker, C. J.; Lynd, N. A. *Polym. Chem.* **2015**, *6*, 1431–1435. [doi]

2014 Phase behavior of electrostatically complexed polyelectrolyte gels using an embedded fluctuation model. Audus, D. J.; Gopez, J. D.; Krogstad, D. V.; Choi, S.-H.; Lynd, N. A.; Kramer, E. J.; Hawker, C. J.; Fredrickson, G. H. *Soft Matter* **2014**, *11*, 1214–1225. [doi]

Small angle neutron scattering study of complex coacervate micelles and hydrogels formed from ionic diblock and triblock copolymers. Krogstad, D. V.; Choi, S.-H.; Lynd, N. A.; Audus, D. J.; Perry, S. L.; Gopez, J. D.; Hawker, C. J.; Kramer, E. J.; Tirrell, M. V. *J. Phys. Chem. B* **2014**, *118*, 13011–13018. [doi]

Histamine-functionalized block copolymer micelles as a drug delivery system in 2D and 3D models of breast cancer. Zhang, Y.; Lundberg, P.; Diether, M.; Porsch, C.; Jansson, C.; Lynd, N. A.; Malkoch, M.; Malmström, E.; Hawker, C. J.; Nyström, A. M. *J. Mater. Chem. B* **2015**, *3*, 2473–2486. [doi]

Hierarchically ordered nanopatterns for spatial control of biomolecules. Tran, H.; Ronaldson, K.; Bailey, N.; Lynd, N. A.; Killops, K. L.; Vunjak-Novakovic, G.; Campos. L. M. *ACS Nano* **2014**, *8*, 11846–11853. [doi]

Synthetic aptamer-polymer hybrid constructs for programmed drug delivery into specific target cells. Oh, S. S.; Lee, B. F.; Leibfarth, F. A.; Eisenstein, M.; Robb, M. J.; Lynd, N. A.; Hawker, C. J.; Soh, H. T. *J. Am. Chem. Soc.* **2014**, *136*, 15010–10015. [doi]

Structural evolution of polyelectrolyte-complex-core micelles and ordered-phase bulk materials. Krogstad, D. V.; Lynd, N. A.; Miyajima, D.; Gopez, J.; Hawker, C. J.; Kramer, E. J.; Tirrell, M. V. *Macromolecules* **2014**, *47*, 8026–8032. [doi]

Symmetric poly(ethylene oxide-b-styrene-b-isoprene) triblock copolymers: Synthesis, characterization, and self-assembly in bulk and thin film. Qiao, Y.; Ferebee, R.; Lee, B.; Mitra, I.; Lynd, N. A.; Hayat, J.; Stein, G. E.; Bockstaller, M. R.; Tang, C. *Macromolecules* **2014**, *47*, 6373–6381. [doi]

Sequence of hydrophobic and hydrophilic residues in amphiphilic polymer coatings affects surface structure and marine antifouling/fouling release properties. van Zoelen, W.; Buss, H. G.; Ellebracht, N.; Hill, Sophie; Lynd, N. A.; Fischer, D. A.; Finlay, J.; Callow, M. E.; Callow, J. A.; Kramer, E. J.; Zuckermann, R. N.; Segalman, R. A. *ACS Macro Lett.* **2014**, *3*, 364–368. [doi]

Toward strong thermoplastic elastomers with asymmetric miktoarm block copolymer architectures. Shi, W.; Lynd, N. A.; Montarnal, D.; Yingdong, L.; Kramer, E. J.; Fredrickson, G. H.; Ntaras, C.; Avgeropoulos, A.; Hexemer, A. *Macromolecules* **2014**, *47*, 2037–2043. [doi]

Fluidity and water in nanoscale domains define coacervate hydrogels. Ortony, J. H.; Choi, S.-H.; Spruell, J. M.; Hunt, J. N.; Lynd, N. A.; Krogstad, D. V.; Urban, V. S.; Hawker, C. J.; Kramer, E. J.; Han, S. *Chem. Sci.* **2014**, *5*, 58–67. [doi]

Phase coexistence calculations of reversibly bonded block copolymers: A unit cell Gibbs ensemble approach. Mester, Z.; Lynd, N. A.; Delaney, K. T.; Fredrickson, G. H. *Macromolecules* **2014**, *47*, 1865–1874. [doi]

2013 Numerical self-consistent field theory of multicomponent polymer blends in the Gibbs ensemble. Mester, Z.; Lynd, N. A.; Fredrickson, G. H. *Soft Matter* **2013**, *9*, 11288–11294. [doi]

Linear versus dendritic molecular binders for hydrogel network formation with clay nanosheets: Studies with ABA triblock copolyethers carrying guanidinium ion pendants. Tamesue, S.; Ohtani, M.; Yamada, K.; Ishida, Y.; Spruell J. M.; Lynd, N. A.; Hawker, C. J.; Aida, T. *J. Am. Chem. Soc.* **2013**, *135*, 15650–15655. [doi]

Allyl Glycidyl Ether-Based Polymer Electrolytes for Room Temperature Lithium Batteries. Barteau, K. P.; Wolffs, M.; Lynd, N. A.; Fredrickson, G. H.; Kramer, E. J.; Hawker, C. J. *Macromolecules* **2013**, *46*, 8988–8994. [doi]

Physiologically relevant, pH-responsive PEG-based block and statistical copolymers with N,N-diisopropyl-amine units. Lee, A.; Lundberg, P.; Klinger, D.; Lee, B. F.; Hawker, C. J.; Lynd, N. A. *Polym. Chem.* **2013**, *4*, 5735–5742. [doi]

Supramolecular guests in solvent driven block copolymer assembly: From internally structured nanoparticles to micelles. Klinger, D.; Robb, M. J.; Spruell, J. M.; Lynd, N. A.; Hawker, C. J.; Connal, L. A. *Polym. Chem.* **2013**, *4*, 5038–5042. [doi]

Effects of polymer and salt concentration on the structure and properties of a triblock copolymer coacervate hydrogels. Krogstad, D. V.; Lynd, N. A.; Choi, S.-H.; Spruell, J. M.; Kramer, E. J.; Hawker, C. J.; Tirrell, M. V. *Macromolecules* **2013**, *46*, 1512–1518. [doi]

pH-triggered self-assembly of biocompatible histamine-functional triblock copolymers. Lundberg, P.; Lynd, N. A.; Zhang, Y.; Zeng, X.; Krogstad, D. V.; Paffen, T.; Malkoch, M.; Nyström, A. M.; Hawker, C. J. *Soft Matter* **2013**, *9*, 82–89. [doi]

2012 Mesostructured block copolymer nanoparticles: Versatile templates for hybrid inorganic nanostructures. Connal, L.; Lynd, N.; Robb, M.; Jang, S.; Spruell, J.; Hawker, C. *Chem. Mater.* **2012**, *24*, 4036–4042. [doi]

Poly[(ethylene oxide)-co-(methylene ethylene oxide)]: A hydrolytically degradable poly(ethylene oxide) platform. Lundberg, P.; Lee, B. F.; van den Berg, S. A.; Pressly, E. D.; Lee, A.; Hawker, C. J.; Lynd, N. A. *ACS Macro Lett.* **2012**, *1*, 1240–1243. [doi]

Reactivity ratios and mechanistic insight for anionic ring-opening copolymerization of epoxides. Lee, B. F.; Wolffs, M.; Delaney, K. T.; Sprafke, J.; Leibfarth, F. A.; Hawker, C. J.; Lynd, N. A., *Macromolecules* **2012**, *45*, 3722–3731. [doi]

Nanopatterning biomolecules by block copolymer self-assembly. Killops, K. L.; Gupta, N.; Dimitriou, M. D.; Lynd, N. A.; Jung, H.; Tran, H.; Bang, J.; Campos, L. M. *ACS Macro Lett.* **2012**, *1*, 758–763. [doi]

Functional block copolymer nanoparticles: Toward the next generation of delivery vehicles. Robb, M. J.; Connal, L. A.; Lee, B. F.; Lynd, N. A.; Hawker, C. J. *Polym. Chem.* **2012**, *3*, 1618–1628. [doi]

2011 Poly(allyl glycidyl ether)–A versatile functional polyether platform. Lee, B. F.; Kade, M. J.; Chute, J. A.; Gupta, N.; Campos, L. M.; Fredrickson, G. H.; Kramer, E. J.; Lynd, N. A.; Hawker, C. J. *J. Polym. Sci. Part A: Polym. Chem.* **2011**, *49*, 4498–4504. [doi]

A general approach to controlling the surface composition of poly(ethylene oxide)-based block copolymers for antifouling coatings. Dimitriou, M. D.; Zhou, Z.; Yoo, H.-S.; Killops, K. L.; Finlay, J. A.; Sundaram, H. S.; Lynd, N. A.; Barteau, K. P.; Campos, L. M.; Fischer, D. A.; Callow, M. E.; Callow, J. A.; Ober, C. K.; Hawker, C. J.; Kramer, E. J. *Langmuir* **2011**, *27*, 13762–13772. [doi]

Synthesis of thermally stable Au-core/Pt-shell nanoparticles and their segregation behavior in diblock copolymer mixtures. Jang, S.; Khan, A.; Dimitriou, M.; Kim, B. J.; Lynd, N. A.; Kramer, E. J.; Hawker, C. J. *Soft Matter* **2011**, *7*, 6255–6263. [doi]

2010 Tunable, high modulus hydrogels driven by ionic coacervation. Hunt, J. N.; Feldman, K. E.; Lynd, N. A.; Deek, J.; Spruell, J. M.; Hernandez, B. M.; Campos, L. M.; Safinya, C. R.; Kramer, E. J.; Hawker, C. J. *Adv. Mater.* **2010**, *23*, 2327–2331. [doi]

Ketene functionalized polyethylene: control of crosslink density and mechanical properties. Leibfarth, F.; Schneider, Y.; Lynd, N. A.; Schultz, A.; Moon, B.; Bazan, G.; Hawker, C. J. *J. Am. Chem. Soc.* **2010**, *132*, 14706–14709. [doi]

Design of soft and strong thermoplastic elastomers based on non-linear block copolymer architectures using self-consistent mean field theory. Lynd, N. A.; Oyerokun, F. T.; O'Donoghue, D. L.; Handlin, D.; Fredrickson, G. H. *Macromolecules* **2010**, *43*, 3479–3486. [doi]

Processing-structure-mechanical property relationships of semicrystalline polyolefin based block copolymers. Deplace, F.; Wang, Z.; Lynd, N. A.; Hotta, A.; Rose, J. M.; Hustad, P. D.; Tian, J.; Ohtaki, H.; Coates, G. W.; Shimizu, F.; Hirokane, K.; Yamada, F.; Shin, Y. W.; Rong, L. X.; Zhu, J.; Toki, S.; Hsiao, B. S.; Fredrickson, G. H.; Kramer, E. J. *J. Polym. Sci., Part B: Polym. Phys.* **2010**, *48*, 1428–1437. [doi]

2009 Novel polyolefin elastomers prepared by grafting poly(n-butylacrylate) from polyethylene macroinitiators. Schneider, Y.; Lynd, N. A.; Kramer, E. J.; Bazan, G. C. *Macromolecules* **2009**, *42*, 8763–8768. [doi]

2008 C_2-symmetric Ni(II) alpha-diimines featuring cumyl-derived ligands: Synthesis of improved elastomeric regioblock polypropylenes. Rose, J. M; Deplace, F.; Lynd, N. A.; Wang, Z.; Hotta, A.; Lobkovsky, E. B.; Kramer, E. J.; Coates, G. W. *Macromolecules* **2008**, *41*, 9548–9555. [doi]

Theory of polydisperse block copolymer melts: Beyond the Schulz-Zimm distribution. Lynd, N. A.; Matsen, M. W.; Hillmyer, M. A. *Macromolecules* **2008**, *41*, 4531–4533. [doi]

Polydispersity and block copolymer self-assembly. Lynd, N. A.; Meuler, A. J.; Hillmyer, M. A. *Prog. Polym. Sci.* **2008**, *33*, 875–893. [doi]

2007 Renewable resource thermoplastic elastomers based on polylactide and polymenthide. Wanamaker, C. L.; O'Learly, L. E.; Lynd, N. A.; Hillmyer, M. A.; Tolman, W. B. *Biomacromolecules* **2007**, *8*, 3634–3640. [doi]

The role of polydispersity in the lamellar mesophase of model diblock copolymers. Lynd, N. A.; Hamilton, B. J.; Hillmyer, M. A. *J. Poly. Sci. Part B: Poly. Phys.* **2007**, *45*, 3386–3393. [doi]

Effects of polydispersity on the order-disorder transition in block copolymer melts. Lynd, N. A.; Hillmyer, M. A. *Macromolecules* **2007**, *40*, 8050–8055. [doi]

2005 Influence of polydispersity on the self-assembly of diblock copolymers. Lynd, N. A.; Hillmyer, M. A. *Macromolecules* **2005**, *38*, 8803–8810. [doi]