

Professor Richard P. Wool



Biography:

Richard Wool is a Professor of Chemical Engineering, former Director of the Center for Composite Materials and current Director of the ACRES (Affordable Composites from Renewable Resources) Program at the University of Delaware. He is author of the books “*Bio-Based Polymers and Composites*” (with Susan Sun) and “*Polymer Interfaces: Structure and Strength*”. Professor Wool is a Fellow of the American Physical Society, Division of Polymer Physics and is the North American Editor of the Journal of Bio-Based Materials and Bio Energy. He is a consultant for Nike, DuPont, Raytheon Missile Defense and Tetra Pak and President of Cara Plastics Inc.

Courses Developed by Professor Wool at the University of Delaware

Green Engineering CHEG 625

Bio-Based Green Materials CHEG 667

Current Conference Leadership:

Gordon Research Conference-Composites: Vice Chair 2010, Chair 2012

Green Chemistry and Engineering: Bio-Based Materials Chair, DC 2009

PROFESSOR RICHARD P. WOOL

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Professional History

Director, Center for Composite Materials, University of Delaware, (CCM focuses on Composite Manufacturing and Science in collaboration with Industry and the DoD) 1994-96

Professor of Chemical Engineering, Colburn Laboratory, University of Delaware, 1994-present

ACRES Program Director, (The Affordable Composites from Renewable Resources Program designs and develops –genetic engineering to manufacturing- Bio-Based Materials in cooperation with Industry, Universities and National Labs. Funded by a DoE grant of \$11M with additional support from NSF, EPA, USDA) University of Delaware, 1996-present

Professor, Materials Science & Engineering, Univ of Illinois at Urbana-Champaign, 1977-1995.

Executive Board of Directors, Center for Composite Materials, Univ of Delaware, 1996-98.

Program Director, IBM Center of Excellence for Advanced Electronic Materials Synthesis, Processing and Properties, University of Illinois, 1985-90 (with J. Greene, J Thornton, A. Rockett, J. Economy, S. Shah, S. Granick, M. Rigsbee, J. Abelson)

Director, Federation of Advanced Materials Industries (The FAMI program interacted with cooperating Industrial Material Suppliers and Users) University of Illinois 1994

Director, Degradable Plastics Laboratory, (Chaired ASTM committee and developed Standards for Biodegradable Plastics in Aquatic and Terrestrial Environments) 1987-94

Professor, Physics Department, Trinity College Dublin, 2002

Professor, Ecole Polytechnique, Condensed Matter Physics, Paris, France, 1991

Resident Associate, Center for Advanced Study, University of Illinois, 1989

Professor, Politecnico Di Milano, Natta Laboratory, Milan, Italy, 1984

Assistant Professor, Chemical Engineering, City College of New York, 1975-77

Research Associate, Mechanical Engineering, Univ. Colorado, 1974-75

Research Assistant, Materials Science & Engineering., Univ. Utah, 1970-74

University Degrees

<u>Degree</u>	<u>Field</u>	<u>Institution</u>	<u>Date</u>
B.Sc.	Chemistry (Honors Degree)	Univ. College Cork Ireland	1970
M.S.	Materials Science & Eng.	University of Utah	1972
Ph.D.	Materials Science & Eng.	University of Utah	1974

Professional Activities of Professor Richard Wool

Professional Societies:

Gordon Research Conference-Composites: Vice Chair 2010, Chair Elect 2012
 Green Chemistry and Engineering, (GCE-ACS). Bio-Based Materials Chair 2008; Program Chair, International Meeting on Bio-based Materials, Washington DC June 21 2005 and 2006
 Materials Research Society (MRS), Chairman on Symposia: 2001, Composites from Renewable Resources; 1997, Advances in Polymer Matrix Composites: Microscopic to Macroscopic; 1994, Fractal Aspects of Materials; 1987, Surfaces and Interfaces in Electronic Materials
 American Physical Society (APS)-Fellow, Division of Polymer Physics. Program Chairman, Division of Polymer Physics 1986-87
 American Chemical Society-Member (ACS), Division of Polymeric Materials
 American Institute of Chemical Engineers (AIChE)-Member
 Society of Rheology-Member
 Society of Plastic Engineers (SPE), member
 American Society for Test Methods, (ASTM) Chairman, Biodegradable Plastics, D20.96.1, 1989-95
 Neutron Scattering Society of America (NSSA), Member
 Bio/Environmentally Degradable Plastic Society, Founding Member.

Advisory Committees and Boards

CSIR MSM Research Advisory Panel, South Africa, 2008-present
 North American Editor, Journal of Biobased Materials and BioEnergy, 2006-present
 Board of Directors, Center for Composite Materials, 1996-99
 Delaware NASA Space Grant Consortium, Advisory Board, 96-present
 American Soybean Association, Composites Technical Advisory Panel, 1996-
 Engineering Outreach Faculty Advisory Committee 1996-99
 Fraunhofer Task Force, State of Delaware 1995-96
 Virginia Tech Graduate Materials Science Review Panel, 1996-
 American Soybean Association, Plastic Polymers Technical Advisory Panel, 1995-present
 Honorary Director, Huaxin Institute for Biodegradable Plastics, Beijing, China, 1991-94
 Illinois Governor's Committee on Degradable Plastics, 1990-1994
 Vice Chancellor's Committee for the Environment, Univ. Illinois, 1992-1994
 Executive Committee for College of Engineering, Univ. Illinois, 1984-87
 Committee to establish a Department of Materials Science and Engineering, University of Illinois, 1984-90
 Board of Directors, Agri-Tech Industries, 1985-88.
 Board of Directors, Cara Plastics Inc., 1997-present

Industrial Consulting and Business Start-Ups

Professor R. P. Wool consults for Nike (Portland OR), TetraPak (Italy, Sweden), DuPont (Delaware), Raytheon Missile Defense System (Tucson AZ), Green Chemistry Institute and

several Law Firms. He is Founder and President of Cara Plastics Inc of Newark Delaware (www.caraplastics.com).

Areas of Professional Expertise

Materials Science and Engineering	Polymer Physics
Fracture Mechanics	Polymer Interfaces
Biodegradable Plastics	Plastics Engineering
Materials from Renewable Resources	Spectroscopy
Composites	Adhesion

Gordon Research Conference Presentations

Composites (2), Polymers-West (2), Polymer Physics (1), Adhesion (2), Fractals (1), Biodegradable Plastics (1), Green Chemistry (2)

Awards

Fellow, American Physical Society, Division of High Polymer Physics
Innovations in Real Materials Award, International Society for Innovation in Materials Research.
Distinguished Paper Award (2007), Adhesion Society
Technical Innovation Award for Composites Excellence, with Russel Fisher, Composite Fabricators Association.
Discover Award semifinalist 2000
Richard Branson Virgin Global Warming Solutions Award nominee (2008)
Federal and Industrial Research Grants and Contracts

Immediate Research Interests (2008)

Twinkling Fractal Theory of the Glass Transition Temperature
Polymer Entanglements: Packing vs. Percolation Theory
Green Materials
Hurricane Resistant Houses
Carbon Fibers from Chicken Feathers
Hydrogen Storage
Nanomaterials
Pressure Sensitive Adhesives, Elastomers
Solutions to Global Warming

TV Documentary

Professor Wool's ACRES Bio-based materials research group will be featured on Sundance Channel's documentary program entitled "Gadgets" on June 17, 2008

Recent Press Coverage

New York Times: Science Times, 2008

Publications of Professor R. P. Wool

The following publications have been cited about 2,670 times (SCI)

Books written by R. P. Wool:

Wool, R. P. (1995). **Polymer Interfaces; Structure and Strength**, New York: Hanser/Gardner Press, 494 pages. ISBN 1-56990-133-3

Wool R. P. (2005) **Bio-Based Polymers and Composites**, with X. S. Sun, Elsevier Press, Burlington MA , 620 pages, ISBN-13:978-0-12-763952-9

Books Edited by R. P. Wool

Wool, R. P. (1995). **Fractal Aspects of Materials**, with F. Family, P. Meakin, B. Sapoval (Eds.), Materials Research Society, Symposium Proc., Vol 367.

Wool, R. P. (2001). **Advanced Fibers, Plastics, Laminates and Composites**, with F. T. Wallenberger, N. E. Weston, R. Ford and K. Chawla (Eds.), Materials Research Society Symposium Proc., Vol 702

Papers Published by R. P. Wool

Wool, R. P., and Statton, W. O. (1974). **Dynamic Polarized Infrared Studies of Stress Relaxation and Creep in Polypropylene**. *Journal of Polymer Science: Polymer Physics Edition*, 12, 1575-1586.

Wool, R. P. (1975). **Mechanisms of Frequency Shifting in the Infrared Spectrum of Stressed Polymers**. *Journal of Polymer Science: Polymer Physics Edition*, 13, 1795-1808.

Wool, R. P. (1976). **Network Fracture in Fibers and Films**. Paper #21S (6 pages). *Proceedings of the 69th Annual Meeting of American Institute of Chemical Engineers*, Chicago.

Wool, R. P. (1976). **Extensional Infrared Orientation**. *Journal of Polymer Science: Polymer Physics Edition*, 14, 1921-1929.

Wool, R. P. and Statton, W. O. (1976). **Dynamic Infrared of Polymers**. *American Chemical Society Polymer Preprints*, 17, 749-757.

Wool, R. P. (1976). **Morphological Mechanics of Springy Polymers**. *Journal of Polymer Science: Polymer Physics Edition*, 14, 603-618.

Wool, R. P. (1977). **Material Response of Viscoelastic Polymers**. Presented at the American Chemical Society Symposium on Nonlinear Viscoelasticity. Also published in *American Chemical Society Organic Coatings and Plastics Chemistry*, 37, 417-420.

- Wool, R. P. (1977). **Molecular Mechanics of Strained Polymers.** *Proceedings of the Macromolecular Symposium of the International Union of Pure and Applied Chemistry*, Dublin, 2, 645-651.
- Wool, R. P. and Statton, W. O. (1978). Chapter 12, **Dynamic Infrared of Polymers.** In E. G. Brame, Jr. (Ed.), *Applications of Polymer Spectroscopy* (pp. 185-205). New York: Academic Press.
- Wool, R. P. (1978). **Material Response and Reversible Cracks in Viscoelastic Polymers.** *Polymer Engineering and Science*, 18, 1057-1061.
- Wool, R. P. (1978). **Peel Mechanics of Adhesive Strips with Constraints.** *International Journal of Fracture*, 14, 597-603.
- Wool, R. P. (1979). **Crack Healing in Polymers.** *American Chemical Society Organic Coatings and Plastics Chemistry*, 40, 271-274.
- Wool, R. P., Lohse, M. I., and Rowland, T. J. (1979). **Broad-line NMR Studies of Deformation and Recovery in Hard Elastic Polypropylene.** *Journal of Polymer Science: Polymer Letters Edition*, 17, 385-389.
- Wool, R. P. and Statton, W. O. (1979). **Properties and Molecular Constitution of Fibres.** In F. Happey (Ed.), *Applied Fibre Science* (Chapter 1, Vol. 3). London: Academic Press.
- Wool, R. P. (1980). **Crack Healing in Semicrystalline Polymers, Block Copolymers and Filled Elastomers.** *Polymer Science and Technology*, 12A, 341; In Lieng-Huong Lee (Ed.), *Adhesion and Absorption of Polymers, Part A* (pp. 341-362). New York: Plenum Publishers.
- Wool, R. P. (1980). **Infrared Studies of Deformation in Semicrystalline Polymers.** *Polymer Engineering and Science*, 20, 805-815.
- Wool, R. P. and Boyd, R. H. (1980). **Molecular Deformation of Polypropylene.** *Journal of Applied Physics*, 51, 5116-5124.
- Levy, R. L. and Wool, R. P. (1980). **Difference Infrared Spectroscopy of Stressed Polymers.** *American Chemical Society Polymer Preprints*, 21, 239-242.
- O'Connor, K M. and Wool, R. P. (1980). **Optical Studies of Void Formation and Healing in Styrene-Isoprene-Styrene Block Copolymers.** *Journal of Applied Physics*, 51, 5075-5079.
- Wool, R. P. and Rockhill, A. T. (1980). **Molecular Aspects of Fracture and Crack Healing in Glassy Polymers.** *American Chemical Society Polymer Preprints*, 21, 223-224.
- Wool, R. P. (1980). [Review of Polymer Fracture by H. H. Kausch, Springer-Verlag (1979)]. *Journal of the American Chemical Society*, 102, 2137.

- Wool, R. P. (1980). [Review of *Advances in Polymer Science*, 29, Springer-Verlag (1979)]. *Journal of the American Chemical Society*, 102, 3986.
- Wool, R. P. (1980). **Material Damage in Polymers**. *Proceedings of the National Science Foundation Workshop on A Continuum Mechanics Approach to Damage and Life Prediction*, Carrollton, KY.
- Wool, R. P. (1981). **Measurements of Infrared Frequency Shifts in Stressed Polymers**. *Journal of Polymer Science: Polymer Physics Edition*, 19, 449-457.
- Wool, R. P. and O'Connor, K. M. (1981). **Craze Healing in Polymer Glasses**. *Polymer Engineering and Science*, 21, 970-977.
- Wool, R. P. and Rockhill, A. T. (1981). **Molecular Fracture in Polystyrene**. *Journal of Macromolecular Science-Physics*, B20, 85-99.
- Wool, R. P. (1981). **Crack Healing in Polymer Composites**. *American Chemical Society Polymer Preprints*, 22, 207-208.
- Bretzlaff, R. S. and Wool, R. P. (1981). **Temperature Effect in Quasiharmonic Infrared Bands of Stressed Polymers**. *Journal of Applied Physics*, 52, 5964-5969.
- Wool, R. P. and O'Connor, K. M. (1981). **A Theory of Crack Healing in Polymers**. *Journal of Applied Physics*, 52, 5953-5963.
- Wool, R. P. and O'Connor, K. M. (1982). **Time Dependence of Crack Healing**. *Journal of Polymer Science: Polymer Letters Edition*, 20, 7-16.
- Wool, R. P. (1982). **Relations for Healing, Fracture, Self-Diffusion and Fatigue of Random Coil Polymer**. *American Chemical Society Polymer Preprints*, 23(2), 62-65.
- Wool, R. P. (1982, November). **Interrelations Between Damage and Healing in Polymers**. *Proceedings of the National Science Foundation Workshop on Mechanics of Fracture and Damage*, Stone Mountain, GA.
- Wool, R. P. (1983, July). **FTIR Studies of Stressed Polymers**. *Proceedings of the 28th Macromolecular Symposium of the International Union of Pure and Applied Chemistry*, Amherst, MA.
- Kim, Y. H. and Wool, R. P. (1983). **A Theory of Healing at a Polymer-Polymer Interface**. *Macromolecules*, 16, 1115-1120.
- Bretzlaff, R. S. and Wool, R. P. (1983). **Frequency Shifting and Asymmetry in Infrared Bands of Stressed Polymers**. *Macromolecules*, 16, 1907-1917.

- Lee, Y.-L, Bretzlaff, R. S. and Wool, R. P. (1984). **Fourier-Transform Infrared Studies of Polypropylene During Mechanical Deformation.** *Journal of Polymer Science: Part B: Polymer Physics*, 22, 681-698.
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- Wool, R. P. and Joss, B. L. (1983, September). **Spectroscopic Observations of the Non-Equilibrium State of Polymer Glasses.** *Proceedings of the North American Thermal Analysis Society Annual Meeting, Symposium on Physical Aging Processes in Molecular and Atomic Glasses*, Williamsburg, VA.
- Wool, R. P. (1984). **Molecular Aspects of Tack.** *Rubber Chemistry and Technology*, 57, 307-319.
- Wool, R. P. (1984). **Strength Development at a Symmetric Polymer-Polymer Interface.** *Proceedings of the 9th International Congress on Rheology*, 3, 573-580.
- Wool, R. P. (1984, December). **Topology of the Critical Entanglement Molecular Weight.** *Proceedings of the International Chemical Congress of Pacific Basin Societies*, Honolulu, HI.
- Wool, R. P. (1984, August). **Principles and Applications of FTIR Spectroscopy of Stressed Polymers.** *Proceedings of the American Chemical Society Symposium on FTIR Characterization of Polymers*, Philadelphia, PA.
- Wool, R. P. (1984). **Properties and Entanglements of Inter-penetrating Chains at a Polymer-Polymer Interface.** *American Chemical Society Polymer Material Science and Engineering Preprints*, 179, 181.
- Joss, B. L., Bretzlaff, R. S., and Wool, R. P. (1984). **Spectroscopic Observations on Non-Equilibrium Glassy Poly(vinyl chloride) and Polystyrene.** *Polymer Engineering and Science*, 24(4), 1130-1137.
- Wool, R. P. (1985). **Properties and Entanglements of Amorphous Polymer Interfaces.** *Journal of Elastomers and Plastics*, 17, 106-118.
- Wool, R. P. (1985). **Entanglements and Deformation.** *Proceedings of the International Symposium on Nonlinear Deformation of Polymers*, Chicago. *American Chemical Society Polymer Preprints*, 26, 139-140.
- Willett, J. L., O'Connor, K. M. and Wool, R. P. (1985). **Mechanical Properties of Polymer-Polymer Welds: Time and Molecular Weight Dependence.** Presented at the International Symposium on Nonlinear Deformation of Polymers, Chicago. *American Chemical Society Polymer Preprints*, 26(2), 123-125.

- Love, B. L. and Wool, R. P. (1985). **Molecular Deformation in Semicrystalline Polymers as Characterized by FTIR.** *American Chemical Society Polymer Preprints*, 26(2).
- Lee, A. and Wool, R. P. (1985). **Fourier Transform Infrared Study of Reptation Dynamics.** *American Chemical Society Polymer Material Science and Engineering Preprints*, 53, 312.
- Joss, B. L. and Wool, R. P. (1985). **Infrared Study of Vitrification and Physical Aging in Glassy Polymers.** *American Chemical Society Polymer Material Science and Engineering Preprints*, 53, 307.
- Lee, A. and Wool, R. P. (1985, July). **Fourier Transform Infrared Study of Reptation Dynamics.** *Proceedings of Workshop on Polymer Flow Interactions*, La Jolla, CA.
- Wool, R. P., Bretzlaff, R. S., Li, B.-Y., Yang, C. H. and Boyd, R. H. (1986). **Infrared and Raman Spectroscopy of Stressed Polyethylene.** *Journal of Polymer Science: Part B: Polymer Physics*, 24, 1039-1066.
- Lee, A. Y. and Wool, R. P. (1986). **FT-IR Study of Orientation Relaxation in Uniaxially Oriented Monodisperse Atactic Polystyrenes.** *Macromolecules*, 19, 1063-1068.
- Willett, J. L., O'Connor, K. M. and Wool, R. P. (1986). **The Role of Chain Scission in Fracture of Amorphous Polymers.** *Journal of Polymer Science: Part B: Polymer Physics*, 24, 2583-2589.
- Lee, A. Y. and Wool, R. P. (1987). **Relaxation Mechanism of Polymer Melts.** *Macromolecules*, 20, 1924-1927.
- Wool, R. P., Willett, J. L., McGarel, O. J. and Yuan, B. L. (1987). **Strength of Polymer Interfaces.** *American Chemical Society Polymer Preprints*, 28(2), 38.
- Lee, A. Y. and Wool, R. P. (1987). **Matrix Effects on the Relaxation of Linear Polymer Melts.** *American Chemical Society Polymer Preprints*, 28(1), 334.
- Wool, R. P. (1987). **Strength and Entanglement Development at Amorphous Polymer Interfaces.** *Proceedings of the Institute of Mathematics and Its Applications Workshop on Amorphous Polymers and Non-Newtonian Fluids. IMA*, 6, 169-187.
- Wool, R. P. (1987, August). **Molecular Dynamics of Stressed Polymers: An FTIR Study.** *Proceedings of 6th International Conference on Fourier Transform Spectroscopy*, Vienna, Austria.
- Wool, R. P. (1987, September). **Dynamics, Structure and Strength of Polymer Interfaces.** *Proceedings of the U. S. Germany Polymer Science Symposium*, Napa Valley, CA.
- McGarel, O. J. and Wool, R. P. (1987). **Craze Growth and Healing in Polystyrene.** *Journal of Polymer Science: Part B: Polymer Physics*, 25, 2541-2560.

- Wool, R. P. (1988). **Welding and Fracture of Glassy Polymers.** *American Chemical Society Polymer Preprints*, 29(2), 139.
- Wool, R. P. (1988, May). **Processing of Starch Based Biodegradable Plastics.** *Proceedings of the 4th Annual Meeting of the Polymer Processing Society International*, Orlando, FL.
- Wool, R. P. (1988, November). **Biodegradable Plastics From Cornstarch.** *Proceedings of the 2nd National Corn Utilization Conference*, Columbus, OH.
- Kline, D. B. and Wool, R. P. (1988). **Polymer Welding Relations Investigated by a Lap Shear Joint Method.** *Polymer Engineering and Science*, 28(1), 52-57.
- Wool, R. P. and Cole, M. A. (1988). **Microbial Degradation.** In *ASM Engineering Materials Handbook Vol. 2: Engineering Plastics* (pp. 783-787). New York: Plenum Publishing.
- Whitlow, S. J. and Wool, R. P. (1989). **Investigation of Diffusion in Polystyrene Using Secondary Ion Mass Spectroscopy.** *Macromolecules*, 22, 2648-2652.
- Zhang, H. and Wool, R. P. (1989). **Concentration Profile For a Polymer-Polymer Interface. 1. Identical Chemical Composition and Molecular Weight.** *Macromolecules*, 22, 3018-3021.
- Wool, R. P., Yuan, B. L. and McGarel, O. J. (1989). **Welding of Polymer Interfaces.** *Polymer Engineering and Science*, 29(19), 1340-1367.
- Wool, R. P. (1989, January). **Perspectives on Degradable Plastics.** *Proceedings of the Symposium on Corn-Based Degradable Plastics*, Des Moines, IA.
- O'Connor, K. M. and Wool, R. P. (1989). **Mechanical Studies of Damage and Healing in SIS Block Copolymers.** *Journal of Polymer Science, Polymer Physics Edition*,
- Wool, R. P. (1990). **Dynamics and Fractal Structure of Polymer Interfaces.** In L.-H. Lee (Ed.), *New Trends in Physics and Physical Chemistry* (pp. 129-136). New York: Plenum Publishing.
- Wool, R. P. and Long, J. M. (1990). **Structure of Diffuse Polymer Metal Interfaces.** *American Chemical Society Polymer Preprints*, 31(2).
- Wool, R. P., Peanasky, J. S., Long, J. M. and Goheen, S. M. (1990). **Degradation Mechanisms in Polyethylene-Starch Blends.** In S. A. Barenberg, J. L. Brash, R. Narayan and A. E. Redpath (Eds.) *Degradable Materials* (pp. 515-544). Boston: CRC Press.
- Long, J. M., Futrelle, J. and Wool, R. P. (1990). **Two Dimensional Site Percolation.** Computer Software Package for IBM PC-AT or PS/2. Madison, WI: Wiseware.

- Yuan, B. L. and Wool, R. P. (1990). **Strength Development at Incompatible Semicrystalline Polymer Interfaces.** *Polymer Engineering and Science*, 30(22), 1454-1464.
- Zhang, H. and Wool, R. P. (1990). **Concentration Profiles at Amorphous Polymer Interfaces.** *American Chemical Society Polymer Preprints*, 31(2) 511
- Wool, R. P. (1990). **Science, Technology and Standards for Biodegradable Plastics.** *American Chemical Society Polymer Preprints*, Bailey Memorial Symposium.
- Wool, R. P. (1991). **Welding, Tack, and Green Strength of Polymers.** In L.-H. Lee (Ed.), *Fundamentals of Adhesion* (pp. 207-248). New York: Plenum Publishing.
- Goheen, S. M. and Wool, R. P. (1991). **Degradation of Polyethylene-Starch Blends in Soil.** *Journal of Applied Polymer Science*, 42, 2691-2701.
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- Foster, K. L. and Wool, R. P. (1991). **Strength of Polystyrene-Poly(methyl methacrylate) Interfaces.** *Macromolecules*, 24, 1397-1403.
- Whitlow, S. J. and Wool, R. P. (1991). **Diffusion of Polymers at Interfaces: Secondary Ion Mass Spectroscopy Study.** *Macromolecules*, 24, 5926-5938.
- Walczak, W. J. and Wool, R. P. (1991). **Investigation of Polymer Melt Relaxation Mechanisms via Dynamic Infrared Dichroism.** *Macromolecules*, 24, 4657-4665.
- Wool, R. P., Wagner, G. and Raghavan, R. (1991, November). **Dynamics of Biodegradation of Polymer-Starch Blends.** *Proceedings of the Second International Workshop on Biodegradable Plastics*, Montpellier, France.
- Agrawal, G and Wool, R. P. (1992). **A Critical Reptation Analysis Using Short Time Interdiffusion at Polymer Interfaces.** *Polymer Materials Science and Engineering, ACS Preprints*, 67, 166.
- Raghavan, D., Wagner, G. C. and Wool, R. P. (1992). **Carbon Balance During Biodegradation of a Polymer.** *Polymer Materials Science & Engineering, ACS Preprints*, 67, 357.
- Desai, P. G., Young, J. F. and Wool, R. P. (1992). **Cross-linking Reactions in Macro Defect-Free Cement Composites.** In F. P. Glasser, P. L. Pratt, T. O. Mason and G. J. McCarthy (Eds.) *Advanced Cementitious Systems: Mechanisms and Properties*, MRS Proceedings, 245.
- Wool, R. P. (1993). **Polymer Entanglements.** *Macromolecules*, 26, 1564.

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- Wool, R. P. and Long, K. M. (1993). **Fractal Structure of Polymer Interfaces**, *Macromolecules*, 26, 5227.
- Willett, J. L. and Wool, R. P., (1993). **Strength of Incompatible Amorphous Polymer Interfaces**, *Macromolecules*, 26, 5336
- Russell, T. P., Deline, V. R., Dozier, W. D., Felcher, G. P., Agrawal, G., Wool, R. P., Mays, J. W., (1993). **Direct Observation of Reptation at Polymer Interfaces**, *Nature*, Vol. 365, 235 Sept.
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- Wool, R. P., (1993). **Structure and Strength of Polymer Interfaces**, *Polymer Preprints*, 34(2).
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- Agrawal, G. and Wool, R. P., (1993). **Structure of Welded Symmetric Interfaces with Reptation**, *Polymer Preprints*, 34(2), 305.
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- Wool, R. P., **Perspectives on Standards Test Methods for Biodegradable Plastics**, *Proceedings of International Workshop on Biodegradable Polymers*, Osaka, Japan, November 1993. (p. 250-258) in *Biodegradable Plastics and Polymers*, Y. Doi and K. Fukuda (Eds.), Elsevier Science, Amsterdam, (1994)
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