

RICHARD A. REGISTER

Department of Chemical and Biological Engineering, Princeton University, Princeton, NJ 08544-5263
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Research Interests: synthesis, morphology, properties, and dynamics of structured polymeric materials, in bulk and in thin films, particularly block copolymers, polymer blends, semicrystalline polymers, and ionomers; chemically-recyclable polymers; polymeric separation membranes; polymer phase transitions; rheology of associating polymers; nanopatterning and nanofabrication; applications of small-angle scattering.

Born: September 6, 1963; Cheverly, Maryland

Education: University of Wisconsin - Madison
Ph.D. Chemical Engineering, 1989 (with Stuart L. Cooper)
Massachusetts Institute of Technology
M.S. Chemical Engineering Practice, 1985
S.B. Chemical Engineering, 1984
S.B. Chemistry, 1983

Professional Appointments:

7/00-present Professor of Chemical and Biological Engineering (CBE), Princeton University
Eugene Higgins Professor of Chemical and Biological Engineering (7/12-present)
Chair, Department of Chemical and Biological Engineering (7/08-6/16; Acting Chair, 2/20-8/20)
Director, Princeton Center for Complex Materials (9/05-11/08); Associate Director (9/03-8/05)
Member, Princeton Institute for the Science and Technology of Materials (11/03-present)

7/96-6/00 Associate Professor of Chemical Engineering, Princeton University
Director of Graduate Studies, Chemical Engineering (7/98-6/03; also for CBE, 7/20-6/21)
Visitor, Exxon Corporate Research Laboratories (9/97-2/98, sabbatical leave)

1/90-6/96 Assistant Professor of Chemical Engineering, Princeton University

Honors:

School of Engineering and Applied Science (SEAS) Distinguished Teacher Award, 2018 (one per year in SEAS)
Princeton Engineering Council Excellence in Teaching Award, 2018 (for CBE 544, Spring 2017)
Fellow, American Institute of Chemical Engineers, 2014
Fellow, American Chemical Society, 2012
Graduate Mentoring Award, Princeton University, 2008
Charles M.A. Stine Award, Materials Engineering and Sciences, American Institute of Chemical Engineers, 2002
Fellow, American Physical Society, 2001
National Science Foundation Young Investigator Award, 1992-1997
NEC Preceptor in the School of Engineering and Applied Science, 1993-1996
DuPont Young Professor, 1993-1996
Unilever Award for Outstanding Graduate Research in Polymer Chemistry, American Chemical Society, 1992
Emerson Electric Company Faculty Advancement Award in Engineering, 1990
Fannie and John Hertz Foundation Fellowship, 1987-89
S.C. Johnson and Son Research Fellowship, 1986-87
Wisconsin Alumni Research Foundation Fellowship, 1986
Rockwell International Graduate Fellowship, 1984
Robert T. Haslam Cup for Outstanding Professional Promise, MIT Chemical Engineering, 1984
Chevron Scholarship, 1983-84; Phi Beta Kappa, 1983; Tau Beta Pi, 1983
Presidential Scholar, Maryland, 1980

Professional Affiliations and Activities:

American Chemical Society, Board Committee on the Petroleum Research Fund, Polymer Science (2017-2022)
Scientific Advisory Board, Braskem (2014-2018, inaugural member)
Chair, Gordon Research Conference on Polymer Physics (2016)
Condensed Matter and Materials Research Committee, National Research Council (2008-2011)
Current Editorial Board Member: *Materials Science and Engineering R* (2007-present); Current Editorial Advisory Board Member, *Journal of Polymer Science* (2001-present, initially as *JPS-B*); *Polymers for Advanced Technologies* (1995-present); *Polymer* (2002-present); *Polymer Crystallization* (2018-present); *Giant* (2020-present); *Macromolecules* (2004-2006; 2019-2021); *ACS Macro Letters* (2019-2022)
American Physical Society (Division of Polymer Physics, DPOLY: Publications Committee, 1998-2001; DPOLY Vice-Chair 2002, Chair-Elect 2003, Chair 2004, Past Chair 2005; Fellowship Committee, 2018-2020)
American Chemical Society (Division of Polymer Chemistry, Events Committee Chair and Board Member, 1990-1992; Division of Polymeric Materials Science and Engineering, Member-at-Large and Executive Committee Member, 1993-1996 and 1998-2001, Technical Program Co-Chair, 1996-1998)
American Institute of Chemical Engineers (Princeton Student Chapter Advisor, 1990-1995; Materials Engineering and Sciences Division (MESD), Stine Award Selection Committee, 2002-2006, and MESD Director, 2004-2006)
Materials Research Society (*MRS Bulletin* 2007 Volume Organizer)
Society of Plastics Engineers, Society of Rheology, Sigma Xi

RICHARD A. REGISTER - SCIENTIFIC PUBLICATIONS

Journal Articles

- 1) Ding, Y.S., R.A. Register, M.R. Nagarajan, H.K. Pan, and S.L. Cooper, "EXAFS Analysis of Plasticized Zinc-Neutralized Sulfonated Polystyrene Ionomers", *J. Polym. Sci. B: Polym. Phys.*, **26**, 289-300 (1988).
- 2) Lee, D.-c., R.A. Register, C.-z. Yang, and S.L. Cooper, "Methylenebis(*p*-phenyl isocyanate)-Based Polyurethane Ionomers. I. New Small-Angle X-Ray Scattering Model", *Macromolecules*, **21**, 998-1004 (1988).
- 3) Lee, D.-c., R.A. Register, C.-z. Yang, and S.L. Cooper, "Methylenebis(*p*-phenyl isocyanate)-Based Polyurethane Ionomers. II. Structure-Property Relationships", *Macromolecules*, **21**, 1005-1008 (1988).
- 4) Register, R.A., M. Foucart, R. Jérôme, Y.S. Ding, and S.L. Cooper, "Structure-Property Relationships in Elastomeric Carboxy-Telechelic Polyisoprene Ionomers Neutralized with Divalent Cations", *Macromolecules*, **21**, 1009-1015 (1988); correction, **21**, 2652 (1988).
- 5) Ding, Y.S., S.R. Hubbard, K.O. Hodgson, R.A. Register, and S.L. Cooper, "Anomalous Small-Angle X-Ray Scattering from a Sulfonated Polystyrene Ionomer", *Macromolecules*, **21**, 1698-1703 (1988).
- 6) Register, R.A., and S.L. Cooper, "Smearing Effects in 'Pinhole' Collimation with One-Dimensional Detection", *J. Appl. Crystallogr.*, **21**, 550-557 (1988).
- 7) Register, R.A., A. Sen, R.A. Weiss, and S.L. Cooper, "Effect of Thermal Treatment on Cation Local Structure in Manganese-Neutralized Sulfonated Polystyrene Ionomers", *Macromolecules*, **22**, 2224-2229 (1989).
- 8) Ding, Y.S., R.A. Register, C.-z. Yang, and S.L. Cooper, "Synthesis and Characterization of Sulphonated Polyurethane Ionomers Based on Toluene Diisocyanate", *Polymer*, **30**, 1204-1212 (1989).
- 9) Ding, Y.S., R.A. Register, C.-z. Yang, and S.L. Cooper, "Small-Angle X-Ray Scattering from Sulphonated Polyurethane Ionomers Based on Toluene Diisocyanate", *Polymer*, **30**, 1213-1220 (1989).
- 10) Ding, Y.S., R.A. Register, C.-z. Yang, and S.L. Cooper, "Effect of Cation Local Structure on the Physical Properties of Sulphonated Polyurethane Ionomers Based on Toluene Diisocyanate", *Polymer*, **30**, 1221-1226 (1989).
- 11) Li, C., R.A. Register, and S.L. Cooper, "Direct Observation of Ionic Aggregates in Sulphonated Polystyrene Ionomers", *Polymer*, **30**, 1227-1233 (1989).
- 12) Register, R.A., A. Sen, R.A. Weiss, C. Li, and S.L. Cooper, "Morphology and Cation Local Structure in a Blend of Copper-Neutralized Carboxy-Terminated Polybutadiene and Poly(styrene-*co*-4-vinylpyridine)", *J. Polym. Sci. B: Polym. Phys.*, **27**, 1911-1925 (1989).
- 13) Register, R.A., X.-h. Yu, and S.L. Cooper, "Effects of Matrix Polarity and Ambient Aging on the Morphology of Sulfonated Polyurethane Ionomers", *Polym. Bull.*, **22**, 565-571 (1989).
- 14) Register, R.A., and S.L. Cooper, "Anomalous Small-Angle X-ray Scattering from Nickel-Neutralized Ionomers: 1. Amorphous Polymer Matrices", *Macromolecules*, **23**, 310-317 (1990).
- 15) Register, R.A., and S.L. Cooper, "Anomalous Small-Angle X-ray Scattering from Nickel-Neutralized Ionomers: 2. Semicrystalline Polymer Matrices", *Macromolecules*, **23**, 318-323 (1990).
- 16) Register, R.A., S.L. Cooper, P. Thiyagarajan, S. Chakrapani, and R. Jérôme, "Effect of Ionic Aggregation on Ionomer Chain Dimensions: 1. Telechelic Polystyrenes", *Macromolecules*, **23**, 2978-2983 (1990).
- 17) Register, R.A., G. Pruckmayr, and S.L. Cooper, "Effect of Ionic Aggregation on Ionomer Chain Dimensions: 2. Sulfonated Polyurethanes", *Macromolecules*, **23**, 3023-3026 (1990).

RICHARD A. REGISTER - SCIENTIFIC PUBLICATIONS (cont.)

Journal Articles (cont.)

- 18) Yang, C.-z., T.G. Grasel, J.L. Bell, R.A. Register, and S.L. Cooper, "Carboxylate-Containing Chain-Extended Polyurethanes", *J. Polym. Sci. B: Polym. Phys.*, **29**, 581-588 (1991).
- 19) Register, R.A. and T.R. Bell, "Miscible Blends of Zinc-Neutralized Sulfonated Polystyrene and Poly(2,6-dimethyl 1,4-phenylene oxide)", *J. Polym. Sci. B: Polym. Phys.*, **30**, 569-575 (1992).
- 20) Tomita, H. and R.A. Register, "Morphology of Lightly Carboxylated Polystyrene Ionomers", *Macromolecules*, **26**, 2791-2795 (1993).
- 21) Tomita, H. and R.A. Register, "Miscibility of Polystyrene-based Ionomers with Poly(2,6-dimethyl 1,4-phenylene oxide)", *Macromolecules*, **26**, 2796-2801 (1993).
- 22) Taylor-Smith, R.E. and R.A. Register, "Probing Interdomain Mixing Effects via Specific Interactions: A Model System Approach", *Macromolecules*, **26**, 2802-2809 (1993).
- 23) Rangarajan, P., R.A. Register, and L.J. Fetters, "Morphology of Semicrystalline Block Copolymers of Ethylene-(Ethylene-*alt*-Propylene)", *Macromolecules*, **26**, 4640-4645 (1993).
- 24) Hajduk, D.A., S.M. Gruner, P. Rangarajan, R.A. Register, L.J. Fetters, C. Honeker, R. Albalak, and E.L. Thomas, "Observation of a Reversible Thermotropic Order-Order Transition in a Diblock Copolymer", *Macromolecules*, **27**, 490-501 (1994).
- 25) Taylor-Smith, R.E. and R.A. Register, "Characterizing Domain Mixing Effects in Hydrogen-Bond-Compatibilized Polymer Blends", *J. Polym. Sci. B: Polym. Phys.*, **32**, 2105-2114 (1994).
- 26) Adams, J.L., W.W. Graessley, and R.A. Register, "Rheology and the Microphase Separation Transition in Styrene-Isoprene Block Copolymers", *Macromolecules*, **27**, 6026-6032 (1994).
- 27) Wu, C.C., J.K.M. Chun, P.E. Burrows, J.C. Sturm, M.E. Thompson, S.R. Forrest, and R.A. Register, "Poly(*p*-phenylene vinylene)/Tris(8-hydroxy)quinoline Aluminum Heterostructure Light Emitting Diode", *Appl. Phys. Lett.*, **66**, 653-655 (1995).
- 28) Rangarajan, P., R.A. Register, D.H. Adamson, L.J. Fetters, S. Naylor, and A.J. Ryan, "Dynamics of Structure Formation in Crystallizable Block Copolymers", *Macromolecules*, **28**, 1422-1428 (1995).
- 29) Chu, J.H., P. Rangarajan, J.L. Adams, and R.A. Register, "Morphologies of Strongly-Segregated Polystyrene-Polydimethylsiloxane Diblock Copolymers", *Polymer*, **36**, 1569-1575 (1995).
- 30) Tian, J., C.-c. Wu, M.E. Thompson, J.C. Sturm, R.A. Register, T.M. Swager, and M.J. Marsella, "Electroluminescent Properties of Self-Assembled Polymer Thin Films", *Adv. Mater.*, **7**, 395-398 (1995).
- 31) Caballero, K.P., S.F. Karel, and R.A. Register, "Biosynthesis and Characterization of Hydroxybutyrate-Hydroxycaproate Copolymers", *Int. J. Biol. Macromol.*, **17**, 86-92 (1995).
- 32) Taylor-Smith, R.E. and R.A. Register, "Modelling Intercomponent Mixing Effects in Rubber-Modified Glassy Polymers", *J. Appl. Polym. Sci.*, **57**, 105-112 (1995).
- 33) Rangarajan, P., R.A. Register, L.J. Fetters, W. Bras, S. Naylor, and A.J. Ryan, "Crystallization of a Weakly-Segregated Polyolefin Diblock Copolymer", *Macromolecules*, **28**, 4932-4938 (1995).
- 34) Bronstein, L.M., E.Sh. Mirzoeva, P.M. Valetsky, S.P. Solodovnikov, and R.A. Register, "Nanodispersed Cobalt Particles in a Thermolysed Poly(acrylonitrile) Matrix", *J. Mater. Chem.*, **5**, 1197-1201 (1995).

RICHARD A. REGISTER - SCIENTIFIC PUBLICATIONS (cont.)

Journal Articles (cont.)

- 35) Hajduk, D.A., P. Urayama, S.M. Gruner, S. Erramilli, R.A. Register, K. Brister, and L.J. Fetters, "High Pressure Effects on the Disordered Phase of Block Copolymer Melts", *Macromolecules*, **28**, 7148-7156 (1995).
- 36) Reichart, G.C., R.A. Register, W.W. Graessley, R. Krishnamoorti, and D.J. Lohse, "Effect of Nonuniform Deuterium Labeling on Small-Angle Neutron Scattering Results for Polymer Blends", *Macromolecules*, **28**, 8862-8864 (1995).
- 37) Tian, J., C.-C. Wu, T.A. Ronneberg, M.E. Thompson, J.C. Sturm, and R.A. Register, "Photophysical Properties, Self-Assembled Thin Films and Light-Emitting Diodes of Poly(*p*-pyridylvinylene)s and Poly(*p*-pyridinium vinylene)s", *Chem. Mater.*, **7**, 2190-2198 (1995).
- 38) Vanhoorne, P. and R.A. Register, "Low-Shear Melt Rheology of Partially-Neutralized Ethylene-Methacrylic Acid Ionomers", *Macromolecules*, **29**, 598-604 (1996).
- 39) Ueda, M. and R.A. Register, "Crystallization-Induced Phase Separation in a Blend of Model Linear and Short-Chain Branched Polyethylenes", *J. Macromol. Sci. - Phys.*, **B35**, 23-36 (1996).
- 40) Hajduk, D.A., S.M. Gruner, S. Erramilli, R.A. Register, and L.J. Fetters, "High Pressure Effects on the Order-Disorder Transition in Block Copolymer Melts", *Macromolecules*, **29**, 1473-1481 (1996).
- 41) Dean, D.M., N.A. Mehl, L. Rebenfeld, and R.A. Register, "Influence of Molecular Weight on the Morphology and Crystallization Kinetics of PPS Composites", *J. Mater. Processing & Manuf. Sci.*, **4**, 233-242 (1996).
- 42) Adams, J.L., D.J. Quiram, W.W. Graessley, R.A. Register, and G.R. Marchand, "Ordering Dynamics of Compositionally Asymmetric Styrene-Isoprene Block Copolymers", *Macromolecules*, **29**, 2929-2938 (1996).
- 43) Mansky, P., C. Harrison, P. Chaikin, R. Register, and N. Yao, "Nanolithographic Templates from Diblock Copolymer Thin Films", *Appl. Phys. Lett.*, **68**, 2586-2588 (1996).
- 44) Lee, H.H., R.A. Register, D.A. Hajduk, and S.M. Gruner, "Orientation of Triblock Copolymers in Planar Extension", *Polym. Eng. Sci.*, **36**, 1414-1424 (1996).
- 45) Bronstein, L.M., P.M. Valetsky, S.P. Solodovnikov, M.V. Seregina, and R.A. Register, "Nanodispersed Metal and Metal Oxide Particles in Polymeric Matrices from Polyacrylonitrile Precursors", *Macromol. Symp.*, **106**, 73-86 (1996).
- 46) Wu, C.-c., J.C. Sturm, R.A. Register, and M.E. Thompson, "Integrated Three-Color Organic Light-Emitting Devices", *Appl. Phys. Lett.*, **69**, 3117-3119 (1996).
- 47) Rangarajan, P., C.F. Haisch, R.A. Register, D.H. Adamson, and L.J. Fetters, "Influence of Semicrystalline Homopolymer Addition on the Morphology of Semicrystalline Diblock Copolymers", *Macromolecules*, **30**, 494-502 (1997).
- 48) Reichart, G.C., W.W. Graessley, R.A. Register, R. Krishnamoorti, and D.J. Lohse, "Anomalous Attractive Interactions in Polypropylene Blends", *Macromolecules*, **30**, 3036-3041 (1997).
- 49) Reichart, G.C., W.W. Graessley, R.A. Register, R. Krishnamoorti, and D.J. Lohse, "Measurement of Thermodynamic Interaction in Ternary Polymer Blends by Small-Angle Neutron Scattering", *Macromolecules*, **30**, 3363-3368 (1997).
- 50) Park, M., C. Harrison, P.M. Chaikin, R.A. Register, and D.H. Adamson, "Block Copolymer Lithography: Periodic Arrays of $\sim 10^{11}$ Holes in 1 Square Centimeter", *Science*, **276**, 1401-1404 (1997).

RICHARD A. REGISTER - SCIENTIFIC PUBLICATIONS (cont.)

Journal Articles (cont.)

- 51) Wu, C.-c., J.C. Sturm, R.A. Register, J. Tian, E.P. Dana, and M.E. Thompson, "Efficient Organic Electroluminescent Devices Using Single-Layer Doped Polymer Thin Films with Bipolar Carrier Transport Abilities", *IEEE Trans. Elec. Dev.*, **44**, 1269-1281 (1997).
- 52) Quiram, D.J., R.A. Register, and G.R. Marchand, "Crystallization of Asymmetric Diblock Copolymers from Microphase-Separated Melts", *Macromolecules*, **30**, 4551-4558 (1997).
- 53) Quiram, D.J., R.A. Register, G.R. Marchand, and A.J. Ryan, "Dynamics of Structure Formation and Crystallization in Asymmetric Diblock Copolymers", *Macromolecules*, **30**, 8338-8343 (1997).
- 54) Adams, J.L., D.J. Quiram, W.W. Graessley, R.A. Register, and G.R. Marchand, "Interaction Strengths in Styrene-Diene Block Copolymers and their Hydrogenated Derivatives", *Macromolecules*, **31**, 201-204 (1998).
- 55) Kalika, D.S., D.G. Gibson, D.J. Quiram, and R.A. Register, "Relationship Between Morphology and Glass Transition Temperature in Solvent-Crystallized Poly(aryl ether ketones)", *J. Polym. Sci. B: Polym. Phys.*, **36**, 65-75 (1998).
- 56) Quiram, D.J., R.A. Register, and A.J. Ryan, "Crystallization and Ionic Associations in Semicrystalline Ionomers", *Macromolecules*, **31**, 1432-1435 (1998).
- 57) Harrison, C., M. Park, P. Chaikin, R.A. Register, D.H. Adamson, and N. Yao, "Depth Profiling Block Copolymer Microstructures", *Macromolecules*, **31**, 2185-2189 (1998).
- 58) Harrison, C., M. Park, P.M. Chaikin, R.A. Register, D.H. Adamson, and N. Yao, "Layer by Layer Imaging of Diblock Copolymer Films with a Scanning Electron Microscope", *Polymer*, **39**, 2733-2744 (1998).
- 59) Harrison, C., M. Park, P.M. Chaikin, R.A. Register, and D.H. Adamson, "Lithography with a Mask of Block Copolymer Microstructures", *J. Vacuum Sci. Technol. B*, **16**, 544-552 (1998).
- 60) Jack, K.S., J. Wang, A. Natansohn, and R.A. Register, "Characterization of the Microdomain Structure in Polystyrene-Polyisoprene Block Copolymers by ¹H Spin Diffusion and Small-Angle X-Ray Scattering Methods", *Macromolecules*, **31**, 3282-3291 (1998).
- 61) Quiram, D.J., R.A. Register, G.R. Marchand, and D.H. Adamson, "Chain Orientation in Block Copolymers Exhibiting Cylindrically Confined Crystallization", *Macromolecules*, **31**, 4891-4898 (1998).
- 62) Dean, D.M., and R.A. Register, "Oriented γ -Isotactic Polypropylene Crystallized at Atmospheric Pressure", *J. Polym. Sci. B: Polym. Phys.*, **36**, 2821-2827 (1998).
- 63) Huang, E., T.P. Russell, C. Harrison, P.M. Chaikin, R.A. Register, C.J. Hawker, and J. Mays, "Using Surface Active Random Copolymers to Control the Domain Orientation in Diblock Copolymer Thin Films", *Macromolecules*, **31**, 7641-7650 (1998).
- 64) Reichart, G.C., W.W. Graessley, R.A. Register, and D.J. Lohse, "Thermodynamics of Mixing for Statistical Copolymers of Ethylene and α -Olefins", *Macromolecules*, **31**, 7886-7894 (1998).
- 65) Dean, D.M., L. Rebenfeld, R.A. Register, and B.S. Hsiao, "Matrix Molecular Orientation in Fiber-Reinforced Polypropylene Composites", *J. Mater. Sci.*, **33**, 4797-4812 (1998).
- 66) Grady, B.P., J.A. Floyd, W.B. Genetti, P. Vanhoorne, and R.A. Register, "X-ray Absorption Spectroscopy Studies of Zinc-Neutralized Ethylene-Methacrylic Acid Ionomers", *Polymer*, **40**, 283-288 (1999).

RICHARD A. REGISTER - SCIENTIFIC PUBLICATIONS (cont.)

Journal Articles (cont.)

- 67) Dean, D.M., A.A. Marchione, L. Rebenfeld, and R.A. Register, "Flexural Properties of Fiber-Reinforced Polypropylene Composites With and Without a Transcrystalline Layer", *Polym. Adv. Technol.*, **10**, 655-668 (1999).
- 68) Huang, E., P. Mansky, T.P. Russell, C. Harrison, P.M. Chaikin, R.A. Register, C.J. Hawker, and J. Mays, "Mixed Lamellar Films: Evolution, Commensurability Effects, and Preferential Defect Formation", *Macromolecules*, **33**, 80-88 (2000).
- 69) Harrison, C., P.M. Chaikin, D. Huse, R.A. Register, D.H. Adamson, A. Daniel, E. Huang, P. Mansky, T.P. Russell, C.J. Hawker, D.A. Egolf, I.V. Melnikov, and E. Bodenschatz, "Reducing Substrate Pinning of Block Copolymer Microdomains with a Buffer Layer of Polymer Brushes", *Macromolecules*, **33**, 857-865 (2000).
- 70) Li, R.R., P.D. Dapkus, M.E. Thompson, W.G. Jeong, C. Harrison, P.M. Chaikin, R.A. Register, and D.H. Adamson, "Dense Arrays of Ordered GaAs Nanostructures by Selective Area Growth on Substrates Patterned by Block Copolymer Lithography", *Appl. Phys. Lett.*, **76**, 1689-1691 (2000).
- 71) Loo, Y.-L., R.A. Register, and A.J. Ryan, "Polymer Crystallization in 25 nm Spheres", *Phys. Rev. Lett.*, **84**, 4120-4123 (2000).
- 72) Lai, C.J., W.B. Russel, R.A. Register, G.R. Marchand, and D.H. Adamson, "Phase Behavior of Styrene-Isoprene Diblock Derivatives with Varying Conformational Asymmetry", *Macromolecules*, **33**, 3461-3466 (2000).
- 73) Jiang, X., R.A. Register, K.A. Killeen, M.E. Thompson, F. Pschenitzka, and J.C. Sturm, "Statistical Copolymers with Side-Chain Hole and Electron Transport Groups for Single-Layer Electroluminescent Device Applications", *Chem. Mater.*, **12**, 2542-2549 (2000).
- 74) Loo, Y.-L., R.A. Register, and D.H. Adamson, "Direct Imaging of Polyethylene Crystallites within Block Copolymer Microdomains", *J. Polym. Sci. B: Polym. Phys.*, **38**, 2564-2570 (2000).
- 75) Loo, Y.-L., R.A. Register, and D.H. Adamson, "Polyethylene Crystal Orientation Induced by Block Copolymer Cylinders", *Macromolecules*, **33**, 8361-8366 (2000).
- 76) Harrison, C., D.H. Adamson, Z. Cheng, J.M. Sebastian, S. Sethuraman, D.A. Huse, R.A. Register, and P.M. Chaikin, "Mechanisms of Ordering in Striped Patterns", *Science*, **290**, 1558-1560 (2000).
- 77) Trzaska, S.T., L.-B.W. Lee, and R.A. Register, "Synthesis of Narrow-Distribution 'Perfect' Polyethylene and its Block Copolymers by Polymerization of Cyclopentene", *Macromolecules*, **33**, 9215-9221 (2000).
- 78) Park, M., P.M. Chaikin, R.A. Register, and D.H. Adamson, "Large Area Dense Nanoscale Patterning of Arbitrary Surfaces", *Appl. Phys. Lett.*, **79**, 257-259 (2001).
- 79) Vega, D.A., J.M. Sebastian, Y.-L. Loo, and R.A. Register, "Phase Behavior and Viscoelastic Properties of Entangled Block Copolymer Gels", *J. Polym. Sci. B: Polym. Phys.*, **39**, 2183-2197 (2001).
- 80) Sebastian, J.M. and R.A. Register, "Block Copolymer Molecular Weight Determination via Gel Permeation Chromatography: Choosing a Combining Rule", *J. Appl. Polym. Sci.*, **82**, 2056-2069 (2001).
- 81) Loo, Y.-L., R.A. Register, A.J. Ryan, and G.T. Dee, "Polymer Crystallization Confined in One, Two, or Three Dimensions", *Macromolecules*, **34**, 8968-8977 (2001).

RICHARD A. REGISTER - SCIENTIFIC PUBLICATIONS (cont.)

Journal Articles (cont.)

- 82) Vega, D.A., J.M. Sebastian, W.B. Russel, and R.A. Register, "Viscoelastic Properties of Entangled Star Polymer Melts: Comparison of Theory and Experiment", *Macromolecules*, **35**, 169-177 (2002).
- 83) Lai, C.J., W.B. Russel, and R.A. Register, "Phase Behavior of Styrene-Isoprene Diblock Copolymers in Strongly Selective Solvents", *Macromolecules*, **35**, 841-849 (2002).
- 84) Notestein, J.M., L.-B.W. Lee, and R.A. Register, "Well-Defined Diblock Copolymers via Termination of Living ROMP with Anionically-Polymerized Macromolecular Aldehydes", *Macromolecules*, **35**, 1985-1987 (2002).
- 85) Tierney, N.K. and R.A. Register, "Ion-Hopping in Ethylene-Methacrylic Acid Ionomer Melts as Probed by Rheometry and Cation Diffusion Measurements", *Macromolecules*, **35**, 2358-2364 (2002).
- 86) Loo, Y.-L., R.A. Register, and A.J. Ryan, "Modes of Crystallization in Block Copolymer Microdomains: Breakout, Templated, and Confined", *Macromolecules*, **35**, 2365-2374 (2002).
- 87) Sebastian, J.M., C.J. Lai, W.W. Graessley, and R.A. Register, "Steady-Shear Rheology of Block Copolymer Melts: Zero-Shear Viscosity and Shear-Disordering in Body-Centered-Cubic Systems", *Macromolecules*, **35**, 2700-2706 (2002).
- 88) Sebastian, J.M., C.J. Lai, W.W. Graessley, and R.A. Register, "Steady-Shear Rheology of Block Copolymer Melts and Concentrated Solutions: Disordering Stress in Body-Centered-Cubic Systems", *Macromolecules*, **35**, 2707-2713 (2002).
- 89) Lai, C.J., W.B. Russel, and R.A. Register, "Scaling of Domain Spacing in Concentrated Solutions of Block Copolymers in Selective Solvents", *Macromolecules*, **35**, 4044-4049 (2002).
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- “Shear-Induced Melting of the Block Copolymer Spherical Phase”, PMSE/Younger Chemists Committee Symposium, American Chemical Society National Meeting, New Orleans, LA (August 25, 1999).
- “Surface Nanopatterning with Block Copolymer Thin Films”, Symposium on “Nonlithographic Approaches to Micro- and Nanoscale Organization”, Materials Research Society 1999 Fall Meeting, Boston, MA (December 1, 1999).
- “Rheology of Spherical Phase Block Copolymer Melts and Solutions”, Dillon Medal Symposium in Honor of Wesley R. Burghardt, American Physical Society March Meeting, Minneapolis, MN (March 21, 2000).
- “Polyethylene Block Copolymers”, ACS Award in Applied Polymer Science Symposium in Honor of Dr. Lewis Fetters, American Chemical Society National Meeting, San Francisco, CA (March 27, 2000).

RICHARD A. REGISTER - INVITED PRESENTATIONS AT PROFESSIONAL MEETINGS (cont.)

- “The Spherical Phase in Block Copolymers”, Gordon Research Conference on Polymer Physics, New London, CT (July 30, 2000).
- “Block Copolymer Thin Films: Patterns and Patterning”, invited symposium on “Polymeric Nanostructures”, American Physical Society March Meeting, Seattle, WA (March 14, 2001).
- “Nanoscale Polymer Crystallization Within Block Copolymers”, 10th Annual Fibre Diffraction and Non-Crystalline Diffraction Workshop, University of Stirling, Scotland (June 14, 2001).
- “Crystallizable Block Copolymers: Two Self-Organizing Mechanisms in a Single Material”, MESD Plenary Session, American Institute of Chemical Engineers Annual Meeting, Reno, NV (November 7, 2001).
- “Development of Long-Range Order and Orientation in Block Copolymer Thin Films”, Symposium on “Polymer Interfaces and Thin Films”, Materials Research Society 2001 Fall Meeting, Boston, MA (November 26, 2001).
- “K-6 Science Curriculum Support Project (SCSP) at the Princeton Center for Complex Materials”, invited symposium on “Educational Outreach”, Division of Polymer Physics, American Physical Society, Indianapolis, IN (March 19, 2002).
- “Crystallization in Block Copolymers”, European Physical Society Conference on Macromolecular Physics, Synchrotron Radiation in Polymer Science II, Sheffield, UK (September 5, 2002).
- “Controlled Crystallization in Block Copolymers”, Charles M.A. Stine Award Address, American Institute of Chemical Engineers Annual Meeting, Indianapolis, IN (November 6, 2002).
- “Defect Motion in Block Copolymer Thin Films”, Symposium on “Defect Mediated Phenomena in Ordered Polymers”, Materials Research Society 2002 Fall Meeting, Boston, MA (December 3, 2002).
- “Chain and Ion Dynamics in Ionomer Melts”, Symposium on “Polymer Dynamics”, American Physical Society March Meeting, Austin, TX (March 5, 2003).
- “Controlling Crystal Morphology in Block Copolymers”, Symposium on “Foundations of Polymer Science: Paul Flory’s Seminal Contributions, Present Status, and Projections, American Chemical Society National Meeting, New York, NY (September 7, 2003).
- “Chain and Ion Dynamics in Commercial and Model Ionomers”, Microsymposium on Polymer Melt Rheology and Processing, Venture Business Laboratory, Yamagata University, Yonezawa, Japan (March 17, 2004).
- “Block Copolymer Thin Films: Patterns and Patterning”, Frontiers in Liquid Crystals and Molecular Self-Assembly, FLC Materials Research Center, University of Colorado, Boulder, CO (June 11, 2004).
- “Fabrication of Dense Periodic Arrays Using Block Copolymer Nanolithography”, SPIE Optics East, Symposium on Nanofabrication: Technologies, Devices, and Applications, Philadelphia, PA (October 26, 2004).
- “Nanofabrication with Self-Assembling Block Copolymer Masks”, Plenary Lecture on Nanotechnology, Emerging Information Technology Conference, Princeton, NJ (October 28, 2004).
- “Block Copolymers with Precisely Tuned Crystal Thicknesses and Melting Points”, Symposium on “Multicomponent Polymer Systems: Phase Behavior, Dynamics, and Applications”, Materials Research Society 2004 Fall Meeting, Boston, MA (November 26, 2004).
- “Shear-Aligned Block Copolymer Thin Films as Nanofabrication Templates”, Polymers West Gordon Research Conference, Ventura, CA (January 13, 2005).

RICHARD A. REGISTER - INVITED PRESENTATIONS AT PROFESSIONAL MEETINGS (cont.)

- “Shear Alignment of Block Copolymer Thin Films and their Use in Nanofabrication”, Frontiers of Soft Condensed Matter Workshop, Annandale, NJ (May 19, 2005).
- “Thermoreversible Transitions To and From the Hexagonally-Perforated Lamellar Structure in Diblock Copolymers”, Symposium on “Scattering from Polymers”, American Chemical Society National Meeting, Washington, DC (August 30, 2005).
- “Shear-Induced Alignment in Thin Films of a Sphere-Forming Block Copolymer”, Symposium on “Defects in Polymer Nanostructures”, American Chemical Society National Meeting, Washington, DC (August 30, 2005).
- “Crystallizable Block Copolymers: Directing Crystallization via Polymer Architecture”, Plenary Lecture, 18th National Congress of the Mexican Polymer Society, Puerto Vallarta, Jalisco, Mexico (October 19, 2005).
- “Shear Alignment of Hexagonal and Striped Patterns in Block Copolymer Thin Films”, Symposium on “Shear-Induced Phenomena in Complex Fluids”, American Physical Society March Meeting, Baltimore, MD (March 14, 2006).
- “Structure of Crystallizable ROMP Homopolymers and Block Copolymers”, Gordon Research Conference on Polymer Physics, New London, CT (July 23, 2006).
- “Precisely Controlled Crystal Thicknesses and Melting Points in Crystalline-Amorphous Diblock and Triblock Copolymers”, Symposium on “Block Copolymers as Nanoscale Materials”, American Chemical Society National Meeting, San Francisco, CA (September 12, 2006).
- “Crystallizable Block Copolymers: Directing Crystallization via Polymer Architecture”, European Commission COST P12 Workshop on “X-Ray Studies of Polymer Crystallization”, Diamond Light Source, Rutherford Appleton Laboratory, Oxfordshire, United Kingdom (October 24, 2006).
- “Shear-Aligned Block Copolymer Thin Films and Their Use as Nanofabrication Templates”, 2007 Taiwan-US Soft Materials Symposium, Taipei, Taiwan (January 6, 2007).
- “Shear Alignment of Microdomains in Block Copolymer Thin Films”, Carl S. Marvel Creative Polymer Chemistry Award Symposium in Honor of Anne M. Mayes, American Chemical Society National Meeting, Chicago, IL (March 25, 2007).
- “Writing Mesoscale Patterns in Block Copolymer Thin Films via Channel Flow of a Nonsolvent Fluid”, Symposium on “Unconventional Processes for Nanostructured and Microstructured Polymer Systems”, American Chemical Society National Meeting, Chicago, IL (March 27, 2007).
- “Shear-Aligned Block Copolymer Thin Films as Nanofabrication Templates”, Keynote Address, 24th Conference of Photopolymer Science and Technology, Chiba, Japan (June 28, 2007).
- “Crystallization of Perfectly Linear Polyethylene inside Nanodomains”, Symposium on “50 Years of Polymer Single Crystals”, American Chemical Society National Meeting, Boston, MA (August 21, 2007).
- “Block Copolymer Thin Films as Nanofabrication Templates”, Symposium Honoring Dr. Ralph Milkovich, International Rubber Science Hall of Fame, Akron, OH (November 1, 2007).
- “Shear Alignment and Realignment of Block Copolymer Microdomains in Thin Films”, Symposium on Dynamics of Polymers, American Physical Society March Meeting, New Orleans, LA (March 13, 2008).

RICHARD A. REGISTER - INVITED PRESENTATIONS AT PROFESSIONAL MEETINGS (cont.)

- “Polyethylene-Polyvinylcyclohexane Diblock Copolymers Comprising Perfectly Linear Polyethylene”, PMSE Cooperative Research Award Symposium in Honor of Stephen F. Hahn, Dennis A. Hucul, Frank S. Bates, Glenn H. Fredrickson, and Edward J. Kramer, American Chemical Society National Meeting, New Orleans, LA (April 6, 2008).
- “Crystallizable Block Copolymers: Directing Crystallization via Polymer Architecture”, Topical Conference (TOPCON) of the Engineering Properties and Structure Division (EPSDIV) of the Society of Plastics Engineers (SPE), Wilmington, DE (October 14, 2008).
- “Block Copolymer Thin Films as Nanofabrication Templates”, 2nd International Symposium on Engineering Micro-/Nano-materials Based on Self-Assembling and Self-Organization (ISEM2008 Returns), Tokyo, Japan (December 8, 2008).
- “Shear-Alignment of Block Copolymer Films and their Applications in Nanopatterning”, Plenary Lecture, Archipol '09 (5th Annual Joint Chile-Argentina Polymer Conference), Los Cocos, Argentina (October 19, 2009).
- “Crystallization of Unbranched Polyethylene Confined within Block Copolymer Mesophases”, Focus Session on Crystallization in Confined Geometry, American Physical Society March Meeting, Portland, OR (March 15, 2010).
- “Block Copolymers with Composite Crystalline-Glassy Hard Domains Formed from Single-Phase Melts”, Dillon Medal Symposium in Honor of Yueh-Lin Loo, American Physical Society March Meeting, Portland, OR (March 16, 2010).
- “Thermoplastic Elastomers with Composite Crystalline/Glassy Hard Domains”, PMSE Award in Applied Polymer Science Symposium in Honor of Andrew J. Lovinger, American Chemical Society National Meeting, San Francisco, CA (March 23, 2010).
- “Block Copolymer Thin Film Coatings: Film Structure, Shear Alignment, and Nanopatterning Applications”, Smart Coatings 2011 (Sixth International Smart Coatings Symposium), Orlando, FL (February 23, 2011).
- “Block Copolymer Thermoplastic Elastomers with Composite Crystalline-Glassy Hard Domains”, Keynote Lecture, 2011 International Conference on Advanced Fibers and Polymer Materials, Shanghai, China (August 17, 2011).
- “Block Thin Films as Nanostructure Templates”, MESD Plenary Session, American Institute of Chemical Engineers Annual Meeting, Minneapolis, MN (October 19, 2011).
- “Shear Alignment of Perpendicular Lamellae in Block Copolymer Thin Films”, Dillon Medal Symposium in Honor of Rachel A. Segalman, American Physical Society March Meeting, Boston, MA (February 28, 2012).
- “Crystallizable Block Copolymers”, Paul J. Flory Award Symposium in Honor of Robert E. Cohen, American Chemical Society National Meeting, San Diego, CA (March 28, 2012).
- “Ordering in Shear-Aligned Block Copolymer Thin Films”, Symposium on Surfaces and Interfaces, IUPAC World Polymer Congress, Blacksburg, VA (June 27, 2012).
- “New Macromolecular Architectures for Crystallizable Block Copolymers”, Emerging Areas in Polymer Science & Engineering, American Institute of Chemical Engineers Annual Meeting, Pittsburgh, PA (October 29, 2012).
- “Melt and Solid-State Structures of Polydisperse Polyolefin Block Copolymers”, Dillon Medal Symposium in Honor of Mahesh K. Mahanthappa, American Physical Society March Meeting, Baltimore, MD (March 19, 2013).

RICHARD A. REGISTER - INVITED PRESENTATIONS AT PROFESSIONAL MEETINGS (cont.)

- “Ordered Block Copolymer Films as Nanofabrication Templates”, Workshop on Interfacial Phenomena in Nanostructured Materials and Devices, Telluride Science Research Center, Telluride, CO (February 3, 2014).
- “Regular and Irregular Mixing in Hydrocarbon Block Copolymers”, Dillon Medal Symposium in Honor of Ryan C. Hayward, American Physical Society March Meeting, Denver, CO (March 4, 2014).
- “Crystallizable Block Copolymers: Directing Crystallization via Polymer Architecture”, Gordon Research Conference on Polymer Physics, Mt. Holyoke College, South Hadley, MA (July 15, 2014).
- “Block Copolymers: Thin Films and Thermoswitchable Surfaces”, Smart Coatings 2015, Orlando, FL (February 25, 2015).
- “Miscibility and Crystallization in Hydrocarbon Block and Block-Random Copolymers”, PMSE Cooperative Research Award Symposium in Honor of Benjamin S. Hsiao and Andy H. Tsou, American Chemical Society National Meeting, Denver, CO (March 23, 2015).
- “Thermoplastic Elastomers with Semicrystalline, Glassy, and Rubbery Blocks”, Herman Mark Award Symposium in Honor of Timothy P. Lodge, American Chemical Society National Meeting, Boston, MA (August 18, 2015).
- “High- T_g Polynorbornene-Based Block and Random Copolymers for Butanol Pervaporation Membranes”, Dillon Medal Symposium in Honor of Thomas H. Epps III, American Physical Society March Meeting, Baltimore, MD (March 15, 2016).
- “Structure and Properties of Polymers”, plenary lecture at workshop on Frontiers in Polymer Science and Engineering, National Science Foundation, Arlington, VA (August 17, 2016).
- “Orientation and Order in Shear-Aligned Thin Films of Cylinder-Forming Block Copolymers”, Focus Session Honoring Edward J. Kramer, American Physical Society March Meeting, New Orleans, LA (March 14, 2017).
- “Thermoplastic Elastomers from Linear and Star Polymers Containing Polyethylene Blocks”, Symposium on “Recent Advances in Multiblock Copolymers”, American Chemical Society National Meeting, San Francisco, CA (April 5, 2017).
- “Melt Miscibility of Polyethylene with Hydrogenated ROMP Poly(*x*-norbornene)s”, Advances in Polyolefins XI, Santa Rosa, CA (September 26, 2017).
- “Block Copolymer Thin Films: Structure, Shear Alignment, and Applications in Nanofabrication”, 2018 Bowei Research Conference “From Chemistry to Material Design”, Hsinchu, Taiwan (January 6, 2018).
- “Melt Miscibility and Solid-State Properties in Block Copolymers of Polyethylene with Hydrogenated Poly(*x*-norbornene)s”, ACS Award in Applied Polymer Science in Honor of Paula T. Hammond, American Chemical Society National Meeting, New Orleans, LA (March 18, 2018).
- “Block Copolymers of Polyethylene and Hydrogenated Poly(*x*-norbornene)s: Melt Miscibility and Solid-State Properties”, Polymer Society of Korea, Daejeon, Republic of Korea (April 6, 2018).
- “Polyethylene-Poly(*x*-Norbornene) Block Copolymers: Synthesis, Miscibility, and Properties”, 5th Blue Sky Conference on Catalytic Olefin Polymerization, Sorrento, Italy (June 27, 2019).
- “Polynorbornene Pervaporation Membranes for Biobutanol Purification”, 2020 Bowei Research Conference, Yilan, Taiwan, Republic of China (January 3, 2020).

RICHARD A. REGISTER - INVITED PRESENTATIONS AT PROFESSIONAL MEETINGS (cont.)

“Spatially-Resolved Measurements of the Local Glass Transition Temperature in Nanostructured Block Copolymers”, ACS Macro Letters / Biomacromolecules / Macromolecules Young Investigator Symposium Honoring Rodney D. Priestley and Keiji Numata, American Chemical Society Virtual National Meeting, on-demand presentation (available August 16-20, 2020).

“Incorporation of Styrene into a Model Polyolefin for Enhanced Compatibility with Polyisoprene”, Dillon Medal Symposium in Honor of Bryan W. Boudouris, American Physical Society March Meeting Online (March 16, 2021).

“Synthesis of End-Functional Polyethylene Precursors and Comb Copolymers by Cyclopentene ROMP with Regioselective Chain Transfer”, Symposium on Advances in Functionalized Polyolefin Synthesis, American Chemical Society Virtual National Meeting (April 6, 2021).

RICHARD A. REGISTER - INVITED SEMINARS

- “Ionomer Morphology Probed by X-Ray Techniques”, Department of Chemical Engineering, Massachusetts Institute of Technology, Cambridge, MA (February 24, 1989).
- “Ionomer Morphology Probed by X-Ray Techniques”, Department of Chemical Engineering, Princeton University, Princeton, NJ (February 27, 1989).
- “Ionomer Morphology Probed by X-Ray Techniques”, Department of Chemistry, University of Wisconsin, Madison, WI (March 1, 1989).
- “Ionomer Morphology Probed by X-Ray Techniques”, Department of Chemical Engineering, Lehigh University, Bethlehem, PA (March 9, 1989).
- “Ionomer Morphology Probed by X-Ray Techniques”, Department of Chemical Engineering, California Institute of Technology, Pasadena, CA (March 16, 1989).
- “Ionomer Morphology Probed by X-Ray Techniques”, Institute of Materials Science, University of Connecticut, Storrs, CT (May 9, 1989).
- “Ionomer Morphology Probed by X-Ray Techniques”, Department of Polymer Science and Engineering, University of Massachusetts, Amherst, MA (May 10, 1989).
- “Ionomer Chain Dimensions in Bulk Probed by Small-Angle Neutron Scattering”, AT&T Bell Laboratories, Murray Hill, NJ (March 2, 1990).
- “Ionomer Morphology”, Rohm & Haas Corporate Seminar Series, Bristol, PA (March 20, 1991) and Spring House, PA (March 21, 1991).
- “Ionomer Morphology”, Department of Materials Science and Engineering, Rutgers University, Piscataway, NJ (September 19, 1991).
- “Polymer Blends with Strong Interactions”, General Electric Corporate Research and Development Center, Schenectady, NY (March 20, 1992).
- “Polymer Blends with Strong Interactions”, Hoechst-Celanese Corporation, Robert L. Mitchell Technical Center, Summit, NJ (August 12, 1992).
- “Complex Polymer Research”, National Science Foundation - Russian Academy of Sciences Joint Polymers Workshop, Washington, DC (August 28, 1992).
- “Ionomer Morphology”, Unilever Research U.S., Edgewater, NJ (October 27, 1992).
- “Polymer Blends with Strong Interactions”, Hercules Research Center, Wilmington, DE (December 1, 1992).
- “Block Copolymer Structure and Dynamics”, Dow Chemical USA, Louisiana Research and Development, Plaquemine, LA (May 12, 1993).
- “Polymer Blends with Strong Interactions”, Ford Motor Company Research Laboratories, Dearborn, MI (July 26, 1993).
- “Structure and Properties of Ionomers”, DuPont Sabine River Works, Orange, TX (August 17, 1993).
- “Block Copolymer Structure and Dynamics”, Rensselaer Polytechnic Institute, Polymer Science and Engineering Seminar Series, Troy, NY (November 1, 1993).
- “Block Copolymer Structure and Dynamics”, General Electric Corporate Research and Development Center, Schenectady, NY (November 2, 1993).

RICHARD A. REGISTER - INVITED SEMINARS (cont.)

- “Structure and Properties of Ionomers”, DuPont Marshall Laboratories, Philadelphia, PA (January 10, 1994).
- “Mesophase Formation in Block Copolymers”, University of Delaware, Department of Chemical Engineering, Newark, DE (May 18, 1994).
- “Block Copolymer Structure and Dynamics”, Dow Chemical USA, M.E. Pruitt Research Center, Midland, MI (August 18, 1994).
- “Biodegradable Plastics from Bacteria”, Princeton University, Center for Energy and Environmental Studies, Princeton, NJ (September 26, 1994).
- “Block Copolymers: Probing the Self-Assembly Process”, Johns Hopkins University, Department of Chemical Engineering, Baltimore, MD (October 20, 1994).
- “Block Copolymers: Probing the Self-Assembly Process”, State University of New York at Stony Brook, Department of Materials Science and Engineering, Stony Brook, NY (November 9, 1994).
- “Structure Formation in Block Copolymers”, Dow Chemical USA, Louisiana Research and Development, Plaquemine, LA (August 16, 1995).
- “Low-Shear Melt Rheology of Ethylene-Methacrylic Acid Ionomers”, DuPont Central Research & Development, Wilmington, DE (September 21, 1995).
- “Rheological Properties of Surlyn Ionomers”, DuPont Sabine River Works, Orange, TX (September 27, 1995).
- “Dynamics of Structure Formation in Block Copolymers”, Department of Chemical Engineering, Massachusetts Institute of Technology, Cambridge, MA (September 29, 1995).
- “Dynamics of Structure Formation in Block Copolymers”, Department of Polymer Science, University of Southern Mississippi, Hattiesburg, MS (January 24, 1996).
- “Controlling the Morphology of Crystallizable Block Copolymers”, Department of Chemical Engineering, University of Wisconsin, Madison, WI (September 5, 1996).
- “Controlling the Morphology of Crystallizable Block Copolymers”, Department of Macromolecular Science, Case Western Reserve University, Cleveland, OH (September 27, 1996).
- “Rheology and Cation Diffusion in Surlyn Ionomers: Recent Progress”, DuPont Sabine River Works, Orange, TX (October 3, 1996).
- “Controlling the Morphology of Crystallizable Block Copolymers”, Exploratory Polymer Research, The Goodyear Tire and Rubber Company, Akron, OH (October 24, 1996).
- “Rheology and Cation Diffusion in Surlyn Ionomers: Recent Progress”, DuPont Experimental Station, Wilmington, DE (October 29, 1996).
- “Controlling the Morphology of Crystallizable Block Copolymers”, Procter & Gamble Co., Miami Valley Laboratories, Cincinnati, OH (November 22, 1996).
- “Connection Between Hot Tack and Melt Rheological Properties of Ionomers”, DuPont Sabine River Works, Orange, TX (May 7, 1997).
- “Relative Contributions of Crystallinity and Ionic Associations to Creep Resistance in Ionomers”, DuPont Sabine River Works, Orange, TX (May 7, 1997).

RICHARD A. REGISTER - INVITED SEMINARS (cont.)

- “Crystallizable Block Copolymers”, Workshop on Material Properties through Controlled Microstructure, University of Minnesota - Twin Cities, Center for Interfacial Engineering, Minneapolis, MN (May 15, 1997).
- “Polymeric Light Emitting Devices”, American Institute of Chemical Engineers, Central Jersey Section, Trenton, NJ (May 27, 1997).
- “Ionomer Melt Rheology and its Connection to Hot Tack”, DuPont Chestnut Run Laboratories, Wilmington, DE (June 6, 1997).
- “Crystallizable Block Copolymers”, University of Pennsylvania, Department of Chemical Engineering, Philadelphia, PA (September 29, 1997).
- “Crystallizable Block Copolymers”, 21st Annual Symposium of the Macromolecular Science and Engineering Center, University of Michigan, Ann Arbor, MI (October 23, 1997).
- “Crystallizable Polyolefin Block Copolymers”, Polymers, Surfaces, & Material Sciences Series (inaugural speaker), Union Carbide Corporation, Bound Brook, NJ (October 31, 1997).
- “Nanolithography via Block Copolymer Thin Films”, University of Illinois at Urbana-Champaign, Department of Chemical Engineering, Urbana, IL (November 11, 1997).
- “Crystallizable Block Copolymers”, University of Delaware, Department of Chemical Engineering, Newark, DE (April 8, 1998).
- “Stress Cracking in Polyethylene and Ethylene Copolymers: A Review”, DuPont Experimental Station, Wilmington, DE (April 24, 1998).
- “Gizmos, Gadgets, and Materials of Tomorrow”, Princeton University, Reunions Alumni-Faculty Forum Panel Discussion, Princeton, NJ (May 29, 1998).
- “Block Copolymer Phase Behavior”, DuPont Photopolymer and Electronic Products, Parlin, NJ (October 26, 1998).
- “Block Copolymers as Nanolithography Templates”, University of Sheffield, Department of Chemistry, Sheffield, United Kingdom (November 2, 1998).
- “Effects of Long-Chain Branching on Polymer Melt Rheology: A Review”, DuPont Experimental Station, Wilmington, DE (April 27, 1999).
- “The Origin of Directional Tear in Blown Films of Surlyn, Nucrel, and LDPE”, DuPont Experimental Station, Wilmington, DE (April 27, 1999).
- “Ion-Hopping in Ionomers as Probed by Cation Diffusion Measurements”, DuPont Experimental Station, Wilmington, DE (April 27, 1999).
- “New Materials from Hydrogenated Block Copolymers”, Goodyear Research Center, The Goodyear Tire and Rubber Company, Akron, OH (June 9, 1999).
- “Crystallizable Block Copolymers”, Rohm & Haas Company, Research Laboratories, Spring House, PA (September 9, 1999).
- “Optimizing Hot Tack in Package Sealing Operations”, DuPont Chestnut Run Laboratories, Wilmington, DE (September 22, 1999).
- “Block Copolymer Thin Films as Nanolithography Templates”, Brooklyn Polytechnic University, Department of Chemical Engineering and Chemistry, Brooklyn, NY (February 2, 2000).

RICHARD A. REGISTER - INVITED SEMINARS (cont.)

- “Block Copolymer Thin Films as Nanolithography Templates”, DuPont Carothers Polymer Seminar Series, DuPont Experimental Station, Wilmington, DE (February 9, 2000).
- “Crystallizable Block Copolymers”, University of Massachusetts, Polymer Science and Engineering Department, Amherst, MA (May 5, 2000).
- “Nanopatterning via Block Copolymer Thin Films”, Princeton/Rhodia Symposium, Princeton University, Princeton, NJ (June 22, 2000).
- “Dynamics of Ionomer Melts: Recent Progress”, DuPont Experimental Station, Wilmington, DE (September 12, 2000).
- “Nanostructuring of and with Polymers”, Union Carbide Corporation, Bound Brook, NJ (October 18, 2000).
- “Nanolithography and Nanofabrication via Block Copolymer Thin Films”, Department of Chemical Engineering, North Carolina State University, Raleigh, NC (February 19, 2001).
- “Crystallization in Block Copolymers”, Chemical Physics/Physical Chemistry Seminar Series, University of Maryland, College Park, MD (May 9, 2001).
- “Nanolithography and Nanofabrication via Block Copolymer Thin Films”, Materials Science Program, University of Wisconsin, Madison, WI (May 10, 2001).
- “Block Copolymer Thin Films: Patterns, Patterning, and Nanofabrication”, Department of Materials Science and Engineering, The Pennsylvania State University, University Park, PA (November 1, 2001).
- “Slow Crystallization, and its Effect on Properties, in Modified Ionomers”, DuPont Experimental Station, Wilmington, DE (January 9, 2002).
- “Crystallization in Block Copolymers”, Department of Chemical Engineering, University of Kentucky, Lexington, KY (March 27, 2002).
- “Microdomain Patterns in Block Copolymer Thin Films”, Garcia Center for Polymers at Engineered Interfaces, State University of New York at Stony Brook, Stony Brook, NY (April 17, 2002).
- “Microdomain Patterns in Block Copolymer Thin Films”, Department of Chemistry, University of Toronto, Toronto, Ontario, Canada (June 27, 2002).
- “Controlled Crystallization in Block Copolymers”, School of Chemical Engineering and Materials Science, University of Oklahoma, Norman, OK (September 26, 2002).
- “Block Copolymer Thin Films: Micropatterns and Nanopatterning”, Department of Chemical Engineering, City College of the City University of New York, New York, NY (October 27, 2002).
- “Some Opportunities for Polymer Science at NSLS-II”, Workshop on Scientific Opportunities in Soft Matter and Biophysics at NSLS-II, State University of New York at Stony Brook, Stony Brook, NY (September 5, 2003).
- “Controlling Crystal Morphology in Block Copolymers”, Department of Chemical Engineering, University of Houston, Houston, TX (September 12, 2003).
- “Block Copolymer Thin Films: Micropatterns and Nanopatterning”, Department of Chemical Engineering, University of Florida, Gainesville, FL (September 29, 2003).

RICHARD A. REGISTER - INVITED SEMINARS (cont.)

- “Controlling Crystal Morphology in Block Copolymers”, Department of Chemical Engineering, University of Pittsburgh, Pittsburgh, PA (October 3, 2003).
- “Controlling Crystal Morphology in Block Copolymers”, Department of Chemical Engineering and Chemistry, Technical University of Eindhoven, The Netherlands (December 16, 2003).
- “Polymers with Complex Supramolecular Structures: Crystallizable Block Copolymers”, Dow Chemical Company, Weston Canal Center, Somerset, NJ (January 20, 2004).
- “Controlling Polymer Crystallization through Block Copolymerization”, Department of Chemical Engineering, Florida State University/Florida Agricultural and Mechanical University, Tallahassee, FL (January 23, 2004).
- “Nanolithography with Block Copolymer Thin Films”, Mitsubishi Chemical Group, Science and Technology Research Center, Yokohama, Japan (March 15, 2004).
- “Melt Dynamics and Solid-State Properties of Ethylene-Based Ionomers”, Mitsui-Dupont Polychemicals, Technical Center, Chiba, Japan (March 19, 2004).
- “Controlled Crystallization in Block Copolymers”, Hyuk Yu Symposium, Department of Chemistry, University of Wisconsin, Madison, WI (May 22, 2004).
- “Surlyn Structure-Property Relationships: Recent Work”, DuPont Packaging and Industrial Polymers, Sabine Research Laboratory, Orange, TX (May 25, 2004).
- “Structural and Mechanical Properties of Small-Scale Structures”, ICI Small-Scale Structures Workshop, National Starch, Bridgewater, NJ (September 20, 2004).
- “Block Copolymer Crystallization”, Department of Chemical Engineering, McGill University, Montreal, Canada (October 18, 2004).
- “Block Copolymer Crystallization”, GE Global Research, Niskayuna, NY (December 17, 2004).
- “Block Copolymer Thin Films: Patterns and Patterning”, 3M Center, St. Paul, MN (June 14, 2005).
- “Block Copolymer Thin Films as Nanofabrication Templates”, School of Chemical and Biomolecular Engineering, Georgia Institute of Technology, Atlanta, GA (September 21, 2005).
- “Crystallizable Block Copolymers: Directing Crystallization via Polymer Architecture”, Department of Chemical and Biochemical Engineering, Rutgers University, Piscataway, NJ (October 6, 2005).
- “Block Copolymer Thin Films as Nanofabrication Templates”, Department of Physics, Temple University, Philadelphia, PA (October 10, 2005).
- “Well-Defined Crystallizable Homopolymers and Block Copolymers from Ring-Opening Metathesis Polymerization”, Symposium on Olefin Metathesis, Lyondell Chemical Company, Newtown Square, PA (October 11, 2005).
- “Crystallizable Block Copolymers: Directing Crystallization via Polymer Architecture”, Department of Chemical and Biochemical Engineering, New Jersey Institute of Technology, Newark, NJ (February 6, 2006).
- “Block Copolymer Thin Films as Nanofabrication Templates”, Department of Chemical Engineering, Columbia University, New York, NY (February 14, 2006).

RICHARD A. REGISTER - INVITED SEMINARS (cont.)

- “Block Copolymer Thin Films as Nanofabrication Templates”, Air Force Research Laboratory, Wright-Patterson Air Force Base, Dayton, OH (May 26, 2006).
- “Crystallizable Block Copolymers: Directing Crystallization via Polymer Architecture”, The Dow Chemical Company, Freeport, TX (August 24, 2006).
- “Block Copolymer Thin Films and Their Use in Nanofabrication”, Department of Chemical Engineering, University of California – Berkeley, Berkeley, CA (September 6, 2006).
- “Block Copolymer Thin Films and Their Use in Nanofabrication”, Department of Chemistry, Indiana University, Bloomington, IN (October 12, 2006).
- “Crystallization and Microphase Separation in ‘Polyethylene’ Block Copolymers”, Kraton Polymers, Houston, TX (October 30, 2006).
- “Ionomer Melts and Solids: Strongly Associating Polymers”, Chevron Phillips Lecture Series, Macromolecules and Interfaces Institute, Virginia Polytechnic Institute and State University, Blacksburg, VA (February 28, 2007).
- “Block Copolymer Thin Films as Nanofabrication Templates”, Xerox Webster Research Center, Webster, NY (June 20, 2007).
- “Block Copolymer Thin Films as Nanofabrication Templates”, School of Chemical and Biomolecular Engineering, Cornell University, Ithaca, NY (January 28, 2008).
- “Crystallizable ROMP Block Copolymers”, Alan Lawley Lecture, Department of Materials Science and Engineering, Drexel University, Philadelphia, PA (September 23, 2008).
- “Block Copolymer Thin Films as Nanofabrication Templates”, Chemical Resources Laboratory, Tokyo Institute of Technology, Tokyo, Japan (December 11, 2008).
- “Block Copolymer Thin Films as Nanofabrication Templates”, Nano Seminar Series, Stevens Institute of Technology, Hoboken, NJ (April 15, 2009).
- “Nanofabrication with Block Copolymer Templates”, Ecole Supérieure d’Ingenieurs en Electronique et Electrotechnique, Paris, France (July 9, 2009).
- “Crystallizable Block Copolymers: Directing Crystallization via Polymer Architecture”, Polymers Division, National Institute of Standards and Technology, Gaithersburg, MD (July 20, 2009).
- “Shear-Aligned Block Copolymer Thin Films as Nanofabrication Templates”, Department of Materials Science and Engineering, Massachusetts Institute of Technology, Cambridge, MA (September 10, 2009).
- “Shear-Aligned Block Copolymer Thin Films as Nanofabrication Templates”, Department of Chemical and Biomolecular Engineering, University of Illinois at Urbana-Champaign, Urbana, IL (September 15, 2009).
- “Shear Alignment of Block Copolymer Thin Films and their Applications in Nanopatterning”, Department of Chemical and Biological Engineering, University of Colorado at Boulder, Boulder, CO (November 3, 2009).
- “Shear Alignment of Block Copolymer Thin Films and their Applications in Nanopatterning”, Center for Nanoscale Science and Technology, National Institute of Standards and Technology, Gaithersburg, MD (January 15, 2010).

RICHARD A. REGISTER - INVITED SEMINARS (cont.)

- “Shear Alignment of Block Copolymer Thin Films and their Applications in Nanopatterning”, School of Chemical Engineering, Purdue University, West Lafayette, IN (February 9, 2010).
- “Shear Alignment of Block Copolymer Thin Films and their Applications in Nanopatterning”, School for Engineering of Matter, Transport, and Energy, Arizona State University, Tempe, AZ (October 1, 2010).
- “Block Copolymer Thin Films: Shear Alignment and Applications in Nanofabrication”, Department of Chemical and Biological Engineering, University of Wisconsin, Madison, WI (October 5, 2010).
- “Block Copolymer Thin Films: Shear Alignment and Applications in Nanopatterning”, Department of Chemical Engineering, University of Texas, Austin, TX (November 30, 2010).
- “Block Copolymer Thin Films: Shear Alignment and Applications in Nanopatterning”, Department of Chemical Engineering, University of Delaware, Newark, DE (December 3, 2010).
- “Crystallizable Block Copolymers: Directing Crystallization via Polymer Architecture”, 2010-2011 Grande Conference IUPAC, Département de Chimie, Université de Montréal (April 27, 2011).
- “Block Copolymer Thin Films: Structure, Shear Alignment, and Applications in Nanofabrication”, Department of Chemical and Biomolecular Engineering, Rice University, Houston, TX (September 8, 2011).
- “Block Copolymer Thin Films: Structure, Shear Alignment, and Applications in Nanofabrication”, Department of Chemical and Biomolecular Engineering, University of Pennsylvania, Philadelphia, PA (September 14, 2011).
- “Crystallizable Block Copolymers: Directing Crystallization via Polymer Architecture”, Institute of Materials Science, University of Connecticut, Storrs, CT (February 10, 2012).
- “Melt and Solid-State Structures of Polyethylene-Containing Block Copolymers”, ExxonMobil Chemical Company, Baytown Technology & Engineering Complex, Baytown, TX (September 7, 2012).
- “Crystallizable Block Copolymers: Directing Crystallization via Polymer Architecture”, ExxonMobil Research and Engineering, Corporate Strategic Research Laboratory, Annandale, NJ (September 13, 2012).
- “Block Copolymer Thin Films: Structure, Shear Alignment, and Applications in Nanofabrication”, Department of Chemical Engineering, University of Massachusetts, Amherst, MA (October 2, 2012).
- “Block Copolymer Thin Films: Structure, Shear Alignment, and Applications in Nanofabrication”, Department of Chemical and Biomolecular Engineering, University of Houston, Houston, TX (September 20, 2013).
- “Crystallizable Block Copolymers: Directing Crystallization via Polymer Architecture”, Department of Chemical Engineering, University of Florida, Gainesville, FL (February 10, 2014).
- “Block Copolymer Thin Films: Structure, Shear Alignment, and Applications in Nanofabrication”, Department of Chemical and Biomolecular Engineering, Ohio State University, Columbus, OH (March 20, 2014).
- “Block Copolymer Thin Films: Structure, Shear Alignment, and Applications in Nanofabrication”, Department of Chemical and Biomolecular Engineering, Tulane University, New Orleans, LA (April 4, 2014).
- “Block Copolymers Based on Polyethylene and Other Crystallizable Polymers”, ExxonMobil Chemical Company, Baytown Technology & Engineering Complex, Baytown, TX (June 6, 2014).
- “Crystallizable Norbornene-Based ROMP Polymers and Block Copolymers”, Promerus LLC, Brecksville, OH (June 23, 2014).

RICHARD A. REGISTER - INVITED SEMINARS (cont.)

- “Block Copolymers Based on Polyethylene and Other Crystallizable Polymers”, Braskem America Technology Center, Pittsburgh, PA (August 19, 2014).
- “Block Copolymer Thin Films: Structure, Shear Alignment, and Applications in Nanofabrication”, Science at the Edge Interdisciplinary Seminar Series, Michigan State University, East Lansing, MI (October 24, 2014).
- “Block Copolymer Thin Films: Structure, Shear Alignment, and Applications in Nanofabrication”, Distinguished Lecture, Department of Chemical Engineering, Northeastern University, Boston, MA (March 18, 2015).
- “Block Copolymer Thin Films: Structure, Shear Alignment, and Applications in Nanofabrication”, Department of Chemical Engineering and Materials Science, University of Minnesota, Minneapolis, MN (May 5, 2015).
- “Block Copolymer Thin Films: Structure, Shear Alignment, and Applications in Nanofabrication”, Molecular Engineering & Sciences Institute, University of Washington, Seattle, WA (May 26, 2015).
- “Living Vinyl Addition Polymerization of Substituted Norbornenes: A Route to High-Performance Pervaporation Membranes for Butanol Isolation”, Department of Chemistry and Biochemistry, Seton Hall University, South Orange, NJ (January 19, 2016).
- “Living Vinyl Addition Polymerization of Substituted Norbornenes: A Route to High-Performance Pervaporation Membranes for Butanol Isolation”, School of Chemical and Biomolecular Engineering, Georgia Institute of Technology, Atlanta, GA (February 24, 2016).
- “Living Vinyl Addition Polymerization of Substituted Norbornenes: A Route to High-Performance Pervaporation Membranes for Butanol Isolation”, Chemical and Biological Engineering, Rensselaer Polytechnic Institute, Troy, NY (April 27, 2016).
- “Thermoplastic Elastomers with Semicrystalline, Glassy, and Rubbery Blocks”, Braskem America Technology Center, Pittsburgh, PA (September 21, 2016).
- “Pervaporation Membranes from Addition Polynorbornenes for Effective Butanol Recovery”, Keynote Lecture, Research Day, Department of Chemical and Biomedical Engineering, Florida A&M University - Florida State University College of Engineering, Tallahassee, FL (March 24, 2017).
- “Polymers with Crystallizable Blocks”, Arkema Inc. Research Center, King of Prussia, PA (March 29, 2017).
- “Pervaporation Membranes from Addition Polynorbornenes for Effective Butanol Recovery”, Biology and Soft Matter Division, Oak Ridge National Laboratory, Oak Ridge, TN (May 30, 2017).
- “Polyethylene Block Copolymers: Synthesis, Miscibility, and Properties”, Department of Chemistry, Virginia Polytechnic Institute and State University, Blacksburg, VA (September 8, 2017).
- “Melt Miscibility of Polyethylene with Hydrogenated ROMP Poly(*x*-norbornene)s: Synthesis, Miscibility, and Properties”, Braskem America Technology Center, Pittsburgh, PA (September 19, 2017).
- “Polyethylene Block Copolymers: Synthesis, Miscibility, and Properties”, Department of Chemical Engineering, The Pennsylvania State University, State College, PA (October 26, 2017).
- “Pervaporation Membranes from Addition Polynorbornenes for Effective Butanol Recovery”, Department of Chemical and Biomolecular Engineering, Korea Advanced Institute of Science and Technology, Daejeon, ROK (April 5, 2018).
- “Pervaporation Membranes from Addition Polynorbornenes for Effective Butanol Recovery”, School of Energy and Chemical Engineering, Ulsan National Institute of Science and Technology, Ulsan, ROK (April 9, 2018).

RICHARD A. REGISTER - INVITED SEMINARS (cont.)

- “Polyethylene Block Copolymers: Synthesis, Miscibility, and Properties”, Department of Chemical and Biological Engineering, Northwestern University, Evanston, IL (May 31, 2018).
- “Polyethylene-Poly(*x*-Norbornene) Block Copolymers: Synthesis, Miscibility, and Properties”, ExxonMobil Research and Engineering, Corporate Strategic Research Laboratory, Annandale, NJ (August 16, 2018).
- “Polyethylene-Poly(*x*-Norbornene) Block Copolymers: Synthesis, Miscibility, and Properties”, ExxonMobil Chemical Company, Baytown Technology & Engineering Complex, Baytown, TX (October 5, 2018).
- “Living Vinyl Addition Polymerization of Substituted Norbornenes: A Route to High-Performance Pervaporation Membranes for Butanol Isolation ”, Braskem America Technology Center, Pittsburgh, PA (November 1, 2018).
- “Enhancing the Solid-State Properties of Polyethylene by Block Copolymerization”, Department of Chemical and Biomolecular Engineering, University of California, Los Angeles (UCLA), Los Angeles, CA (November 16, 2018).
- “Structure-Property Relationships in Semicrystalline E/MAA Copolymers and Ionomers”, Braskem Innovation and Technology, delivered via Microsoft Teams to sites in Pittsburgh, PA and Triunfo, RS, Brazil (July 8, 2020).
- “Model Linear Polyethylenes (and Block, Gradient, and Comb Copolymers) from Cyclopentene ROMP”, School of Polymer Science and Polymer Engineering, University of Akron, Akron, OH (October 22, 2021).