Statement of Teaching, Research, and Service:
Accomplishments and Future Plans

Mitchell Anthamatten
University of Rochester
Department of Chemical Engineering

Mitchell Anthamatten
University of Rochester
Department of Chemical Engineering, Rochester, NY 14627
Tel: (585) 273-5526; Fax: (585) 273-1348
E-mail: anthamatten@che.rochester.edu
http://www.che.rochester.edu/~anthamat/

EDUCATION

- Massachusetts Institute of Technology (08/96 – 09/01)
  Ph.D. in Chemical Engineering (Advisor: Professor Paula T. Hammond)
  Thesis: Order in Liquid Crystalline Diblock Copolymers
  Minor: Applied Mathematics

- Massachusetts Institute of Technology (08/96 – 09/98)
  M.S. Chemical Engineering Practice
  Practice Stations: Dow Chemical, Freeport TX; Rhone Poulenc, Lyon, France

- University of Missouri—Columbia (08/92 – 05/96)
  B.S. Chemical Engineering, magna cum laude
  Minor: German

PROFESSIONAL EXPERIENCE

- University of Rochester, Department of Chemical Engineering
  Associate Professor (7/10 – present)
  Assistant Professor (1/04 – 6/10)

- Lawrence-Livermore National Laboratory
  Staff Scientist (12/02 – 12/03)
  Postdoctoral Fellowship, Chemistry & Materials Science (9/01 – 11/02)

FELLOSWHIPS, HONOR & AWARDS

- Guest Editor, Journal of Polymer Science Part B: Polymer Physics (2015)
- University of Rochester, Multidisciplinary Provost's Award (2009)
- 3M Non-tenured Faculty Award (2007)
- American Chemical Society, Petroleum Research Fund, Starter Grant (2005)
- Recipient of NIF Program Award (2003)
- Recipient of Amoco Poster Award (2000)
- Bright Flight Scholarship (1992-96)
- Curator's Scholarship & Award (1992-96)

SYNERGISTIC & PROFESSIONAL ACTIVITIES

- Director of Graduate Program, Department of Chemical Engineering, University of Rochester (2012-present)
- Annual Judge for National Siemens Competition in Math, Science & Technology (2006-2012, 2014-present)
- Reviewer for numerous research journals including *ACS Macro Letters*, *Advanced Materials*, *Macromolecules*, *Langmuir*, *JACS*, *Nature*, *Nature Materials*, *Soft Matter*
- Grant Reviewer for NSF (6 panels, 8 mail-in reviews), DOE, ACS-PRF, and for international research institutions (Romania, Singapore) (2007-present)

COLLABORATORS

E. Brown (Univ. of Rochester); C. Bowman (Univ. Colorado—Boulder); S.H. Chen (Univ. of Rochester); T. Fisk (Alpha Insights, SiO_2 Medical Products); D. Gidley (Univ. Michigan); D. Harding (Univ. of Rochester); J. Jorné (Univ. of Rochester); J. Lambropoulos (Univ. of Rochester); D.T. Moore (Univ. of Rochester); N.T. Muthuraman (BSN Medical); W.S. Oates (Florida State Univ.); A.A. Shestopalov (Univ. of Rochester); H. Stern (Univ. of Rochester); K. Tucker (BSN medical).

STUDENTS & POSTDOCTORAL FELLOWS

Current Doctoral Advisees:

- Onur Ozcalik, "Ion-conducting Supramolecular Networks" (2012-present) with fellowship from Turkish Government
- Yuan Meng, "Shape Memory Networks and Actuators" (2011-present), Hooker Fellowship recipient;
- Jey-Chang Yang, "Crystallization within Polymer Networks" (2015-present), Horton Fellow
- Dawei Chen, thesis topic, TBD

Current Masters Advisees:

- Danaya Pratchayanan, "Thermoplastic Shape Memory Polymers" (2015-present)

Current Undergraduate Research Advisees:

- Hojun Lee, "Influence of Network Architecture on Shape-Memory Performance" (Summer, 2015)
- Kevin Hadad, "Shape Memory Engine" (Summer, 2015)
- Jeffrey Weinfeld, "Hard Particle Ordering" (Summer, 2015, co-advised with Prof. Chen)

ALUMNI

Graduate Student Alumni (Degree Earned at UR), Last Known Affiliation

- Ran Tao (PhD, 2015), seeking employment, San Francisco
- Spencer Kingsbury (MS, 2014), Engineer at Corning Inc.,
- Christopher Lewis (PhD, 2014), Assistant Professor, R.I.T.

- Alokendra Ghosh (MS, 2013), doctoral student, Univ. Pennsylvania
- Yuan Zhang (MS, 2013), unknown
- Supacharee Roddecha (PhD, 2012), Assistant Professor, Kasetsart Univ., Thailand
- Jiahui Li (PhD, 2011) Research Scientist, Conoco-Phillips
- Kavya Ramachandra (MS, 2011) Process Engineer, Intel
- Alexander Papastrat (MS, 2010) Plant Engineer, Dow Chemical Company
- Michelle Wrue (PhD, 2010), Rochester, NY
- Xichong Chen, (PhD, 2009) Sr. Process Engineer, ASM
- Lijun Zou, (PhD 2009) Research Scientist, W.L. Gore
- Zachary I. Green (MS, 2008) Project Engineer at Giner, Inc.

Undergraduate Researcher Alumni (Degree Earned at UR), Last Known Affiliation

- Jisu Jiang (BS, 2015), PhD candidate, Georgia Tech
- Molly Tsai (BS, 2015), Test Engineer, FuelCell Energy, Boston
- Kathleen Stuart (BS, 2014), Management, Massachusetts General Hospital
- Gregory Pennamon (BS, 2014), unknown
- Peter Thayer (BS, 2013, MS 2014), EPIC Systems, Rochester
- Thach Chu (BS 2011), PhD Candidate, Yale University
- Darcy Chen (BS, 2011), Chemical Engineer, 2D Systems Corporation
- Suze Ninh (BS, 2010), PhD Carnegie Mellon, R&D Scientist, Abbott
- Guy Mongelli (BS, 2010), PhD Candidate, Case Western Reserve University
- Aaron McUmber (BS, 2009), PhD candidate University of Colorado—Boulder
- Aaron Gelinne (BS, 2008), MD candidate, University of Vermont
- Andrew Hilmer (BS, 2008), PhD MIT, postdoctoral researcher, Stanford University
- Helen Park (BS, 2008), PhD MIT, postdoctoral researcher, Naval Research Laboratory
- Derek Smith (BS, 2008), PhD MIT, R&D engineer, Proctor & Gamble
- James Viveros (BS, 2007), Manager, Market Insights at Xcenda
- Ben Lin (BS, 2007), PhD MIT, Engagement Manager at L.E.K. Consulting
- Adam Mayernick (BS, 2006), PhD Penn State, Project Leader, Shell
- Kristen Leskow (BS 2006, MS 2007), Scientist, Ironwood Pharmaceuticals

PUBLICATIONS, LECTURES & PRESENTATIONS

A) Refereed Publications
B) Patents
C) Dissertations
D) Invited Conference Presentations,
E) Departmental Colloquia / Seminar
F) Contributed Lectures
G) Contributed Posters
H) Media Listings
I) Other Publications and Public Appearances

A) Refereed Publications

Peer-reviewed publications are listed below in reverse chronological order. The majority were submitted as contributed works to journals spanning the fields of chemistry, physics, and engineering. A few of those listed are contributions to books or encyclopedia volumes. An asterisk (*) signifies invited works. Anthamatten's total citations and h-index were determined using Google Scholar on January 27th, 2016 and are summarized in the table below.

	Publications†	Total Citations	h-index
Career	46	877	17
University of Rochester	29	420	11

† The number of publications reflects two additional publications which are "in press" and two encyclopedia/ book entries that do not appear in the citation search.

– University of Rochester–

XX. M. Anthamatten, J. J. Ou, J. Weinfeld, S. H. Chen, "Enthalpy versus Entropy: What Drives Hard-particle Ordering in Condensed Phases?" *submitted*.

46.* Y. Meng, J. Jiang, M. Anthamatten, "Body Temperature Triggered Shape-Memory Polymers with High Elastic Energy Storage Capacity", *Journal of Polymer Science Part B: Polymer Physics, accepted (cover)*

45. R. Tao, M. Anthamatten, "Quenching Phase Separation by Vapor Deposition Polymerization", *Macromolecular Materials and Engineering*, **2016**, *301*, 99-109.

44. C. L. Lewis, Y. Meng, M. Anthamatten, "Well-Defined Shape-Memory Networks with High Elastic Energy Capacity", *Macromolecules*, **2015**, *48*, 4918-4926.

43. Y. Meng, M. Tsai, G. R. Schmidt, M. Anthamatten , "Gradient-Index Materials Based on Thiol-ene Networks" *ACS Applied Materials & Interfaces*, **2015**, *7*, 8601-8605.

42.* M. Anthamatten, "Hydrogen Bonding in Supramolecular Polymer Networks: Glasses, Melts, and Elastomers" in Supramolecular Polymer Networks, *Advances in Polymer Science*, **2015**, *268*, 47-99.

41. Y. Meng, J. Jiang, M. Anthamatten, "Shape Actuation via Internal Stress-Induced Crystallization of Dual-Cure Networks", *ACS Macro Letters*, **2015**, *4*, 115-118. *Editor Choice Award!*

40. Y. Meng, C. R. Fenoli, A. Aguirre-Soto, C. N. Bowman, M. Anthamatten, "Photoinduced Diffusion through Polymer Networks", *Advanced Materials*, **2014**, *26*, 6497-6502.

39. D. R. Harding, H. Goodrich, A. Caveglia, M. Anthamatten, "Effect of Temperature and Volume on the Tensile and Adhesive Properties of Photocurable Resins", *Journal of Polymer Science Part B: Polymer Physics*, **2014**, *52*, 936-945.

38. C. L. Lewis, K. Stewart, M. Anthamatten, "The Influence of Hydrogen Bonding Side-Groups on Viscoelastic Behavior of Linear and Network Polymers", *Macromolecules*, **2014**, *47*, 729-740.

37. R. Tao, M. Anthamatten, "Porous Polymers by Simultaneous Phase Separation and Vapor Deposition", *Macromolecular Rapid Communications*, **2013**, *34*, 1755-1760.

36. M. Anthamatten, J. Li, S. Roddecha, "Energy Storage Capacity of Shape-Memory Polymers", *Macromolecules*, **2013**, *10*, 4230-4234.

35. C. Lewis, M. Anthamatten, "Synthesis, Swelling Behavior, and Viscoelastic Properties of Functional Poly(hydroxyethyl methacrylate) with Ureidopyrimidinone Side-Groups", *Soft Matter*, **2013**, *9*, 4058-4066.

34. R. Tao, M. Anthamatten , "Condensation and Polymerization of Supersaturated Monomer Vapor", *Langmuir*, **2012**, *28*, 16580-16587.

33. S. Roddecha, Z. Dong, Y. Wu, M. Anthamatten, "Mechanical Properties and Ionic Conductivity of Electrospun Quaternary Ammonium Ionomers", *Journal of Membrane Science*, **2012**, *389*, 478-485.

32. J. Li, C. Lewis, D. Chen, M. Anthamatten, "Dynamic Mechanical Behavior of Photo-Crosslinked Shape-Memory Elastomers", *Macromolecules*, **2011**, *44*, 5336-5343.

31. A.G. Papastrat, T. Chu, M. Anthamatten, "Monomer Crystallization during Vapor Deposition Polymerization", *Chemical Vapor Deposition*, **2011**, *17*, 141-148.

30. S. Roddecha, M. Anthamatten, "Synthesis and Thermotropic Phase Behavior of Imidazole-terminated Liquid Crystals", *Liquid Crystals*, **2010**, *37*, 389-397.

29. J. Li, K.D. Sullivan, E.B. Brown, M. Anthamatten, "Thermally Activated Diffusion in Reversibly Associating Polymers", *Soft Matter*, **2010**, *6*, 235-238.

28. M.H. Wrue, A.C. McUmber, M. Anthamatten, "Atom Transfer Radical Polymerization of End-Functionalized Hydrogen Bonding Polymers and Resulting Polymer Miscibility", *Macromolecules*, **2009**, *42*, 9255-9262.

27. X. Chen, M. Anthamatten, "Solvent-Assisted Dewetting during Chemical Vapor Deposition", *Langmuir* **2009**, 25, 11555-11562.

26.* M. Anthamatten, K. K. S. Lau, "Vapor Deposition Polymerization", *Encyclopedia of Chemical Processing*, **2009.**

25.* Z. I. Green, X. Chen, A, Papastrat, L. Zou, M. Anthamatten, "Morphology of Vapor Deposited Polyimides Containing Copper Phthalocyanine", *Chemical Vapor Deposition* **2009**, *15*, 106-111.

24. L. Zou, S. Roddecha, M. Anthamatten, "Morphology, Hydration, and Proton Transport in Novel Sulfonated Polyimide-Silica Nanocomposites", *Polymer* **2009**, *50*, 3136-3144.

23. R. Beers, M. Anthamatten, D. Reid, S. A. Kahn, C. W. Lentz, "Development Of A Safety Device For Preventing Clothing Iron Contact Burns", *Journal of Burn Care and Research*, **2008**, December.

22. X. Chen, M. Anthamatten, "Vapor Deposition Polymerization of Poly(Methyl Methacrylate) in an Axisymmetric Vacuum Reactor", *Polymer*, **2008**, *49*, 1823-1830.

21. M. Anthamatten, "Phase Behavior Predictions for Polymer Blends Containing Reversibly Associating End-Groups", *Journal of Polymer Science: Part B: Polymer Physics*, **2007**, *45*, 3285-3299.

20. J. Li, J. A. Viveros, M. H. Wrue, M. Anthamatten, "Shape Memory Effects in Polymer Networks Containing Reversibly Associating Side-Groups", *Advanced Materials*, **2007**, *19*, 2851-2855.

19. L. Zou, M. Anthamatten, "Synthesis and Characterization of Polyimide-Polysiloxane Segmented Copolymers for Fuel Cell Applications", *Journal of Polymer Science: Part A: Polymer Chemistry*, **2007**, *45*, 3747-3758.

18. X. Chen, M. Anthamatten, D. Harding, "Vapor Deposition of Polybenzoxazole Precursors", *Macromolecules*, **2006**, 39, 7561-7565.

– Lawrence Livermore National Lab –

17. S. Letts, E. Fearon, M. Anthamatten, S. Buckley, C. King, and R. Cook, "Preparation of Polyimide Ablator Coatings Meeting the NIF Specifications", *Fusion Technology*, **2006**, 49, 714-720.

16. M. Anthamatten, S. A. Letts, K. Day, R. C. Cook, A.P. Gies, T.P. Hamilton, W.H. Nonidez, " An Investigation of Solid-State Amidization and Imidization Reactions in Vapor-Deposited Poly(amic acid)", *Journal of Polymer Physics: Part A: Polymer Chemistry*, **2004**, *42*, 5999-6010.

15. S.O. Kucheyev, T. E. Felter, M. Anthamatten, J.E. Bradby, "Deformation Behavior of Ion-irradiated Polyimide" *Applied Physics Letters*, **2004**, *85*, 733-735.

14. A. P. Gies, W. K. Nonidez, M. Anthamatten, R. C. Cook, "A Matrix Assisted Laser Desorption Ionization Time-of-Flight Mass Spectrometry Study of Imidization of Vapor Deposited ODA-PMDA Poly(amic acid)", *Macromolecules*, **2004**, *37*, 5923-5929.

13. M. Anthamatten, S. A. Letts, R. C. Cook, "Controlling Surface Roughness in Poly(amic acid) Films by Solvent Vapor Exposure", *Langmuir*, **2004**, *20*, 6288-6296.

12. R. Cook, M. Anthamatten, S.A. Letts, A. Nikroo, D. Czechowicz, "IR Absorptive Properties of Plastic Mandrels Used in ICF Capsules", *Fusion Science & Technology*, **2004**, *45*, 148-156.

11. S.A. Letts, M. Anthamatten, S.R. Buckley, E. Fearon, A.E.H. Nissen, R.C. Cook, "Progress Toward Meeting NIF Specifications for Vapor-Deposited Polyimide Ablator Coatings", *Fusion Science & Technology*, **2004**, *45*, 180-186.

10. A.P. Gies, W.K. Nonidez, M. Anthamatten, R.C. Cook, J.W. Mays, "Characterization of an Insoluable Polyimide Oligomer by Matrix Assisted Laser Desorption Ionization Time-of-flight Mass Spectrometry", *J. of Mass Spectroscopy, Rapid Communications*, **2002**, *16*, 1903-1910.

– Massachusetts Institute of Technology –

9. M. Anthamatten, J.S. Wu, and P. T. Hammond, "Direct Observation of a Smectic Bilayer Microstructure in Side-Chain Liquid Crystalline Diblock Copolymers", *Macromolecules*, **2001**, *34*, 8574-8579

8. M. Anthamatten, and P. T. Hammond, "A Free Energy Model of Side Chain Liquid Crystalline Diblock Copolymers", *Journal of Polymer Science B: Polymer Physics*, **2001**, *39*, 2671-2691.

7.* M. Anthamatten and P. T. Hammond, "Order-Disorder and Order-Order Transitions in Smectic C* Liquid Crystalline Diblock Copolymers", *Order in Anisotropic Materials*, ACS Books, Glaser, R. Ed.; **2000**, 32, 8066-8076.

6. M. Anthamatten and P. T. Hammond, "A SAXS Study of Microstructure Ordering Transitions in Liquid Crystalline Side-Chain Diblock Copolymers", *Macromolecules*, **1999**, *32*, 8066-8076.

5. M. Anthamatten, W.Y. Zheng, and P.T. Hammond, "A Morphological Study of Well-Defined Smectic Side-Chain LC Block Copolymers", *Macromolecules*, **1999**, *32*, 4838-4848

– University of Missouri - Columbia –

4. D. Ohlmann, H. Pritzkow, H. Gruetzmacher, M. Anthamatten and R. Glaser, "A Hexanuclear Copper Arylselenolate: Synthesis, Structure and Proposal for its Rearrangement", *J. Chem. Soc., Chem. Commun.*, **1995**, 1101.

3. R. Glaser, G.S. Chen, M. Anthamatten, C.L. Barnes, "Comparative Analysis of Crystal Structures of (E,E)-Configured Para-Substituted Acetophenone Azines with Halogen, Oxygen, Nitrogen, and Carbon Functional Groups", *J. Chem. Soc., Chem. Commun.*, **1995**, 1449-1458.

2. G.S. Chen, M. Anthamatten, C.L. Barnes, R. Glaser , "Stereochemistry and Stereoelectronics of Azines. A Solid State Study of Para-Substituted (H, F, Cl, Br, CN) Acetophenone Azines", *J. Org. Chem.*, **1994**, *59*, 4336.

1. G.S.Chen, M. Anthamatten, C.L. Barnes, R. Glaser, "Polymorphism and C=N-N=C Conformational Isomers of Azines: X-ray Crystal and Ab Initio Structures of Two Rotational Isomers of Methyl (para-Tolyl) Ketone Azine", *Angew. Chem., Int. Ed. Engl.*, **1994**, *33*, 1081.

B) Patents

4. Anthamatten M. L.; Meng, Y. "Shape-memory Polymers and Methods of Making and Use Thereof" Provisional Patent Filed June 5, **2015**. (62/171,675)

3. Anthamatten M. L.; Lewis, C. L.; Meng, Y. "Shape-memory Polymers and Methods of Making and Use Thereof" Provisional Patent Filed February 19, **2015**. (62/118,106)

2. Anthamatten M. L.; Li, J.; Lewis C. L. "Shape Memory Polymers" **2011**, US Patent Number 8,172,873.

1. Anthamatten M. L.; Li, J.; "Shape Memory Polymers" **2008**, US Patent Number 7,935,131.

C) Dissertations

i) Supervised

14. Ran Tao, “Porous Polymer by Vapor Deposition Polymerization”, Ph.D. Dissertation, University of Rochester, 2015.

13. Spencer Kingsbury, “Molecular Engineering of Comb Block Copolymers for Surface Lubrication”, M.S. Dissertation, University of Rochester, 2014.

12. Christopher Lewis, “Structure Property Relationships for Polymers Bearing Reversibly Associating Side-groups”, Ph.D. Dissertation, University of Rochester, 2014.

11. Alokendra Ghosh, “The Influence of Geometric Surfactants on the Phase Behavior of Hard Spheres and Spherocylinders”, M.S. Dissertation, University of Rochester, 2013.

10. Yuan Zhang, “Synthesis and Characterization of Thermal Reversible Diblock Copolymers”, M.S. Dissertation, University of Rochester, 2013.

9. Supacharee Roddecha, “Design and Synthesis of Novel Proton Conducting Electrolytes: Protogenic Liquid Crystals and Electrospun Quaternary Ammonium Ionomers”, Ph.D. Dissertation, University of Rochester, 2012.

8. Jiahui Li, “Polymer Networks Containing Reversibly Associating Side-Groups”, Ph.D. Dissertation, University of Rochester, 2011.

7. Kavya Ramachandra, “Design of Chemical Vapor Deposition Process to Grow Polymer Thin Films”, M.S. Dissertation, University of Rochester, 2011.

6. Alexander G. Papastrat, “Chemical Vapor Deposition of Thin Film Polymers”, M.S. Dissertation, University of Rochester, 2010.

5. Michelle Wrue, “Synthesis and Phase Behavior of End-functionalized Associating Polymers”, Ph.D. Dissertation, University of Rochester, 2010.

4. Lijun Zou, “Synthesis and Characterization of Nanostructured Sulfonated Polyimides for Proton Exchange Membranes”, Ph.D. Dissertation, University of Rochester, 2009.

3. Xichong Chen, “Fabrication of Structured Polymer Films Using Vapor Deposition Techniques”, Ph.D. Dissertation, University of Rochester, 2009.

2. Zachary I. Green, “Vapor Deposition Polymerization as a Route to Organic Electronic Devices”, M.S. Dissertation, University of Rochester, 2008.

ii) Written

1. Mitchell Anthamatten, “Order in Side-Chain Liquid Crystalline Diblock Copolymers”, Ph.D. Dissertation, Massachusetts Institute of Technology, 2001; Advisor: Professor Paula T. Hammond, Committee Members: Profs. Daniel Blankschtein, Gregory C. Rutledge, Edwin L. Thomas.

D) Invited Conference Lectures & Workshop Presentations

14. “Thermosets Containing both Permanent and Reversible Bonds”, APS March Meeting, San Antonio TX, March 2, 2015.
13. “H-bonding Polymers: from Glasses to Shape Memory Polymers”, American Chemical Society 248th National Meeting, San Francisco CA, August 13, 2014.
12. “H-bonding Polymers: from Glasses to Shape Memory Polymers”, American Chemical Society 248th National Meeting, San Francisco, August 13, 2014.
11. “Engineering Elastomers and Melts with Reversibly Associating Side-groups”, Baekland Symposium, Niagara Falls, Canada, June 25, 2013.
10. “Reversibly Association of Hydrogen-Bonding Motifs within Water-swollen Hydrogels”, American Chemical Society Annual Meeting, San Diego CA; March 27, 2012.
9. “Reversibly Associating Polymer Networks: Shape Memory & Transport Properties”, 10th New York Complex Matter Workshop; Ithaca NY; June 18, 2010.
8. “Engineering of Shape Memory Polymers: Influence of Reversibly Associating Groups on Mechanical Properties & Dye Diffusion”, Northeast ACS Regional Meeting; Potsdam NY; June 3, 2010.
7. “Network Polymers Bearing Reversibly Associating Side-Groups”, Northeast ACS Regional Meeting; Burlington VT; July 2, 2008.
6. “Unique Properties of Reversibly Associating Polymer Networks”, APS March Meeting; New Orleans, LA; March 10th, 2008.
5. “Dynamic Polymer Networks Containing Reversibly Associating Side-Groups”, 1st Annual Science & Engineering Faculty Day; St. Paul, MN; June 20, 2007.
4. “Macromolecular Self-Organization in the Melt State”, Materials Research Symposium; Rochester, NY; April 8, 2006.
3. “Solid-State Reaction Kinetics in Vapor Deposited Polyimide Films”, ACS Northeast Regional Meeting; Rochester, NY; November 1, 2004.
2. “Polyimide Block Copolymers for Fuel Cell Applications”, M. Anthamatten, Materials Issues for Fuel Cells Workshop, Alfred University, Alfred NY; October 14, 2004.
1. “Self-Assembly and Mesophase Behavior of Asymmetric Block Copolymers”, 7th Pacific Polymer Conference, Oaxaca, Mexico; December 6th, 2001.

E) Departmental Colloquia, Seminar & Guest Lectures

Titles of lectures are given followed by the name of the host, the hosting institution, and the date of the presentation. All lectures were publically announced colloquia. Lectures presented during my faculty search, in 2003, are denoted by asterisks.

23. “H-bonding Polymers: from Glasses to Shape-Memory Elastomers”, Prof. Niels Holten-Andersen, Massachusetts Institute of Technology, Program of Polymers and Soft Matter, December 10, 2014.
22. “H-bonding Polymers: from Glasses to Shape-Memory Elastomers”, Prof. Christopher Bowman, University of Colorado-- Boulder, Bowman Research Colloquia, March 6, 2014.
21. “Engineering Ion-Conductive Soft Materials for Energy Applications”, Prof. David McCamant, University of Rochester, Department of Chemistry, Physical Seminar, May 6, 2013.
20. “Engineering Ion-Conductive Soft Materials for Energy Applications”, Prof. Yiquan Wu, Alfred University, Materials Science and Engineering, November 15, 2012.
19. “Non-covalent Shape Quenching of Elastomers and Hydrogels”, Prof. Kenneth K. S. Lau, Drexel University, Chemical and Biological Engineering, April 20, 2012.
18. “Non-Covalent Shape Quenching of Elastomers”, Prof. Ron Preifer, Niagara University, Dept. of Chemistry, November 3, 2011.
17. “Enhanced Binding Cooperativity within Polymers, Networks, and Gels Containing Reversibly Associating Side-Groups”, Prof. Todd Krauss, University of Rochester, Rochester Advanced Materials Program, May 23, 2011.
16. “Bottom-up Engineering of Polymers, Networks, and Gels Containing Reversibly-Associating Side-Groups”, Prof. Anself Griffin, Georgia Institute of Technology, School of Polymer, Textile, and Fiber Engineering, October 4, 2010.
15. “Physical Properties of Network Polymers Bearing Reversibly Associating Groups”, Prof. Krystyn Van Vliet, Massachusetts Institute of Technology, Prog. of Poly. Sci. and Tech., March 11, 2009.
14. “A Transformer Elastomer: More Than Meets the Eye”, Prof. Michael Lewis, Saint Louis University; April 1, 2008.
13. “A Transformer Elastomer: More Than Meets the Eye”, Prof. Thomas M. Mitzel, Trinity College; September 28th, 2008.
12. “Physical Properties of Network Polymers Bearing Reversibly Associating Side-Groups”, Prof. Rainer Glaser, University of Missouri- Columbia; March 31, 2008.
11. “A Retrospective Rubber: More than Meets the Eye”, Prof. Patrick Mather, Syracuse University; February 8, 2008.
10. “A Shape Memory Effect Derived from Reversible Hydrogen Bonding”, Prof. Anthony Chianese, Colgate University; January 22, 2008.
9. “Dynamic Polymer Networks Containing Reversibly Associating Side-Groups”, Department of Chemical Engineering, Rose-Hulman Inst. of Tech; October 27, 2007.
8. “Vapor Deposition and Smoothing of Polyimides: an Elegant Approach to Surface Modification”; Prof. David Foster, Kodak, Corporate Research Colloquium, April 14, 2005.
7. “Solvent Vapor Smoothing - A New Approach to Surface Modification”, Prof. Stephan Jacobs, University of Rochester, LLE Science & Technology Seminar, February 18th, 2005.
6.* “Morphology and Mesophase in Side-Group Liquid Crystalline Block Copolymers”, Prof. William K. Nonidez, University of Alabama- Birmingham, Chemistry, Sept. 30, 2004.

5.* "Order in Liquid Crystalline Block Copolymers", Prof. Satish J. Parulekar, Illinois Inst. of Technology, Dept. Chem. Eng., Feb 28th, 2003.
4.* "Order in Liquid Crystalline Block Copolymers", Prof. Balaji Narasimhan, Iowa State University, Dept. Chem. Eng., Feb 7th, 2003.
3.* "Order in Liquid Crystalline Block Copolymers", Prof. Shaw Chen; University of Rochester, Dept. Chem. Eng., Jan 28th 2003.
2. "Experiments Aimed at Understanding Solvent-Vapor Smoothing of Polyimide NIF Targets", Dr. Thomas Felter; Materials Science & Technology Division, LLNL, July 18th, 2003.
1. "Order in Liquid Crystalline Block Copolymers", Prof. Micheal Rubner, MIT; Polymer Program of Science and Technology, September 27th, 2000.

F) Contributed Lectures

Contributed lectures include papers presented at national and regional scientific meetings and symposia. The majority were presented technical society meetings including the American Physical Society (APS), the American Institute of Chemical Engineering (AIChE), and the American Chemical Society. Presentations are listed in reverse chronological order, separated according to affiliation, and the presenting author is underlined.

– University of Rochester –

46. "Shape-Memory and Shape Actuation of Well Defined Thermoset Networks", M. Anthamatten, Y. Meng, C. Lewis, MRS Fall Meeting, Boston, MA; December 4, 2015.
45. "Quenching Phase Separation by Vapor Deposition Polymerization", R. Tao, M. Anthamatten, APS March Meeting; San Antonio, TX; March 3, 2015.
44. "Shape Actuation of Competitive Networks", Y. Meng, J. Jiang, M. Anthamatten, APS March Meeting; San Antonio, TX; March 2, 2015.
43. "Photo-induced Mass Transport through Polymer Networks", Y. Meng, M. Anthamatten, APS March Meeting; Denver, CO; March 2, 2014.
42. "Hydrogen Bonding in Poly(butyl acrylate) Melts and Elastomers", M. Anthamatten, C.L. Lewis, APS March Meeting; Denver, CO; March 3, 2014.
41. "Evidence of Phase Separation during Vapor Deposition Polymerization" R. Tao, M. Anthamatten, APS March Meeting; Baltimore, MD; March 21, 2013.
40. "Influence of Reversibly Associating Side Group Bond Strength on Viscoelastic Properties of Polymer Melts", C. Lewis, K. Stewart, M. Anthamatten, APS March Meeting; Baltimore, MD; March 20, 2013.
39. "Synthesis and Characterization of Poly(hydroxyethyl methacrylate) Hydrogels Bearing Reversibly Associating Side Groups", C. Lewis, J. Li, M. Anthamatten APS March Meeting; Boston, MA; February 28, 2012.
38. "Viscoelastic Properties of Photo-crosslinked Shape Memory Elastomer", J. Li, C.L. Lewis, D. L. Chen, M. Anthamatten, APS March Meeting; Dallas, TX; March 23, 2011.
37. "Vapor Deposition of Conjugated n-Type Polyimides", A. Papastrat, Thach Chu, M. Anthamatten, APS Annual March Meeting, Portland, OR, March 17, 2010.

36. "Photocrosslinkable Shape-Memory Elastomers Containing Hydrogen-Bonding Groups", J. Li, C. L. Lewis, M. Anthamatten, APS Annual March Meeting, Portland, OR, March 19, 2010.
35. "Electrospinning of an Alkaline Polymer Electrolyte", S. Roddecha, Z. Dong, Y. Wu, M. Anthamatten, APS Annual March Meeting, Portland, OR, March 19, 2010.
34. "Phenomenology of Polymer Thin Film Dewetting during Vapor Deposition Polymerization", M. Anthamatten, X. Chen, APS Annual March Meeting, Pittsburg, PA, March 19, 2009.
33. "Analysis of Diffusion through Dynamic Network Polymers using Multi-photon Fluorescence Recovery after Photobleaching", J. Li, K. Sullivan, E. Brown, M. Anthamatten, APS Annual March Meeting; Pittsburg, PA, March 19, 2009.
32. "Phase Behavior of Blends Containing End-Associating Polymers", M. Wrue, M. Anthamatten, AIChE Annual Meeting; Philadelphia, PA; November 17, 2008.
31. "A Study of Dewetting during Solvent-Assisted Vapor Deposition of Polymer Films", X. Chen, M. Anthamatten, AIChE Annual Meeting; Philadelphia, PA; November 20, 2008.
30. "Sulfonated Polyimide-Silica Proton Exchange Nanocomposites", M. Anthamatten, L. Zou, AIChE Annual Meeting; Philadelphia, PA; November 20, 2008.
29. "Vapor Deposition of Condensation Polymers for Organic Electronics", Z. I. Green, X. Chen, M. Anthamatten, AIChE Annual Meeting; Salt Lake City, UT; November 8, 2007.
28. "Fuel Cell Performance of Nano-Structured Sulfonated Polyimides", L. Zou, M. Anthamatten, AIChE Annual Meeting; Salt Lake City, UT; November 8, 2007.
27. "Novel Dynamic Polymer Networks Containing Reversible Hydrogen Bonding Side-Groups", J. Li, A. J. Hilmer, H.H. Park, M. Anthamatten, AIChE Annual Meeting; Salt Lake City, UT; November 6, 2007.
26. "Initiated Chemical Vapor Deposition of Poly(methyl methacrylate)", X. Chen, M. Anthamatten, 2007 APS Annual March Meeting; Denver, CO, March 7, 2007.
25. "Initiated Chemical Vapor Deposition of Poly(methyl methacrylate)", X. Chen, M. Anthamatten, 2007 APS Annual March Meeting; Denver, CO, March 7, 2007.
24. "Miscibility Studies on Blends Containing Telechelic Supramolecular Polymers", M. Anthamatten, M. Wrue, 2007 APS Annual March Meeting; Denver, CO; March 6, 2007.
23. "Shape-Memory Network Polymers Containining Reversible H-bonding Associating Groups" Jiahui Li, M. Anthamatten, 2007 APS Annual March Meeting; Denver, CO; March 6, 2007.
22. "Morphology and Proton Transport in Polyimide-Polysiloxane Segmented Copolymers", M. Anthamatten, Lijun Zou, 2007 APS Annual March Meeting; Denver, CO; March 5, 2007.
21. "Polybenzoxazole Films Fabricated Using Vapor Deposition Polymerization AIChE Annual Meeting", Xichong Chen, M. Anthamatten, AIChE Annual Meeting; Cincinnati, OH; November 2, 2005.
20. "Modeling of Phase Behavior of Polymer Blends Containing Linear Telechelic Supramolecular Polymers", M. Anthamatten, M. Wrue, AIChE Annual Meeting; Cincinnati, OH; November 2, 2005.
19. "Nanostructured Polyelectrolyte Membranes for Fuel Cells", M. Anthamatten, Rochester Fuel Cell Forum; Rochester, NY; October 22, 2005.

18. "Vapor Deposition of High Performance Polymers", M. Anthamatten, X. Chen, D. Harding, 16th Target Fabrication Specialists Meeting; Scottsdale, AZ; May 3, 2005.
17. "Chemical Vapor Deposition of Polybenzoxazole Precursor", M. Anthamatten, X. Chen, APS Annual March Meeting; Los Angeles, CA; March 25, 2005

– Lawrence Livermore National Laboratory –

16. "An Investigation of the Solid-State Condensation Polymerization Reactions in Vapor-Deposited Poly(amic acid)", M. Anthamatten, S.A. Letts, K. Day, R. Cook, A.P. Gies, W.K. Nonidez, APS Annual March Meeting, 2004; Montreal, Canada; March 23, 2004.
15. "Experiments Aimed at Understanding Solvent-Vapor Smoothing of Polymer Surfaces" M. Anthamatten, S. Letts, S. Buckley, A. Nissen, E. Fearon, R. Cook, 15th Target Fabrication Specialists Meeting; Gleneden Beach OR; June 1-5, 2003.
14. "Progress Toward Meeting NIF Specifications for Vapor Deposited Polyimide Ablator Coating", S. Letts, M. Anthamatten, S. Buckley, E. Fearon, A. Nissen, R. Cook 15th Target Fabrication Specialists Meeting; Gleneden Beach OR; June 1-5, 2003.
13. "Smoothing Polymer Surfaces by Solvent-Vapor Exposure", M. Anthamatten, S. Letts, R. Cook, APS Annual March Meeting; Austin, TX; March 2-6, 2003.
12. "Controlling Surface Roughness in Polyimide NIF Targets by Solvent-Vapor Exposure", M. Anthamatten, S. Letts, S. Buckely, A. Nissen, C. Chancellor, E. Fearon, and R. Cook, LLNL Postdoctoral Symposium, September 2002
11. "Control of Surface Roughness in Polymer Films by Solvent-Vapor Exposure" M. Anthamatten, S. Buckeley, C. Chancellor, A. Nissen, E. Fearon, S. Letts, R. Cook APS Annual March Meeting; Indianapolis, IN; March 20th, 2002

– Massachusetts Institute of Technology –

10. "Modeling the Phase Behavior of Liquid Crystalline Diblock Copolymers" M. Anthamatten, Paula T. Hammond, APS Spring Meeting; Seattle, WA; March 14th, 2001.
9. "Conformational Asymmetry in LC Block Copolymers: Theory and Experiment", M. Anthamatten, P.T. Hammond, AIChE Annual Meeting; Los Angeles CA; November 14th, 2000.
8. "Understanding Self-Assembly in Liquid Crystalline Diblock Copolymers", M. Anthamatten, P.T. Hammond, New England Quarterly Conference on Complex Fluids; MIT, Cambridge, MA; September 24th, 2000.
7. "Order Transitions in Side-Chain Liquid Crystalline Diblock Copolymers", M. Anthamatten and P.T. Hammond, APS Spring Meeting; Minneapolis, MN; March 20-24, 2000.
6. "Microphase and Mesophase Ordering in Side-Chain Liquid Crystalline Diblock Copolymers", P.T. Hammond and M. Anthamatten, MRS Fall Meeting; Boston MA; November 29- December 3, 1999.
5. "Morphology and Mesogen Orientation in Liquid Crystalline Side-Chain Diblock Copolymers", M. Anthamatten and P.T. Hammond, 73rd ACS Colloid and Surface Science Symposium; Cambridge MA; June 13-16, 1999.

4. "Morphology and Mesophase in Ferroelectric Liquid Crystalline Diblock Copolymers" M. Anthamatten and P.T. Hammond, APS Centennial Meeting; Atlanta, GA; March 20-26, 1999.

– University of Missouri- Columbia –

3. "*Ab Initio* Studies of Phenylacetic Acid Enolization and Effects of ortho-Diazonium Substitutions", M. Anthamatten and R. Glaser, Fifth Annual Argonne Symposium for Undergraduates in Science, Engineering, and Mathematics; Argonne National Laboratory; November 6, 1993.
2. "Stereochemistry of Para-Substituted Acetophenone Azines in the Solid State, in Solution, and in the Gas Phase", M. Anthamatten, G.S. Chen, and R. Glaser, Regional American Chemical Society Meeting; Columbia, MO; November 10, 1993.
1. "Stereochemical Analysis of Para-Substituted Acetophenone Azines in the Solid State, in Solution, and in the Gas Phase", M. Anthamatten, G.S. Chen, and R. Glaser. Fourth Annual Argonne Symposium for Undergraduates in Science, Engineering, and Mathematics; Argonne National Laboratory; November 6, 1993.

G) Contributed Posters

The list below includes contributed research posters presented at national and regional scientific conferences, as well as on-campus venues. Posters are listed in reverse chronological order, separated according to affiliation, and the presenting author is underlined.

– University of Rochester –

41. "Physical Property Requirements of Ion-exchange Polymer Membranes for Acid-base Flow Batteries", S. Roddecha, P. Thayer, J. Jorné, M. Anthamatten, APS March Meeting; Baltimore, MD; March 20, 2013.
40. "Reactivity of End-functionalized Polymers Containing Diels-Alder Functional Groups", Y. Meng, Y. Zhang, M. Anthamatten, APS March Meeting; Baltimore, MD; March 21, 2013.
39. "Ionic Conductivity of Imidazole-functionalized Liquid Crystal Mesogens", S. Roddecha, M. Anthamatten, APS March Meeting; Boston, MA; February 27, 2012.
38. "Simultaneous Vapor Deposition and Phase Separation of Polymer Films", R. Tao, M. Anthamatten, APS March Meeting; Boston, MA; February 27, 2012.
37. "Bipolar Membranes for Acid-Base Flow Batteries", M. Anthamatten, S. Roddecha, J. Jorné, A. Coughlan, APS March Meeting; Dallas, TX; March 22, 2011.
36. "Diffusive Transport through Reversibly Associating Polymers", M. Anthamatten, J. Li, K. Sullivan, E. Brown, Gordon Research Conference; Supramolecular Assemblies, Colby College, July 1, 2009.
35. "Dye Diffusion through Reversibly Associating Polymers using Multi-Fluorescence Recovery after Photo-bleaching", M. Anthamatten, J. Li, K. Sullivan, E. Brown 3rd Annual Science & Engineering Faculty Day; St. Paul, MN; June 17, 2009.

34. "Reactive Casting of Sulfonated Polyimides Proton Exchange Membranes", L. Zou, M. Anthamatten, The University of Rochester Fuel Cell Symposium, December 8, 2008.
33. "Synthesis & Characterization of Protogenic Liquid Crystals", S. Roddecha, M. Anthamatten, AIChE Annual Meeting; Philadelphia, PA; November 18, 2008.
32. "Phase Behavior of PS/PB/Toluene UCST Blends Containing End-Associating Polymers", M. H. Wrue, M. Anthamatten, 2nd Annual Science & Engineering Faculty Day; St. Paul, MN; June 18, 2008.
31. "Evidence of Phase Separation in Vapor Deposited Polyimide Films", M. Anthamatten, Z.A. Green, X. Chen, 2nd Annual Science & Engineering Faculty Day; St. Paul, MN; June 18, 2008.
30. "Mass Transport through Dynamic Polymer Networks Containing Reversibly Associating Side-Groups", J. Li, A. Hilmer, M. Anthamatten, H. Chung, J. McGrath APS March Meeting; New Orleans, LA; March 10, 2008.
29. "Phase Behavior of Polymer Blends Containing End-Associating Polymers", M. Wrue, M. Anthamatten, 2008 APS March Meeting; New Orleans, LA; March 10, 2008.
28. "Fabrication of Porous and Structured Polymers Using Vapor Deposition Techniques", X. Chen, M. Anthamatten, 1st Annual Science & Engineering Faculty Day; St. Paul, MN; June 20, 2007.
27. "Development of a Constitutive Model for Shape-Memory Polymers Containing Reversible H-bonding Associating Groups", J. Li, J. Viveros, M. Anthamatten APS Annual March Meeting; Denver CO, March 7, 2007.
26. "Sulfonated Polyimides for Fuel Cells", L. Zou, M. Anthamatten, Alternative Energy Conference in Rochester; Rochester, NY; June 26, 2006.
25. "Polyimide-Polysiloxane Segmented Copolymers for Fuel Cell Applications", L. Zou, M. Anthamatten, AIChE Annual Meeting; Cincinnati, OH; November 2, 2005.
24. "Interpenetrating Networks Containing a Supramolecular Polymer", M. Anthamatten, M.H. Wrue, A.P. Gies, D.M. Hercules, 2005 Polymers (West) Gordon Research Conference; Ventura, CA; January 11, 2005.
23. "Synthesis and Thermal Behavior of PEO-Based Supramolecular Polymers", M.H. Wrue, M. Anthamatten, ACS Northeast Regional Meeting; Rochester, NY; November 2, 2004.
22. "A Vapor-Deposition Route to Polybenzoxazoles", X. Chen, M. Anthamatten, ACS Northeast Regional Meeting; Rochester, NY; November 2, 2004.

– Lawrence Livermore National Laboratory–

21. "MALDI-TOF MS Characterization of Insoluble Polymers", A.P. Gies, W. Nonidez, S.T. Ellison, M. Anthamatten, L. Zou, D.M. Hercules, 2005 Polymers (West) Gordon Research Conference; Ventura, CA; January 11, 2005.
20. "Tailoring Properties of Polyimide by Ion Irradiation", T.E. Felter, M. Anthamatten, S. O. Kucheyev, MRS Fall Meeting, Symposium U; Boston, MA; December 1-5, 2003.
19. "The Physics and Phenomenology of Solvent Vapor Smoothing", M. Anthamatten, S.A. Letts, R.C. Cook, Directorate Review Committee; LLNL, Livermore, CA; November 13, 2003.

18. "A Spectroscopic Study of Curing of Vapor Deposited Poly(Amic Acid)", M. Anthamatten, K. Day, S. Letts, S. Buckley, A. Nissen, E. Fearon, R. Cook, 15th Target Fabrication Specialists Meeting; Gleneden Beach, OR; June 2, 2003.
17. "Oxygen Uptake by Plasma Polymer Materials", S. Letts, M. Anthamatten, R. Cook, A. Nikroo, & A. Greenwood, 15th Target Fabrication Specialists Meeting; Gleneden Beach, OR; June 2, 2003.
16. "IR Absorptive Properties of Plastic Materials Used in ICF Capsules", R. Cook, M. Anthamatten, S. Letts, A. Nikroo, D. Czechowicz, 15th Target Fabrication Specialists Meeting; Gleneden Beach, OR; June 3, 2003.
15. "Details of the Coating Process and Materials Properties for Vapor Deposited Polyimide", S. Letts, M. Anthamatten, S. Buckley, E. Fearon, A. Nissen, & R. Cook 15th Target Fabrication Specialists Meeting; Gleneden Beach, OR; June 3, 2003.
14. "A Spectroscopic Investigation of Vapor-Deposited Polyimide", K. Day, M. Anthamatten, S. Buckley, A. Nissen, C. Chancellor, E. Fearon, S. Letts, B. Cook Undergraduate Summer Research Poster Session; LLNL, Livermore, CA; August 8, 2002.
13. "Solvent Vapor Smoothing of Poly(amic acid) Surfaces", M. Anthamatten, S.A. Letts, R.C. Cook, Scientific Advisory Review Committee; LLNL, Livermore, CA; February 28, 2002.

– Massachusetts Institute of Technology –

12. "Liquid Crystal / Liquid Crystalline Diblock Copolymer Binary Blends", M. Anthamatten, A. A. Tamez, and P. T. Hammond, American Physical Society, Spring Meeting; Seattle WA; March 14, 2001.
11. "Ferroelectric Behavior of Liquid Crystalline Block Copolymers", M. Anthamatten, A A. Tamez, and P.T. Hammond, Gordon Research Conference on Polymer Physics; Connecticut College, New Haven, CT; August 2, 2000.
10. "Order Transitions in Side-Chain Liquid Crystalline Diblock Copolymers", M. Anthamatten, P.T. Hammond, Amoco Poster Session; MIT, Cambridge, MA; April 19, 2000. *Received Poster Award!*
9. "Self-Assembly in Liquid Crystalline Diblock Copolymers", M. Anthamatten, P.T. Hammond, M.I.T. Chemical Engineering Departmental Poster Session; Cambridge, MA; October 13, 1999.
8. "Polymeric Liquid Crystals Confined in Microphase Segregated Domains", M. Anthamatten, P. T. Hammond, Materials Day Poster Session; MIT Cambridge, MA; October 4, 1999.
7. "Liquid Crystalline Induced Morphologies in Amorphous Side-Chain LC Block Copolymers", M. Anthamatten, P. T. Hammond, ACS New Orleans National Meeting; New Orleans, LA, August 22, 1999.
6. "Order-Disorder and Order-Order Transitions in Smectic C* Liquid Crystalline Diblock Copolymers", M. Anthamatten, P. T. Hammond, ACS New Orleans National Meeting; New Orleans, LA; August 22, 1999.
5. "Overlap of Liquid Crystalline and Morphological Order in Diblock Copolymers", M. Anthamatten, W.Y. Zheng, and P. T. Hammond, M.I.T. Practice School Poster Session; Cambridge, MA; September 21, 1998.

4. "Order in Side-Chain Liquid Crystalline Diblock Copolymers", M. Anthamatten, K. Musselwhite, P. T. Hammond, 1st Annual PPST-Amoco Poster Competition; MIT, Cambridge, MA; November 5, 1997.
3. "Order in Liquid Crystalline Diblock Copolymers", M. Anthamatten, W.Y. Zheng, P. T. Hammond, M.I.T. Chemical Engineering Departmental Poster Session; Cambridge, MA; October 15, 1997.

– University of Missouri- Columbia –

2. "The Stereochemistry of Para-Substituted Acetophenone Azines in Solid State, Solution, and in the Gas Phase", M. Anthamatten, G.S. Chen, and R. Glaser, Organic Chemistry Regional Meeting; University of Missouri- Columbia; Spring, 1994.
1. "Stereochemistry of Azines in the Solid State, in Solution, and in the Gas Phase" M. Anthamatten, G.S. Chen, and R. Glaser, Poster Session ChemCY; Iowa State University- Ames; October, 1993.

H) Media Listings

Communication activities have consisted of interviews leading to direct media appearances, for example, through press releases, radio shows, or television excerpts. These events have spawned secondary media appearances through online venues with global reach. Primary press releases involving an interview are listed below, indicated by asterisks. Secondary events are also included below; however, the listing of secondary events is not, and will never be, complete.

19. Phys.org on "New self-stretching material developed", February 13, 2015 (Adapted from UR Communications Press Release)
18.* Audio / Podcast on "Rubber-like Materials Capable of Shape Actuation in the Absence of External Loads, *ACS Polymer Science Podcast*, February, 2015.
17.* Interview and Press Release: "New Self-Stretching Material Developed at University of Rochester", Peter Iglinski, University Communications, February 17th, 2015.
16.* WXXI Rochester Radio Talk Show, End-of-year Show : "*How will the Rochester Landscape be Different in 2040 based on Advances in your Field?*" Evan Dawson, WXXI December 31, 2014.
15.* Interview and Press Release: "Prof. Anthamatten Turns Vapors into Foam-Like Polymer Coatings", Peter Iglinski, *University Communications*, October 15, 2013.
14. Democrat & Chronicle, December 28, 2009. "UR developing shape-memory polymers that may help doctors, auto technicians" by James Goodman.
13. WXXI Rochester, News and Public Affairs, November 17, 2009, interview conducted by Peter Iglinski.
12.* Rochester Review, September-October 2009. "Engineering Redesigned". Interview conducted by Karen McCally.
11.* Radio appearance on "*in vivo*", a technical general interest show at M.I.T.'s WMBR 88.1 College Radio Station. Interview conducted by Anna Bershteyn
10. Rochester Review, March-April 2009. 12-13 "A Safer Way to Iron" by Kathleen McGarvey.

9.* Democrat & Chronicle, January 11, 2009. "Strong's burn center works to increase safety around irons" by Chris Swingle.

8.* Interview and Press Release: "Children's Burned Hands Inspire Design of Safety Device for Clothing Irons", December 12, 2008.

7. The Journal of Young Investigators, v 19 (2), August 2008—Special Issue: Scientific Breakthroughs of 2007 *"A rubber with a memory and its power to change science"* by Jeffrey Kost. [pdf]

6.* Rubber & Plastic News, February 11, 2008. *"Shape memory rubber may create new avenues in market "* by Susan Zimmerman. [pdf]

5. Industrial Plastic News & Application: *Shape Memory Rubber* February 20, 2008. (Adapted from UR Communications Press Release)

4. Online News Science Daily: *'Retrospective Rubber' Remembers Its Old Identities* December 16th, 2007. (Adapted from UR Communications Press Release)

3.* Interview and Press Release: *'Retrospective Rubber' Remembers Its Old Identities*. By Jonathan Sherwood, *University Communications*, December 5, 2007. [pdf]

2.* News 10 (Rochester) "*Preventing Iron Burns*" (5:00 News) February 7, 2005; Rochester NY (Anthamatten Lab, Gavett 238).

1.* R-News (Cable) Health Bits: "*Household Safety*". February 7, 2005; Rochester, NY (Anthamatten Lab, Gavett 238)

I) Other Publications and Public Appearances

2. "Diffusion through Reversibly Associating Polymer Networks", H. Park, M. Anthamatten, Journal of Undergraduate Research – University of Rochester, 2007, 6, 39-43.

1. Debate: Delta Upsilon Spring Lecture Series 2004, "Economics vs. Environmentalism", Rush Rhees Library (Prof. Steven Landsburg for Economics, Anthamatten for Environmentalism), Rochester NY,

SERVICE

A) Reviews of Manuscripts, Proposals, and Educational Materials
B) Consulting, Judging and other Forms of Service
C) Conference Service
D) Departmental & University Service
E) Community Outreach

A) Reviews of Manuscripts, Proposals & Educational Materials

Journal Article Review (>150 reviews written, currently ~ 2 per month)

- *ACS Applied Materials & Interfaces*
- *ACS Macro Letters*
- *ACS Nano*
- *Advanced Functional Materials*
- *Advanced Materials*
- *Analytical Chemistry*
- *Advances in Polymer technology*
- *Biomolecules*
- *Chemical Communications*
- *Chemical Engineering Science*
- *Fusion Technology*
- *Industrial and Engineering Chemistry Research*
- *Journal of Applied Polymer Physics*
- *Journal of Colloid and Interface Science*
- *Journal of Materials Chemistry*
- *Journal of Membrane Science*
- *Journal of Organic Chemistry*
- *Journal of Physics D: Applied Physics*
- *Journal of Poly. Sci: Part A: Polym. Chemistry*
- *Journal of Poly. Sci.: Part B: Polymer Physics*
- *Journal of Vacuum Science & Technology A*
- *Journal of Visualized Experiments*
- *Langmuir*
- *Macromolecular Rapid Communication*
- *Macromolecular Materials & Engineering*
- *Macromolecules*
- *MRS Communications*
- *Nanotechnology* (Inst. of Physics)
- *Nature*
- *Nature Communications*
- *Physical Chemistry Chemical Physics*
- *Polymer*
- *Polymer Chemistry*
- *Soft Matter*

Proposal Reviews (>70 total)

- *Romania, National Council for Scientific Research,* 2012-14, 3 reviews
- *Petroleum Research Fund,* 2014, 1 Reviews
- *NSF-DMREF Panel, Materials Genome Initiative,* 6-2013
- *NSFC (China) Mail Review,* 2009, 1 review
- *NSF-CBET Panel*, 10-2009, 8 reviews
- *NSF-CBET Review Panel*, May 13, 2009, 8 reviews
- *NSF-CBET Review Panel*, December 1-2, 2008, 9 reviews
- *NSF-CTS Review Panel*, June 21-23, 2006, 13 reviews
- *Department of Energy*, since 2006, 4 reviews
- *American Chemical Society (PRF)*, since 2006, 2 reviews
- *National Science Foundation Mail Review,* since 2006, 10 reviews

Educational Materials (3 total)

- Z. K. Avery, S. E. Landsberger, "Introduction to Renewable Energy: A STEM Project-Based Approach", Cengage Learning, reviewed 2014 (four chapters)
- G. Nellis, S. Klein, "Heat Transfer", Cambridge University Press, reviewed 2014 (two chapters)
- Welty, Wicks, Wilson, Rorrer, Fundamentals of Momentum, Heat, and Mass Transfer, 5th ed. John Wiley & Sons, reviewed 2008 (two chapters)

B) Consulting, Judging & other Forms of Service

- Materials Science Judge for *Siemen's Competition in Math, Science, & Technology*. Judging involves a 3-day trip. (2006-10, 2014-15)
- Consultant to Axinn, Veltrop and Harkrider LLP (2009, 10 hours)
- Consultant to Qinetic, North America (2011, 10 hours)
- American Chemical Society, Regional Division, Harrison Howe Award Committee (2007-14)
- Chapter Advisor, *Tau Beta Pi*, Engineering Honor's Society; participated as reader in 4 initiation ceremonies (biannual events from 2006-2012)
- Rochester Scholars: 2 week course "Energy & the Environment" (2004) & 1 week course "Adventures in Polymer Science" (2005-07)

C) Conference Service

Organization of Symposia and Conferences

- Organizer and Chair of the Rochester Advanced Materials Program (RAMP) annual symposium on "Bioinspired Interfaces" held on May 19, 2014. The symposium included four external speakers, six speakers from Univ. of Rochester, and a student poster session. Over 100 people attended.
- Organizer of "Polymers for Energy Application" involving three technical sub-symposia held at the annual AIChE meeting in Salt Lake City, UT, November 5-9, 2007.

Chairmanships at Symposia and Conferences

- Chairman, session on “Nanoscale Structure in Polymers III”, Annual Meeting, AIChE, Philadelphia, PA, November 16-21, 2008.
- Chairman, session on “Physical Properties of Melt and Solutions”, Annual APS March Meeting, New Orleans, LA, March 10-14, 2008.
- Chairman, session on “Thermodynamics of Polymers”, Annual Meeting, AIChE, Salt Lake City, UT, November 4-9, 2007.
- Chariman, session on “Structure & Dynamics in Polymer Nanocomposites”, Annual APS March Meeting, Denver, CO, March 5-9, 2007
- Chairman, session on “Phase Behavior”, Annual APS March Meeting, Montreal, Canada, March 3-7, 2004.
- Chairman, session on “Block Copolymers”, Annual APS March Meeting, Austin, TX, March 3-7, 2003.
- Chairman, session on “Block Copolymers”, Annual APS March Meeting 2002, Indianapolis, IN, March 18-22, 2002.

Societies & Professional Organizations

- American Physics Society
- American Chemical Society
- Materials Research Society
- American Institute of Chemical Engineers
- Tau Beta Pi

D) Departmental & University Service

Since joining the University of Rochester in 2004, Prof. Anthamatten has provided services to the Department of Chemical Engineering, Hajim School, and to the University. He has frequently assumed leadership positions and has contributed to various aspect of the department management including strategic planning, curriculum development, seminar series, event planning, graduate student recruitment and faculty recruiting. Major items are bulleted below.

- 2011-present: Director of Chemical Engineering Graduate Program
- 2012-present: Materials Science Curriculum Committee, currently committee chair
- 2013: Chaired the Chemical Engineering Strategic Planning Committee
- 2010-2015: Chaired two faculty search committees, served on two others
- 2007-2012: managed Chemical Engineering Seminar Series.
- 2006-2010: Served on the undergraduate program committee; led the departmental to prepare for the 2009 engineering accreditation board (ABET) evaluation and established engineering outcome assessment framework that is still used today.
- 2004-2010: Interdepartmental Program Committee, Hajim School
- 2008: Led the redesign of the departmental website; the revised website was used for five years.

Professor Anthamatten has served on several academic examination & thesis committees within and outside of Chemical Engineering.

PhD Final Defenses (39 total): Kejia Fang (OPT, 2016), Karan Mehrorta (ME, 2016), Zezuan Dong (MSC, 2014), Ziji Han (CHM, 2014); Jason Inman (BME, 2014), Yunzhe Jiao (CHM, 2014), Lenore Kubie (CHM, 2014), Javier Laporta (BME, 2014), Christopher Lewis (CHE, 2014), Mark Lifson (BME, 2014), Fen Qiu (CHM, 2014), Hsiang Ning Wu (CHE, 2014), George Arab (CHM, 2013), Mick Brown (OPT, 2013), Hsin-Yi Tsai (CHE, 2013), Taluza Vaidya (CHM, 2012), Weiqiang Wang (MSC, 2012), Minlu Zhang (CHE, 2012), Wei Xia (CHE, 2012), Jiahui Li (CHE, 2011), Xue Wei (CHE, 2011), Charles Bowman, (CHM, 2011), Todd Doran (CHM, 2011), Michelle Wrue (CHE, 2010), Yan Miller (CHM, 2010), Zhenmeng Peng (CHE, 2010), Lichang Zheng (CHE, 2010), Lisa Bonano (CHM, 2010), as well as 11 prior to 2010.

PhD Proposal Examination (23 total): Jin Liu (CHE, 2014), Yuan Meng (CHE, 2014), Debra Saulnier (CHE, 2013), Mike Baranello (CHE, 2012), Hsiang Ning Wu (CHE, 2011), Zexuan Dong (MSC, 2011), Mick Brown (OPT, 2011), Mark Lifson (BME, 2011), Weiqiang Wang (MSC, 2/2010), as well as 14 prior to 2010.

Master Thesis Defenses (15 total) : JingYing Guan (CHE, 2014), Ellen Sadri (ERG, 2014), Mary Ellen Cheico (CHE, 2013), Cong Fu (CHE, 2013), Mark Lifson (BME, 2013), Yuan Zhang (MSC, 2013), Minh Tran (CHE, 2012), Pavrithra Ramanarayanan (CHE, 2011), Kavya Ramachandra (CHE, 2011) Matt Smith (CHE, 6/2010), Hynsoo Lee (CHE, 8/2010) as well as 4 prior to 2010.

Numerous Master's Plan B Exit Exams (>30)

RESEARCH ACCOMPLISHMENTS

1. Overview of the Impact of Professor Anthamatten's Polymer & Soft Matter Research

Through his large body of scholarly work, demonstrating uniqueness and innovation, Professor Anthamatten has established himself as an authority in the fields of associating polymers, shape-memory polymers, and vapor deposition polymerization. Anthamatten has published over forty peer-reviewed works, including two book chapters. In addition, his research has resulted in two issued US patents with another two that have been filed and are under review. The majority of his publications and patents (> 30) have emerged from original research conducted at the University of Rochester since 2004. According to Google Scholar, as of January, 2016, his scholarly works have been cited over 870 times and have an h-index of 17. Four University press releases covering Anthamatten's research have been made, leading to broad dissemination of research into the media through interviews, radio appearances, podcasts, and televised news stories. Anthamatten has been frequently invited to present research talks at national conferences including the American Physical Society and American Chemical Society as well as to a range of departmental seminars and colloquia. In 2015, Anthamatten was invited to compose a chapter for the book series *Advances in Polymer Science* on the topic of supramolecular networks. This contribution has just been published and provides an overview of how hydrogen-bonds can be utilized to engineer polymer networks.

2. Research Accomplishments at the University of Rochester

Prof. Anthamatten's research group applies emerging developments from the fields of chemistry, physics, and soft matter to design and engineer advanced macromolecular and supramolecular materials. His group specializes in integrating reversible molecular interactions and chemical reactions into soft systems to control phase behavior and bulk physical properties (see Figure 1). Within this area, his group's research has realized new classes of polymers with novel shape-memory, self-healing, and ion-transport characteristics. In the past few years, they have developed novel semi-crystalline polymer networks into high performance shape-memory elastomers. The Anthamatten group has also advanced methods to prepare non-equilibrium structures. For example, the group demonstrated vapor-phase growth of conformal, porous polymer films that have potential applications in microelectronics packaging or the chemical separations industries. In the following pages, contributions to several areas will be highlighted.

Polymer Networks Containing Reversibly Associating Side-Groups. The Anthamatten Lab investigated structure-property relationships of polymer networks containing both covalent net points and reversibly associating (non-covalent) net-points. To achieve this architecture, H-bonding ureidopyrimidinones (UPy) were integrated into a polymerized elastomer network by copolymerization of a UPy-containing monomer with a conventional rubbery monomer (butyl acrylate) and a multifunctional crosslinker. The resulting material exhibits novel shape-memory properties whereby shape stabilization is attributed to the formation of temporary hydrogen-bonds. This study demonstrated how shape-memory can be derived exclusively from reversible interactions. At low temperatures net-points rearrange at a slow rate, and elastic strain can be preserved. However, at higher temperatures, net-points quickly reshuffle, allowing the material to revert to its permanent shape. The rate of shape recovery can be adjusted by changing temperature or by changing the density of hydrogen-bond groups.

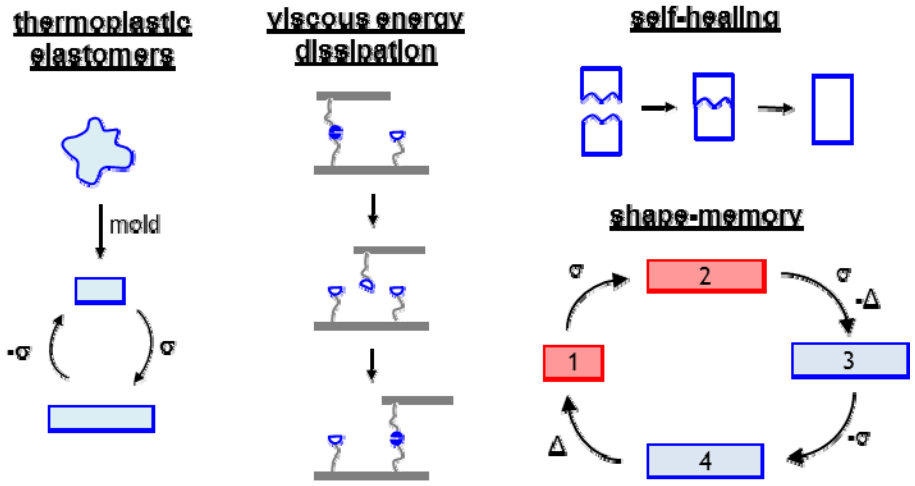

Figure 1. Examples of technologies that the Anthamatten group is pursuing by systematically introducing reversibly associating groups into soft materials.

By studying the rheological behavior of functional polymer melts containing different hydrogen-bonding functionalities, as well as hydrogels, the Anthamatten group has shown that some systems undergo hydrogen-bond dimerization but are incapable of storing mechanical stress. While these systems form a dynamic network, the side-group exchange rates are so fast that they do not influence chain relaxation. Research has shown that side-group molecular structure, polarity, microphase segregation, etc. often have a greater influence on viscoelastic properties than the extent of hydrogen-bonding dimerization.

Anthamatten's lab has also studied mass transport of small molecules and dyes within hydrogen-bonded dynamic networks. These experiments involved a collaboration with Prof. Ed Brown in the Department of Biomedical Engineering. Multiphoton Fluorescence Recovery After Photobleaching (MP-FRAP) techniques were applied to study dye transport through bulk phases of melt and network polymers. Small molecule transport kinetics were compared to the dynamics of viscous relaxation studied by steady-shear rheometery. The group found that H-bond association affects diffusion and viscosity in fundamentally different ways: small molecule transport is determined primarily by the fraction of associated dimers, whereas viscous relaxation is limited by the frequency of dissociation events.

Engineering of High Performance Shape-Memory Polymers. The last decade has witnessed enormous advances in the area of shape-memory polymers (SMPs) including the demonstration of new shape-memory triggers (e.g. light, magnetic fields, pH); multi-stage shape recovery; and two-way shape-memory effects. While envisioned applications typically require the SMP to perform mechanical work against external loads, researchers most often report simple shape-memory metrics (shape fixity and recovery ratios) and ignore discussion of the amount of elastic energy actually stored or released. Funded by a global medical device company, BSN medical, the Anthamatten group analyzed thermomechanical cycles from dozens of representative published reports and estimated the ability of different SMPs to store energy. Their analysis revealed several important material trends and pointed to promising materials for high performance shape memory applications.

To address the need of shape-memory polymers to perform greater amounts of mechanical work, the Anthamatten Group synthesized well defined poly(caprolactone) covalent networks and showed that the work capacity of shape-memory polymers can be significantly enhanced by controlling network architecture and chain connectivity. Their most "perfect" network, formed by a highly efficient thiol-acrylate Michael Addition reaction, showed exemplary shape-memory properties. This network is capable of storing in excess of 1.5 MJ/m^3 of elastic energy—a new record for samples deformed around 300% fixed strain.

A Shape-Memory Polymer Triggered by Body Temperature. The Anthamatten lab designed a shape-memory network with a lower crystallization / melting temperature such that body heat can trigger a shape recovery. The resulting material exhibited high shape fixity, high elastic energy storage capacity, and it can be easily deformed at room temperature whereby strain-induced crystals are formed, and these crystals stabilize the deformed shape. This resulting shape-memory polymer is ideal for a variety of applications including biotechnology and medical devices where a thermally-induced stress accumulation or attainment of physical work is desired. Examples may include bandages for compression, tourniquets, sutures, artificial skin, body-heat assisted medical or consumable dispensers, and so on.

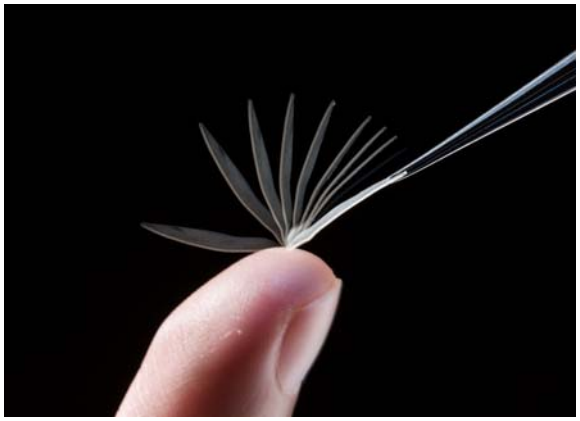

Figure 2. A shape-memory material can be deformed into a temporary shape that holds its form until it is triggered to revert to its permanent shape by application of heat, as shown in this multiple exposure photograph. The Anthamatten Group tuned such an elastomer to change its shape when heated to just beneath the human body temperature. Photo by J. Adam Fenster, University of Rochester

Self-Stretching Elastomers. The Anthamatten Group recently disclosed a new type of shape actuator that undergoes load-free, fully reversible, elastic elongation in programmed direction, upon cooling. Unlike two-way shape memory polymers, shape actuation does not require constant stress, and upon cooling the material self-elongates by over 15% strain, placing it in a class of only a few other known materials. Shape actuation is enabled by creating an internally stressed double network from a crystallizable polymer. Actuation is triggered as configurationally biased poly (caprolactone) chains undergo strain-induced crystallization. The material is very straightforward to prepare: acrylate chain ends of a three-arm poly(caprolactone) precursor are partially polymerized by thiol-ene chemistry to form a network with a fraction of dangling ends. While the material is stretched the dangling

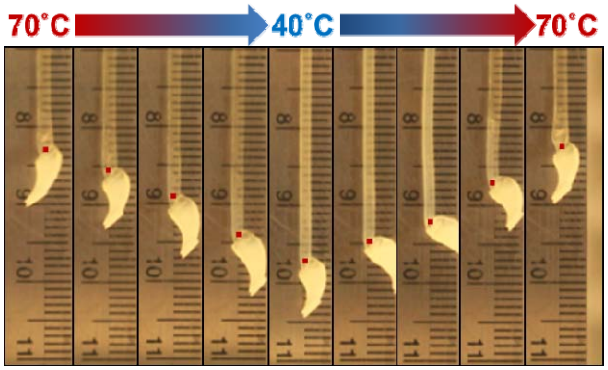

Figure 3. Self-stretching polymer fabricated in the Anthamatten lab. Successive images show reversible elongation upon cooling and retraction upon heating.

ends are polymerized. Light-induced rearrangement of crosslinks under stress can also be employed to prepare self-stretching elastomers. The research builds upon classical studies of liquid crystalline elastomers which are too soft for many applications. A provisional patent has been filed on this technology. One can envision numerous applications stemming from this material, especially in areas of biotechnology, artificial muscles, and robotic system designs.

Phase Behavior of Associating Polymers. A multitude of commodity polymers are created or modified through polymer blending. While polymer miscibility is largely determined by the interactions between polymer segments, subtle changes to polymer end-groups influence miscibility. Anthamatten developed a mean-field model to predict how polymer-polymer miscibility changes when polymers are functionalized with reversibly binding end-groups. Predicted phase diagrams illustrate the extent to which self-complementary interactions can stabilize two-phase regions, and how donor-acceptor interaction can stabilize single-phase regions. This model is a useful tool in understanding the delicate balance between the combinatorial entropy of mixing polymer chains, the repulsive interactions between dissimilar polymers, and the additional enthalpic and entropic changes due to end-group association of chain ends. To experimentally study phase-behavior, Anthamatten's group synthesized well-defined mono-functional and telechelic polystyrenes (PS) bearing associating end-groups. This was accomplished by using atom-transfer controlled free radical polymerization seeded with UPy-containing initiator, thus guaranteeing full end-group functionality. Light scattering and microscopy studies of prepared blends corroborate the model predictions. The ability to predict phase behavior will be valuable, not only in developing new miscible blends, but also in developing shape-memory and self-healing polymers.

Fabrication of Thermosets with a Gradient Refractive Index. Through a project that started from discussions with Prof. Duncan Moore in Optics, Anthamatten and students merged concepts from polymer chemistry with applied optics. They demonstrated a straightforward method to fabricate a Gradient-Index (GRIN) material by using a two-step (diffusion and photocuring) process. The method utilizes the recently popularized photoinduced thiol-ene coupling reactions which are capable of producing well-defined covalent networks (low light scatter) with low shrinkage during curing. These properties make thiol-ene and thiol-acrylate networks attractive for the fabrication of optical components. The resulting materials may find their way into a range of advanced optical components including disk shape lenses, sensors and lenslet arrays.

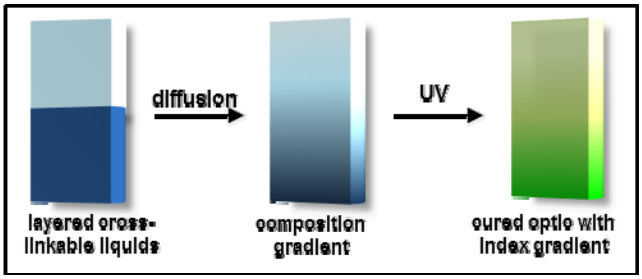

Figure 3. Two-step diffusion process developed by Anthamatten et al. to form GRIN optics. Such thiol-ene or thiol-acrylate networks can potentially meet many needs in advanced optical materials.

Photoresponsive Elastic Networks. Among adaptable materials, photo-responsive polymers are especially attractive as they allow for spatiotemporal stimuli and response. The Anthamatten Group developed a macromolecular network capable of photo-induced mass transport of covalently bound species. The system comprises of crosslinked chains that form an elastic network and photosensitive fluorescent arms that become mobile upon irradiation. Loosely crosslinked polymer networks were formed by Michael-Addition between multifunctional thiols and oligomers containing acrylate end-groups. The arms are connected to

the network by a special dynamic bond, allyl sulfide that undergoes addition-fragmentation chain transfer (AFCT) in the presence of free radicals, causing the release of diffusible fluorophore arms. The networks are loaded with photoinitiators to allow for spatial modulation of radical generation and the ensuing AFCT reactions. Fluorescence Recovery After Photobleaching (FRAP) experiments within bulk elastomers established correlations between the fluorophore's diffusion coefficient and experimental variable such as network architecture, temperature and UV intensity. Photo-induced mass transport between two contacted films is demonstrated, and release of fluorophore into a solvent is investigated using real-time UV-vis spectroscopy. Spatial and temporal control of mass transport could benefit a range of applications including drug release, printing, and sensing.

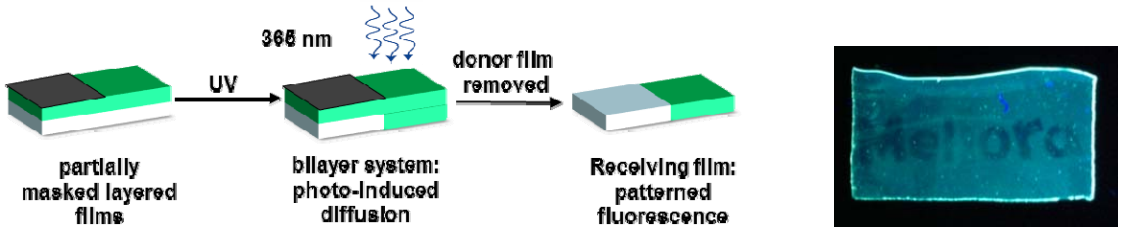

Figure 4. Method employed by the Anthamatten Group to demonstrate spatial-temporal photoinduced mass transport of dye molecules across a polymer interface. The image on the right shows that, by using a mask, dye can be directed to targeted regions.

Vapor Deposition Polymerization of Structured Coatings. Vapor deposition polymerization (VDP) is an alternative to melt-processing and solution-processing of polymer films. It is a one-step deposition-polymerization route to polymeric thin films with several advantages over conventional film processing. VDP is performed by the co-evaporation of two or more reactive monomers onto a substrate under vacuum conditions. It is a solventless process whereby film thickness is easily modulated; conformal coatings can be achieved down to the nanometer length scale; and resulting coatings are free of defects associated with solvent evaporation. VDP traditionally results in uniform, homogeneous films.

Anthamatten and coworkers have developed VDP as a controllable technique to produce porous and micro-structured polymer films. For example, if solvent-vapors are introduced to the process the solvent-polymer mixture dewets from the substrate, resulting in micron-scale islands of glassy polymer. Feature size can be easily tuned by adjusting the rate of deposition and the amount of solvent gas feed. In another example, composite films containing polyimide and copper phthalocyanine (CuPc) have been successfully grown, demonstrating that VDP can be used to influence and modify structure formation. Resulting films consist of a polyimide host with phase-separated CuPc regions that have a length scale of about 100 nm. CuPc is an established p-type semiconductor dye, and the stable morphology and high level of interfacial surface area in our vapor deposited films are potentially useful in developing polymer films as materials for photovoltaic or OLED devices. This direction represents a departure from traditional solution and melt-phase processing. New methods to produce micro-, meso-, and macroporous polymers will greatly benefit the fields of tissue engineering, photovoltaics, microelectronics, hydrogen storage, and gas separations.

Vapor Deposition of Porous Polymer. Recently, the Anthamatten group added a new dimension to vapor deposition of polymer films: control of porous polymer morphology. They were the first to demonstrate the VDP is capable of forming porous polymer coatings by employing an immiscible porogen. Experiments involved simultaneous condensation, polymerization, and phase separation to form conformal, macroporous polymer coatings. During film growth, the ripening of phase-separated domains is quenched by the formation of a polymer network. For each, the relationship between process conditions and the resulting pore-shape and size was evaluated. A range of applications are poised to benefit, including cushions for MEMS, gas sensor diffusion layers, catalytic supports, and laser fusion target capsules.

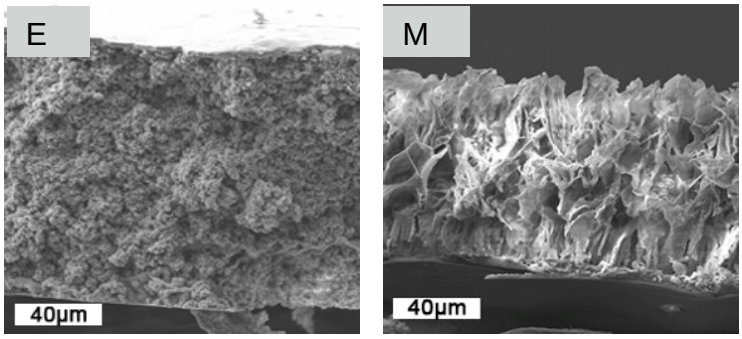

Figure 5. Examples of vapor-grown porous polymer films prepared in the Anthamatten Lab.

Nanostructured Ion-Conductive Membranes. Fuel cells offer efficient and direct conversion of stored chemical energy into valuable electricity. However, industry is hesitant to adopt polymer electrolyte membranes in fuel cells due to the deterrent cost of precious metal catalysts and fluorinated membranes such as Nafion®. The Anthamatten group has contributed toward advancing non-fluorinated ion-conductive membranes. For example, they engineered nanostructured ion-containing polyimides that contain silica domains. The silica domains act as covalent net points and prevent excessive swelling, but they also help draw water into the membrane to keep it hydrated. They have also examined anhydrous proton transport across imidazole-containing materials, including liquid crystalline materials. Membranes offering anhydrous proton transport could serve at higher temperatures where fuel cell reactions are more efficient, lessening the need for precious metal catalysts.

Acid-Base Flow Battery. Interacting with Prof. Jacob Jorné, the Anthamatten Group also demonstrated proof-of-concept for a novel rechargeable flow battery that is based on acid-base neutralization where protons and hydroxyl ions react electrochemically to produce water. The concept is simple and efficient because it is based on the highly reversible hydrogen electrode; and, therefore, it can potentially preclude the use of precious metal electrocatalysts. It is low-cost and it completely avoids heavy metal electrolytes. The team assembled a batch reactor showed how it can be charged (generating acid and base) and electrochemically discharged (causing neutralization) to recoup stored energy.

3. Future Research Direction

Shape-Memory Surfaces for Scalable Nanomanufacturing. Anthamatten was recently awarded a four year NSF grant as lead PI with co-PIs Alexander Shestopalov and John Lambropoulos. With this award, a team of researchers at the University of Rochester will develop a scalable and versatile contact printing process to broadly benefit nanomanufacturing of high-resolution displays, photonics, sensors, and devices. Compared to conventional nanofabrication processes, nanoscale-printing potentially requires less energy, relies on

inexpensive processing tools and generate less waste. A multidisciplinary team will mold responsive shape-memory polymers into patterned surfaces and relate interfacial adhesion to surface microstructure, bulk mechanical properties, and contact load and temperature history. By optimizing the surface's ability to switch adhesion, research could also enable transformative technologies including flow-switchable micro-fluidics, switchable medical adhesives, cell culture and tissue growth templates, and simplified demanufacture of intricate devices to recover materials for recycle or reuse. With an improved understanding of how shape-memory controls material transfer, investigators will optimize printing parameters to obtain robust transfer of inorganic and organic thin films on a large scale. To conclude the project, researchers will team with an industrial partner (eMagin) to apply shape-memory contact printing by manufacturing working organic light emitting diode microdisplays.

Polymer and Supramolecular Networks for Gas Separation. Membrane separations as an efficient and sustainable alternative to energy intensive separation processes such as distillation or absorption. State-of-the-art thermal rearrangement (TR) and polymers of intrinsic microporosity (PIM) membranes suffer from aging issues. Aging involves the collapse of micropores and typically lowers membrane throughput and selectivity. Gas transport through well-defined polymer and supramolecular networks will be studied to advance gas separation membranes and optimize their performance. Using molecular simulation, theory, and experiment, well-defined polymer networks will be optimized to provide: (i) chain mobility and free volume for high-throughput gas transport and (ii) a uniform distribution of free volume hole-sizes to tune the interaction between the membrane matrix and permeant gas molecules. Networks will be examined both above and below their glass transition temperatures.

Hard Particle Ordering and Geometrical Surfactancy. The topic of hard-particle ordering has received renewed attention because of potential applications in the fields of biomedicine, catalysts, and optoelectronics. Prof. Anthamatten has started a collaboration with Prof. Chen to perform computational modeling and analysis to predict the phase behavior, ordering transitions, and thermodynamic properties of hard particles and mixtures thereof. In spite of frequent reports of entropy-driven hard particle ordering, they have recently explained that hard-particle ordering between equilibrium states must be driven by a loss in enthalpy through volume reduction that outweighs an entropic loss upon ordering. Future research will aim to establish and quantify the thermodynamic drivers that are behind experimental observations of hard molecular and colloidal systems. For example, Prof. Chen has observed that blends of non-polar rod-like molecules with sphere-like molecules can be stabilized by the addition of molecular shape-dyads that contain both the rod and sphere components bound by a flexible spacer.

4. Brief Description of Research Accomplishments Prior to University of Rochester

Order in Side-Chain Liquid Crystalline Diblock Copolymers. Anthamatten completed his PhD in Chemical Engineering at MIT in 2001 under the mentorship of Prof. Paula Hammond. There, he studied side-chain liquid crystalline block copolymers (SCLCBCs). These materials self-assemble on multiple length scales: at the molecular scale, liquid crystalline side-groups form an ordered mesophase, and, at larger length scales, the polymer's two blocks phase segregate into liquid crystal and amorphous glassy domains. The thesis objective was to understand the interplay between these two types of order. Anthamatten synthesized a series (>20) of SCLCBCs and, he characterized their resulting morphologies and their thermotropic

behavior. Order-disorder and order-order block copolymer transitions were located and compared to the liquid crystal isotropization temperatures. A free energy model that considered the interaction between LC moieties, interfacial surface energy, the stretching of polymer chains from interfaces, and elastic deformation of LC mesophases was developed to explain experimental results. These studies generated a large amount of experimental data, that revealed the conditions where LC ordering overrules block copolymer ordering and vice versa. The data and the physical explanations reported in these studies have been cited numerous times (>200).

Vapor Deposition and Smoothing of Polyimide. Anthamatten was a postdoctoral researcher from 2001-2003 at Lawrence Livermore National Lab (LLNL) and was promoted to a staff scientist in 2003. At LLNL, working closely with his mentors Dr. Robert Cook and Dr. Stephen Letts, he refined technology to vapor-coat thick polyimide coatings (60 um) onto spherical mandrels to fabricate laser fusion targets. Anthamatten conducted fundamental studies on curing of vapor deposited polyimide; and he developed a smoothing technology whereby polymer surfaces were temporarily swollen by exposure to solvent vapors, permitting surfaces to smooth. Together, the coating and smoothing technologies enabled polyimide laser fusion targets to be fabricated as spherical shells with remarkably low roughness and high symmetry.

TEACHING ACCOMPLISHMENTS, PHILOSOPHY, AND STYLE

Accomplishments. Since joining the University of Rochester in 2004, Anthamatten has instructed four courses, two at the undergraduate level and two at the graduate level. Graphs of annual enrollment and course & instructor evaluations are provided in Figures 6 and 7.

At the undergraduate level, Anthamatten taught ChE 244: Heat and Mass Transfer, from 2004-2010. This is a rigorous chemical engineering core course where students learn to convert engineering problems into solvable math problems. During this time, the undergraduate

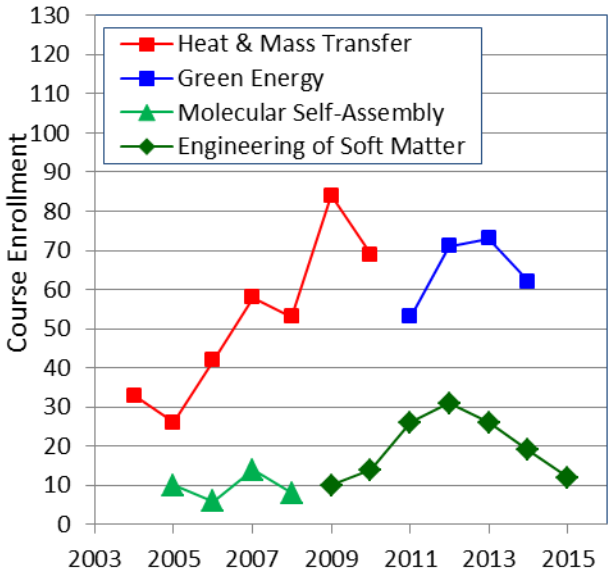

Figure 6. Annual course enrollment for courses instructed by Anthamatten.

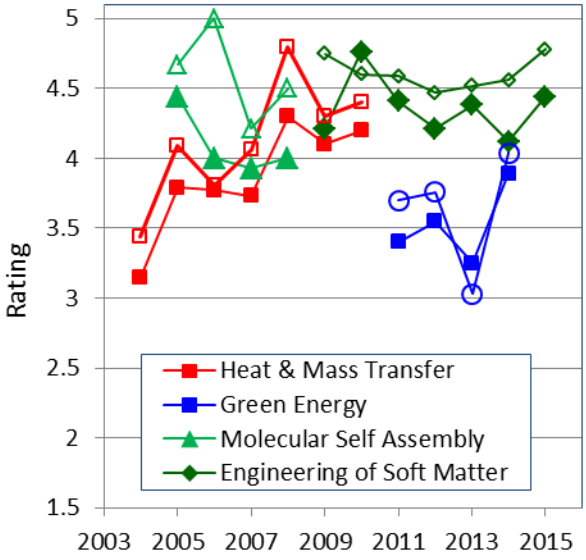

Figure 7. Course evaluation results for courses instructed by Anthamatten: solid symbols are the overall course rating and open symbols are the instructor ratings.

enrollment in the class tripled, and feedback form student course evaluation steadily improved from just above 3.0 to beyond the 4.0 level. Since 2011, Anthamatten has taken charge of ChE 150, Green Energy. This critically important course introduces students to chemical engineering concepts by discussion energy generation, distribution, and consumption issues. About 50-70 freshman take the course each year, and it is intended to excite students and provide them a "hook" to the engineering experience.

At the graduate level, Anthamatten initially developed a course ChE 413: Molecular Self Assembly that was offered from 2005-2008. This course provided an overview of how non-covalent interactions such as hydrogen-bonding, ionic interactions, and van der Waals forces can be utilized in the design of organic materials, for example associating polymers, liquid crystals, self-assembled monolayers, etc. In 2009 Anthamatten implemented a major revision of the course, in order to increase its appeal to students in other disciplines. The revised course, ChE 413: Engineering of Soft Matter, is still taught and covers more fundamental materials science aspects including viscoelasticity, phase transitions, glass formation, polymer physics, liquid crystallinity, and supramolecular self-assembly. This course has consistently received positive feedback through course evaluations.

Teaching Philosophy. For incoming students, the university experience should be a fruitful and formative time to acquire new knowledge and insight and to broaden one's perspective. The primary role of a professor is to guide students through this learning process by providing a clear and logical, objective-based learning framework. Anthamatten seeks to actively engage students. It is imperative for an instructor to be flexible, able to identify and take advantage of learning opportunities, and able to tailor classroom instruction to individual student needs. Moreover, the university setting marks the beginning of a life-long learning process. There, students and teachers should be able to freely share thoughts and opinions. Finally, all involved should exhibit open-mindedness, trust, and mutual respect for one another. All of Anthamatten's teaching content and activities center about a few course objectives. These objectives are geared toward addressing the course topic in a fashion that is in tune with the departmental mission. All homework assignments, projects, and exams support course objectives as learning exercises and assessment tools.

Anthamatten is a firm believer in teaching students how to take charge of their own learning, and his classes promote a culture of life-long learning and scientific curiosity. Students are asked to look up references on the web, to perform "back-of-the-envelope" calculations to quickly assess a problem, or to explain a newly learned concepts to fellow students within small groups. Students are also encouraged to join professional organizations and societies such as the American Chemical Society, or the American Institute of Chemical Engineers. Life-long learning is also encouraged through term projects. For example, in ChE 413, students must independently learn and apply soft matter concepts by proposing and defending an application-oriented material development project or a fundamental scientific study. The experience requires extensive literature review, a progress report, and a final presentation / report, demanding an immense amount of instructional time. To take advantage of the diverse student backgrounds, a new pedagogical approach has been explored that immerses students into multidisciplinary peer-review of their independent projects. Students take part in a review panel (inspired by the NSF panel review process) where they must agree and discuss on a panel assessment statement. This activity was piloted in Spring, 2013 and has been repeated twice with unambiguously positive student feedback.

Teaching Style. Anthamatten divides his contact time with students into formal lectures, informal recitations, and one-on-one interactions. Formal lectures serve as incremental steps toward achieving course objectives. Each 75-minute lecture revolves around one or two central ideas. These ideas are first discussed in theory through derivations and physical / mathematical proofs. Then, they are further explored using real-life examples and in-class demonstrations. During lectures, Anthamatten welcomes student questions and he encourages participation by prompting the audience. He strives to view technical concepts from a student's perspective to better communicate his own perspectives and experiences. Formal lectures typically involve a combination of traditional blackboard combined with PowerPoint viewgraphs that are made available after class. Anthamatten finds that "chalk talks" are effective in establishing a comfortable lecture pace. Weekly recitation periods are used to illustrate the application of newly learned engineering principles. Recitations are intended to be casual and follow the principles the Socratic Method. This is done to provide a student-centered learning atmosphere that encourages students to identify different approaches to the problems posed in class and during discussion. Anthamatten holds weekly office hours to allow for one-on-one interaction, and he encourages his teaching assistants to do the same.

Recently, Anthamatten has experimented with on-line learning tools to facilitate pre-lecture learning. In his freshman course, Green Energy, Anthamatten uses Cengage's MindTap tool. Students are asked to complete short quizzes (not graded) that assess how well they have understood the assigned reading materials.

To help students visualize the underlying physical phenomena, in-class demonstrates are periodically conducted. These demonstrations typically connect newly learned engineering concepts to simple observations made in everyday life, and they are *simple*. For example, silly putty is used to demonstrate viscoelasticity, the contents of baby diapers (spheres of poly(acrylic acid)) placed in water show how polymers can swell in a solvent, and super-saturated solutions are nucleated by dropping a seed crystal to discuss nucleation and growth. More recently, YouTube videos are effective at demonstrating concepts that are too complex to execute in the classroom, and they appear to be just as effective as real-life demonstrations.