Christopher N. Lam

Education

Massachusetts Institute of Technology, Cambridge, Massachusetts
Ph.D., Department of Chemical Engineering, April 2016
Advisor: Prof. Bradley D. Olsen
Thesis: Interactions Governing the Self-Assembly of Globular Protein-Polymer Block Copolymers
Minor: Computer Simulation and Programming

Rice University, Houston, Texas
B.S., Department of Chemical and Biomolecular Engineering, May 2010 — Summa Cum Laude
Minor, Department of Computational and Applied Mathematics

Work Experiences

Huntsman Advanced Materials
The Woodlands, TX — **April 2019 - Present**
Senior Scientist

- Coordinated installation of X-ray µCT instrument and demonstrated application for multiple divisions, including investigating internal morphology of composites and polyurethane coatings and foams
- Supported division and cross-divisional projects through development of thermal and rheological characterization methods, sample testing, data analysis, and equipment maintenance
- Developed evolved gas analysis method using a modified TGA-GC/MS workflow configuration in collaboration with analytical group, providing capability to semi-quantitatively measure pyrolysis decomposition gases of materials for high temperature applications
- Developed stress relaxation measurement rheology method and high temperature/pressure processing procedure to successfully demonstrate proof-of-concept vitrimer material for composite recyclability
- Investigated temperature dependence of interfacial tension of molten adhesive formulations; proposed and performed exploratory bonding interface characterization in collaboration with Oak Ridge National Laboratory (ORNL) using sum frequency generation (SFG) technique
- Optimized cure and pyrolysis temperature profiles for high char yield resin through kinetic modeling and numerical simulation

Oak Ridge National Laboratory, Spallation Neutron Source
Oak Ridge, Tennessee — **May 2016 - April 2019**
Postdoctoral Research Associate — Advisors: Drs. Wei-Ren Chen and Yangyang Wang

- Processed deuterated/protonated blends of highly entangled and unentangled polymer melts into films for small-angle neutron scattering (SANS) and rheology characterization
- Demonstrated new methodology to quantify spatiotemporal dependence of molecular relaxation in deformed polymers from SANS data
- Developed computational programs to apply novel, general mathematical framework for data analysis of soft matter materials under flow for comparison of experiment with theory and simulation
- Characterization of cationic surfactant wormlike micelle solutions using computational model fitting of experimental data
- Experience with performing MD simulations using LAMMPS on *Titan* supercomputer

Massachusetts Institute of Technology, Department of Chemical Engineering
Cambridge, Massachusetts — **Fall 2010 - May 2016**
Graduate Research Assistant — Advisor: Prof. Bradley D. Olsen

- Investigated fundamental physics and thermodynamics of protein-polymer block copolymers as a technology to control the arrangement and orientation of proteins in functional materials
- Characterized first solution phase diagram of protein-polymer block copolymers
- Quantified the shape of protein-polymer block copolymers using experiments, MD simulations (C++), and model fitting (MATLAB)
- Discovered that chemical details of complex protein surface can be coarse-grained to colloidal properties that capture relevant physics of self-assembly
- Demonstrated that protein electrostatics can be engineered to tune protein-protein interactions to control self-assembly
- Project featured in a Science Highlight by U.S. Department of Energy Basic Energy Sciences

Technical Skills

Synthesis: Controlled radical polymerization (RAFT), free radical polymerization
Protein cloning, protein expression in *E. coli*, protein purification, bioconjugation
Characterization: SEC, UV-Vis, zeta potential, circular dichroism, contact angle, X-ray µCT
TGA, DSC, FTIR, rheology, DMA, TMA, SLS, DLS, SAXS, SANS

Computer Skills

Programming languages: MATLAB (advanced)
Python (advanced)
bash, Fortran, C++, Excel VBA (basic/intermediate)
Software: LaTeX, Adobe Photoshop, VMD, PyMOL, WordPress, Blender, AutoCAD

Publications

- Christopher N. Lam, Lilin He, Changwoo Do, Wei-Ren Chen, Weiyu Wang, Kunlun Hong, and Yangyang Wang. Quantifying Molecular Deformation in Polymer Melts by a Generalized Zimm Plot Approach. **Journal of Applied Crystallography**, 2023. 56, 1168-1179.
- Faheem Muhammed, Laure Moretti, Tania Lavaggi, Christopher Lam, Tao Tao, Suresh Advani, and John W. Gillespie Jr. Influence of Pyrolytic Decomposition on the Microstructure Evolution of Benzoxazine-Derived Carbon-Carbon Composites. **Composites & Nanocomposites**, 2022. 57, 21915-21934.
- Guan-Rong Huang, Christopher N. Lam, Kunlun Hong, Yangyang Wang, Yuya Shinohara, Changwoo Do, and Wei-Ren Chen. Ion Atmosphere of Wormlike Micelles Profiled by Contrast Variation Small-Angle Neutron Scattering. **ACS Macro Letters**. 2021. 11, 66-71.
- Guan-Rong Huang, Chi-Huan Tung, Dongsook Chang, Christopher N. Lam, Changwoo Do, Yuya Shinohara, Shou-Yi Chang, Yangyang Wang, Kunlun Hong, and Wei-Ren Chen. Determining Population Densities in Bimodal Micellar Solutions Using Contrast-Variation Small-Angle Neutron Scattering. **The Journal of Chemical Physics**. 2020. 153 (18), 184902.
- William D. Hong, Christopher N. Lam, Yangyang Wang, Youjun He, Luis E. Sanchez-Diaz, Changwoo Do, and Wei-Ren Chen. Influence of Side Chain Isomerism on the Rigidity of Poly(3-Alkylthiophenes) in Solutions Revealed by Neutron Scattering. **Physical Chemistry Chemical Physics**. 2019. 21 (15), 7745-7749.
- Christopher N. Lam, Changwoo Do, Yangyang Wang, Guan-Rong Huang, and Wei-Ren Chen. Structural Properties of the Evolution of CTAB/NaSal Micelles Investigated by SANS and Rheometry. **Physical Chemistry Chemical Physics**. 2019. 21 (33), 18346-18351.
- Christopher N. Lam, Wensheng Xu, Wei-Ren Chen, Zhe Wang, Christopher B. Stanley, Jan-Michael Y. Carrillo, David Uhrig, Weiyu Wang, Kunlun Hong, Yun Liu, Lionel Porcar, Changwoo Do, Gregory S. Smith, Bobby G. Sumpter, and Yangyang Wang. Scaling Behavior of Anisotropy Relaxation in Deformed Polymers. **Physical Review Letters**. 2018. 121, 117801.
- Wensheng Xu, Jan-Michael Y. Carrillo, Christopher N. Lam, Bobby G. Sumpter, and Yangyang Wang. Molecular Dynamics Investigation of the Relaxation Mechanism of Entangled Polymers after a Large Step Deformation. **ACS Macro Letters**. 2018. 7 (2), 190-195.
- Zhe Wang, Christopher N. Lam, Wei-Ren Chen, Weiyu Wang, Jianning Liu, Yun Liu, Lionel Porcar, Christopher B. Stanley, Zhichen Zhao, Kunlun Hong, and Yangyang Wang. Fingerprinting Molecular Relaxation in Deformed Polymers. **Physical Review X** (Viewpoint in *Physics*). 2017. 7, 031003.
- Valentino R. Cooper, Christopher N. Lam, Yangyang Wang, and Bobby G. Sumpter. 2017. Noncovalent Interactions in Nanotechnology. In: Alberto Otero de la Roza and Gino DiLabio (eds.) *Non-Covalent Interactions in Quantum Chemistry and Physics: Theory and Applications* (417-451). Elsevier.
- Christopher N. Lam, Helen Yao, and Bradley D. Olsen. The Effect of Protein Electrostatic Interactions on Globular Protein-Polymer Block Copolymer Self-Assembly. **Biomacromolecules**. 2016. 17 (9), 2820-2829.
- Christopher N. Lam, Dongsook Chang, Muzhou Wang, Wei-Ren Chen, and Bradley D. Olsen. The Shape of Protein-Polymer Conjugates in Dilute Solution. **Journal of Polymer Science Part A: Polymer Chemistry**. 2016. 54 (2), 292-302.
- Christopher N. Lam, Dongsook Chang, and Bradley D. Olsen. 2016. Protein Nanopatterning. In: Mei Zhang, Rajesh R. Naik, Liming Dai (eds.) *Carbon Nanomaterials for Biomedical Applications* (445-480). Springer Series in Biomaterials Science and Engineering, vol. 5. Springer, Cham.
- Xin Li, Christopher N. Lam, Luis Sanchez-Diaz, Gregory Smith, Bradley D. Olsen, and Wei-Ren Chen. Scattering from Colloid-Polymer Conjugates with Excluded Volume Effect. **ACS Macro Letters**. 2015. 4, 165-170.
- Guokui Qin, Matthew J. Glassman, Christopher N. Lam, Dongsook Chang, Eric Schaible, Alex Hexemer, Bradley D. Olsen. Topological Effects on Globular Protein-ELP Fusion Block Copolymer Self-Assembly. Advanced Functional Materials. 2014. 25 (5), 729-738.
- Dongsook Chang, Christopher N. Lam, Shengchang Tang, and Bradley D. Olsen. Effect of Polymer Chemistry on Globular Protein-Polymer Block Copolymer Self-Assembly. Polymer Chemistry (front cover), 2014, 5, 4884-4895.
- Christopher N. Lam, Minkyu Kim, Carla S. Thomas, Dongsook Chang, Gabriel E. Sanoja, Chimdimma U. Okwara, and Bradley D. Olsen. The Nature of Protein Interactions Governing Globular Protein-Polymer Block Copolymer Self-Assembly. Biomacromolecules, 2014, 15 (4), 1248-1258.
- Christopher N. Lam and Bradley D. Olsen. Phase Transitions in Concentrated Solution Self-Assembly of Globular Protein-Polymer Block Copolymers. Soft Matter (front cover), 2013, 9, 2393-2402.
- Bokyung Kim, Christopher N. Lam, and Bradley D. Olsen. Nanopatterned Protein Films Directed by Ionic Complexation with Water-Soluble Diblock Copolymers. Macromolecules, 2012, 45, 4572-4580.
- Dichuan Li, Christopher Lam, and Sibani L. Biswal. Measuring Short-Range Repulsive Forces by Imaging Directed Magnetic-Particle Assembly. Soft Matter, 2010, 6, 239-242.

Presentations

- Christopher N. Lam, Yangyang Wang, Wei-Ren Chen, Zhe Wang, Jianning Liu, Lionel Porcar, Lin Panpan, Shiwang Cheng, Kunlun Hong, and Yun Liu. Molecular Deformation Mechanism of Entangled Polymers in Fast Flow as Revealed by Small-Angle Neutron Scattering. Presented at the In-Situ Rheology for Neutron and X-Ray Scattering Techniques workshop, a satellite event of the IV International Soft Matter Conference. Grenoble, France, September 2016.
- Christopher N. Lam, Carla S. Thomas, Dongsook Chang, Minkyu Kim, Aaron Huang, Guokui Qin, Liza Xu, Gabriel Sanoja, Amma Ukumura, and Bradley D. Olsen. The Impact of Protein Structure on Block Copolymer Self-Assembly. Invited talk. Presented at the 97th Canadian Chemistry Conference and Exhibition on behalf of advisor, Bradley D. Olsen. Vancouver, BC, June 2014.
- Christopher N. Lam, Minkyu Kim, Carla S. Thomas, Dongsook Chang, Gabriel E. Sanoja, Chimdimma U. Okwara, and Bradley D. Olsen. Effect of Protein Surface Potential on Globular Protein-Polymer Block Copolymer Self-Assembly. 2014 APS March Meeting. Denver, CO.
- Christopher N. Lam and Bradley D. Olsen. Phase Transitions in Concentrated Solution Self-Assembly of Globular Protein-Polymer Block Copolymers. Presented at the 2013 APS March Meeting. Baltimore, MD.
- Christopher N. Lam, Anna Kelly, and Kenton H. Whitmire. Nanoparticle Synthesis from Decomposition of $HFe_4(\mu_4 - \eta^2 - CH)(CO)_{12}$. Presented at the American Chemical Society 235th National Meeting and Exposition 2008 undergraduate poster presentation and the Rice University Research Symposium poster presentation, Spring 2008.

Teaching Experiences

Massachusetts Institute of Technology, Cambridge, Massachusetts

Teaching Assistant for Chemical, Energy, and Biological Engineering Projects Lab — **Spring 2013**
Counseled three undergraduate teams and provided guidance to their projects involving oil recovery and synthesis of polymeric materials for diverse applications.

Rice University, Houston, Texas

Physics Department Grader — **Fall 2007 - Spring 2010**
Graded weekly homework sets for Honors Freshman Mechanics and Electricity and Magnetism.

Computational and Applied Mathematics Department Grader — **Spring 2009**
Graded weekly homework sets for Matrix Analysis.

Rice University Mary Gibbs Jones College Academic Fellow — **Fall 2008 - Spring 2009**
Reinforced concepts in general chemistry and MATLAB computer programming and led review sessions for freshman General Chemistry.

Computational and Applied Mathematics Department Teaching Assistant — **Fall 2008**
Instructed and helped students with MATLAB programming at weekly lab sessions.

Chemistry Department Teaching Assistant — **Fall 2007**
Led weekly discussions for Honors Freshman General Chemistry; graded homework sets and exams.

Outreach

Cambridge School Volunteers, Cambridge, Massachusetts

E-Mentor in NetPals Program — **Spring 2015**
Communicated with and advised seventh grade student at the Putnam Avenue Upper School about STEM fields and extracurricular activities by e-mail and through face-to-face meetings.

Massachusetts Institute of Technology, Cambridge, Massachusetts

Tutor for MIT ESL Program for Service Employees — **Summer 2013 - Summer 2014, Summer 2015 - Fall 2015**
Mentored employees to help improve their vocabulary and communication skills.

Honors

Robert T. Haslam Presidential Graduate Fellowship	2010 - 2011
Texas Interscholastic League Foundation Welch Foundation Scholarship	2006 - 2010
Robert C. Byrd Honors Scholarship	2006 - 2010
Tau Beta Pi Scholarship	2009-2010
Samuel T. Sikes, Jr. Scholarship in Engineering	2008-2009, 2009-2010
Fluor Daniel Engineering Scholarship	Spring 2009
Lee Magnon Honorary Scholarship	2008, 2009
Children of NACE Houston Section Members Scholarship	2007-2008, 2008-2009
T.W. Moore Scholarship	2008-2009
William M. McCardell Endowed Scholarship	Fall 2008
AIChE Sophomore Academic Excellence Award	Fall 2008
Rice University Chemical Engineering Rodd/Selman Scholarship	November 2007
Welch Foundation Grant	June 2007
Tsanoff Essay Competition lower-division winner	June 2007
Rice University CRC Press Chemistry Achievement Award	May 2007
American Mensa	2004
National Eagle Scout Association, Three Rivers Council Boy Scout Troop XI	June 2002