

# Peter Beaucage

## Education

- December 2018 **Ph.D. Materials Science & Engineering**, *Cornell University*, Ithaca, New York.  
Thesis: Synthetic Pathways to Mesoporous Superconductors: Quantum Materials from Block Copolymer Self Assembly. Advisors - Profs. Ulrich Wiesner and Sol Gruner
- May 2016 **M.S. Materials Science & Engineering**, *Cornell University*, Ithaca, New York.  
First synthesis of block copolymer-derived mesoporous NbN superconductors with Profs. Uli Wiesner and Sol Gruner
- April 2013 **B.S. Chemical Engineering**, *University of Cincinnati*, Cincinnati, Ohio, *Cum Laude, Honors, GPA – 3.64*.  
Research in small-angle scattering for structural characterization of graphene oxide and sucrose-ester micelles.

## Publications

- 17 E.M. Susca, **P.A. Beaucage**, R.P. Thedford, A. Singer, S.M. Gruner, L.A. Estroff, and U. Wiesner. "Preparation of Macroscopic Block Copolymer-Based Gyroidal Mesoscale Single Crystals by Solvent Evaporation", *Adv. Mater.* **31** 1902565 (2019).
- 16 K.P. Barteau, K. Ma, F. F-E. Kohle, T.C. Gardinier, **P.A. Beaucage**, R.E. Gillilan, U. Wiesner. "Quantitative Measure of the Size Dispersity in Ultrasmall Fluorescent Organic-Inorganic Core-Shell Silica Nanoparticles by Small-Angle X-Ray Scattering", *Chem. Mater.* **31** 643-657 (2019).  
Supplemental Cover
- 15 T. Weller, L. Deilmann, J. Timm, T.S. Doerr, A.S. Cherevan, **P.A. Beaucage**, U.B. Wiesner, D. Eder, R. Marschall. "A crystalline and 3D periodically ordered mesoporous quaternary semiconductor for photocatalytic hydrogen generation", *Nanoscale* **10** 3225-3234 (2018).
- 14 Q. Zhang, F. Matsuoka, H.S. Suh, **P.A. Beaucage**, S. Xiong, D-M. Smilgies, K.W. Tan, J.G. Werner, P.F. Nealey, and U.B. Wiesner. "Pathways to Mesoporous Resin/Carbon Thin Films with Alternating Gyroid Morphology", *ACS Nano* **12** 347-358 (2018).
- 13 **P.A. Beaucage**, E.M. Susca, S.M. Gruner, and U.B. Wiesner. "Discovering Synthesis Routes to Hexagonally Ordered Mesoporous Niobium Nitrides Using Poloxamer/Pluronic Block Copolymers", *Chem. Mater.* **29** 8973-8977 (2017).
- 12 K.W. Oleske, K.P. Barteau, **P.A. Beaucage**, E. Asenath-Smith, U.B. Wiesner, and L.A. Estroff. "Nanopatterning of Crystalline Transition Metal Oxides by Surface Templated Nucleation on Block Copolymer Mesostructures", *Crystal Growth & Design* **17** 5775-5782 (2017).
- 11 K.E. Fritz, **P.A. Beaucage**, F. Matsuoka, U.B. Wiesner, and J. Suntivich. "Mesoporous titanium and niobium nitrides as conductive and stable electrocatalyst supports in acid environments", *Chem. Comm.* **53** 7250-7253 (2017).
- 10 B.J. Smith, L.R. Parent, A. Overholts, **P.A. Beaucage**, R.P. Bisbey, A.D. Chavez, N. Hwang, C. Park, A.M. Evans, N.C. Gianneschi, and W.R. Dichtel. "Colloidal Covalent Organic Frameworks", *ACS Central Science* **3** 58-65 (2017).  
Featured in Chemical & Engineering News, Bucknell News.
- 9 K.W. Oleske, K.P. Barteau, M.Z. Turker, **P.A. Beaucage**, L.A. Estroff, and U. Wiesner. "Block copolymer directed nanostructured surfaces as templates for confined surface reactions", *Macromolecules* **50** 542-549 (2017).
- 8 A.D. Chavez, B.J. Smith, M.K. Smith, **P.A. Beaucage**, B.H. Northrop, W.R. Dichtel. "Discrete, Hexagonal Boronate Ester-Linked Macrocycles Related to Two-Dimensional Covalent Organic Frameworks", *Chem. Mater.* **28** 4884-4888 (2016).

- 7 Q. Zhang, Y. Gu, Y.M. Li, **P.A. Beaucage**, T. Kao, and U. Wiesner. "Dynamically Responsive Multifunctional Asymmetric Triblock Terpolymer Membranes with Intrinsic Binding Sites for Covalent Molecule Attachment", *Chem. Mater.* **28** 3870-3876 (2016).
- 6 D.K. Rai, G. Beaucage, K. Ratkanthwar, **P.A. Beaucage**, R. Ramachandran, and N. Hadjichristidis, "Quantification of interaction and topological parameters of polyisoprene star polymers under good solvent conditions", *Phys. Rev. E* **93** 052501 (2016).
- 5 E.M. Susca, **P.A. Beaucage**, M.A. Hanson, U. Werner-Zwanziger, J.W. Zwanziger, L.A. Estroff, and U. Wiesner. "Self-Assembled Gyroidal Mesoporous Polymer-Derived High Temperature Ceramic Monoliths", *Chem. Mater.* **28** 2131-2137 (2016).
- 4 S.W. Robbins\*, **P.A. Beaucage\***, H. Sai, K.W. Tan, J.P. Sethna, F.J. DiSalvo, S.M. Gruner, R.B. van Dover, and U. Wiesner. "Block Copolymer Self-Assembly Directed Synthesis of Mesoporous Superconductors", *Science Advances* **2** e1501119 (2016).  
\*Indicates equal contribution.  
Featured in Popular Mechanics, Phys.org, Superconductor Week, Cornell Chronicle.
- 3 D.K. Rai, G. Beaucage, K. Rathanthwar, **P.A. Beaucage**, R. Ramachandran, N. Hadjichristidis "Determination of the interaction parameter and topological scaling features of symmetric star polymers in dilute solution." *Phys. Rev. E* **92**, 012602 (2015).
- 2 K.W. Tan, H. Sai, S.W. Robbins, J.G. Werner, T.N. Hoheisel, S.A. Hesse, **P.A. Beaucage**, F.J. DiSalvo, S.M. Gruner, M. Murtagh, U. Wiesner. "Ordered Mesoporous Crystalline Aluminas from Self-Assembly of ABC Triblock Terpolymer-Butanol-Alumina Sols." *RSC Adv.* **5**, 49287-49294 (2015).
- 1 E.O. Jonah, D. T. Britton, **P. Beaucage**, D. K. Rai, G. Beaucage, B. Magunje, J. Ilavsky, M. R. Scriba, and M. Harting. "Topological investigation of electronic silicon nanoparticulate aggregates using ultra-small-angle X-ray scattering." *J. Nanopart. Res.* **14**, 1-10 (2012).

## Selected Presentations

P. Beaucage, "Microbeam SAXS/WAXS mapping with CRLs at CHESS: x-ray techniques to enable next-generation quantum metamaterials" *Advanced Photon Source User Science Seminar, Argonne National Laboratory, Argonne, IL (invited)*.

P. Beaucage, "From Membranes to Superconductors: Functional Mesostructured Materials Enabled By In-situ and High-throughput Synchrotron SAXS/WAXS" *2019 Denver X-Ray Conference, Lombard, IL (invited)*.

P. Beaucage, S.M. Gruner, U. Wiesner, "Discovering Synthetic Pathways to Mesostructured Quantum Materials Using In-situ and High-throughput Synchrotron SAXS/WAXS" *Materials Science & Engineering Division Seminar, NIST, Gaithersburg, MD (invited)*.

P. Beaucage, S.M. Gruner, U. Wiesner, "Exploring Synthetic Pathways in the Block Copolymer Self-Assembly-Derived Synthesis of Mesoporous Gyroidal Superconductors with In Situ SAXS/WAXS." *Gordon Research Seminar - Polymer Physics, Holyoke, MA (invited)*.

P. Beaucage, S.M. Gruner, U. Wiesner, "Synthesis of a new class of superconducting nanoporous morphologies based on a 3-D periodic gyroid structure." *Cornell Physics Department Discussion Series, Ithaca, NY*.

P. Beaucage, S.M. Gruner, U. Wiesner, "Understanding Structure Formation in Block Copolymer-Directed Functional Materials by in situ SAXS/WAXS." *Advanced Photon Source User Science Seminar, Argonne National Laboratory, Argonne, IL (invited)*.

Contributed presentations at APS March Meeting 2013, 2017, 2018, 2019, MRS Fall Meeting 2016, 2017, ACS Fall 2016, ACS Spring 2018, GRC Polymer Physics 2016, 2018, GRC Crystal Growth and Assembly 2015, SAS2018

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## Research, Teaching, Work, and Service Experience

### Research

2018-present **NRC Postdoctoral Fellow**, Functional Polymers Group, *National Institute of Standards and Technology*, Gaithersburg, Maryland.

Postdoctoral research using resonant soft x-ray and quasielastic neutron techniques to explore structure-dynamics-transport correlations in polyamide reverse osmosis and block copolymer filtration membranes.

2013-2018 **Graduate Research Assistant**, Wiesner and Gruner Groups, *Cornell University*, Ithaca, New York.

Thesis research on development of the first block copolymer-derived self-assembled mesoporous superconductors.

Developed microbeam synchrotron x-ray techniques for high-throughput materials discovery and SAXS/SANS methods for characterization of mesostructure formation mechanisms in block copolymer-derived systems.

Maintained lab spaces and equipment servicing two groups of 15+ workers, including inert gloveboxes, x-ray diffractometers, Schlenk lines, furnace systems, rotating anode SAXS system, etc.

Designed and built custom systems for high-temperature annealing in custom gas environments.

Independently developed collaborations with numerous outside groups for SAXS/WAXS investigation of systems ranging from covalent organic frameworks to room temperature delta-phase bismuth oxide.

2010 **Co-Op Student**, USAXS Instrument, Advanced Photon Source, *Argonne National Laboratory*, Argonne, Illinois.

Assisted with instrument development and user support, including software and hardware design for two pinhole SAXS instruments and converting instrument controls to a new software platform. Conducted collaborative research with several users on structure formation in soft materials.

### Teaching

2019 **Tutorial Instructor**, *Cornell University*, Ithaca, New York.

Gave tutorial lecture on anomalous and resonant x-ray and contrast variation neutron scattering at the invitation of the Cornell MSE Graduate Student Association.

2016-2018 **Workshop Instructor**, *Cornell University*, Ithaca, New York.

Taught workshops and one-on-one followups mentoring students on application to the NSF GRFP.

2014 **Teaching Assistant**, Materials Science and Engineering Department, *Cornell University*, Ithaca, New York.

Assisted in teaching an undergraduate course in materials chemistry to 35 Materials Science majors. Wrote homework assignments, led recitations and in-class review sessions, held office hours, and prepared and gave selected lectures. Helped convert the course to a partial flipped classroom format to improve student success.

### Service and Outreach

2019-2022 **Member**, *CHESS User Executive Committee*.

ad hoc **SANS Proposal Reviewer**, *NIST Center for Neutron Research*.

2008-present **Cofounder, Chief Operating Officer, interim (since 2014) Chief Financial Officer**, *Concordia Humana Corporation*, Cincinnati, Ohio.

Cofounded and continue to manage 501(c)(3) charity focused on meeting basic needs around the world. Our most recent project is PowerUp Ethiopia, a \$30,000 solar-powered well for a village of 2,000 people in rural Ethiopia.

2016-2018 **Founding Treasurer**, *LATTICE: The Cornell MSE Graduate Student Association*.

Organized social, research, and advocacy events for the Cornell MSE graduate student society. Co-chaired the first student-organized, student-run research symposium in the Cornell MSE department. Started a monthly student seminar promoting interdisciplinary collaborations.

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## Awards

October 2018 APS Travel Award for Excellence in Graduate Research

May 2018 CHESS User Meeting Best Poster - Scientific Achievement

April 2018 NIST-NRC Postdoctoral Fellowship

National Institute of Standards and Technology, National Research Council

March 2018 ACS Division of Inorganic Chemistry Student Travel Award

May 2017 DOE Science Graduate Student Research Fellowship

US Department of Energy, National Renewable Energy Laboratory

April 2014 NSF Graduate Research Fellowship  
National Science Foundation

April 2013 Distinguished Undergraduate Service Award  
Department of Chemical Engineering, University of Cincinnati

## Analytical & Laboratory Experience

- Synthesis Anionic Polymerization, Air-Free (Schlenk Line/Glovebox) Synthesis, Lithography, Sputter Deposition, Sol-Gel Chemistry
- Analytical XRD (powder and single-crystal), IR, NMR, GPC, TGA, DSC, Nitrogen Sorption, Small-Angle Light, X-Ray, and Neutron Scattering. With Collaborators: Solid-State NMR, Inert Gas Fusion
- National User Facilities Lead author and/or PI on successful proposals for 200+ shifts of beamtime for SAXS, USAXS, GISAXS, GIWAXS, XANES, SANS, NEXAFS, and RSoXS time at the Cornell High Energy Synchrotron Source, Advanced Photon Source, Spallation Neutron Source, NIST Center for Neutron Research, Advanced Light Source, and National Synchrotron Light Source-II.  
Developed several custom instruments/sample environments at CHESS for in situ GISAXS and GIWAXS analysis during annealing in inert and reactive gas environments at high temperature.
- Programming Igor Pro, Scientific Python, some MATLAB, Java, Linux command line
- Other Skills Experience in machining, mechanical design/fabrication/repair; excellent public speaking, writing, and communication skills.