

David Bauer, Ph.D.
Managing Scientist

Professional Profile

Dr. David Bauer is a Managing Scientist in Exponent's Vehicle Engineering practice, joining Exponent after over 29 years with Ford Motor Company. Dr. Bauer has carried out research in several areas of polymeric materials including paint, plastics, elastomers, and fuel cells. His major research focus has been in the areas of paint and plastics failure analysis and service life prediction. Along with developing new approaches to measuring material degradation, Dr. Bauer has taken the results of accelerated tests and used them to accurately determine field performance. Dr. Bauer has made important contributions to the understanding of UV degradation, thermal oxidation, and hydrolysis of polymers. He has published more than 115 papers in peer-reviewed journals and made more than 150 presentations in a wide range of areas including paint cure, paint rheology, paint weathering, plastics characterization, plastics failure analysis, and tire aging. He has edited two books on service life prediction in coatings and is currently coauthoring a book on tire aging. He has won two of the major awards in Coatings Science: the Roy Tess Award in Coatings and the Mattiello Lecture.

Academic Credentials and Professional Honors

Ph.D., Chemistry, Stanford University, 1975

B.S., Chemistry, California Institute of Technology, 1971

Presented Joseph Mattiello Lecture to Federation of Societies of Coatings Technology (1996); Winner Roy W. Tess Award for Outstanding Contributions to Coatings Science (2000); Elected Fellow of the Polymeric Materials: Science and Engineering Division of the American Chemical Society (2000); Best Paper Award, "Effects of Nitrogen Inflation on Tire Aging and Performance. Rubber Division Meeting, Grand Rapids, MI (2004); Ford Chassis Engineering Technical Achievement Award, "Accelerated Tests for Tire Aging (2006)

Patents

Patent No. 6,495,279: Ultrahigh power density miniaturized solid oxide fuel cell, issued December 2002 (with A. Bogicevic, D.R. Bauer, and C. Wolverton).

Publications

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Bauer DR, Baldwin JM, Ellwood KR. Rubber aging in tires. 2: Accelerated oven aging tests. *Polym Degrad Stabil*, in press.

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Bauer DR, Adamsons K. The role of fundamental mechanistic studies in practical service life prediction. p. 162. In: *Service Life Prediction II*. Bauer DR, Martin JW (eds), ACS Symposium Series No. 805, Oxford Press, Washington, DC, 2002.

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Crosbie GM, Murray EP, Bauer DR, Kim H, Park S, Vohs JM, Gorte RJ. Application of direct oxidation of liquid hydrocarbon fuels in solid oxide fuel cells to automotive auxiliary power units. p. 71. In: SAE, Fuel Cells and Alternative Fuels/Energy Systems, 2001.

Bauer DR. Automotive coatings and paint systems. In: Encyclopedia of Materials: Science and Technology. Elsevier Press, 2001.

Bauer DR. Requirements and challenges for a fuel cell auxiliary power unit. Proceedings, EVS-18, Berlin, Germany, 2001.

Bauer DR. Stabilization of coatings. p. 99. In: Plastics and Coatings—Durability, Stabilization, Testing. Ryntz R (ed), Hanser Pub., 2001.

Bauer DR. Global exposure models for automotive coating photooxidation. Polym Degrad Stabil 2000; 69.

Bauer DR. Interpreting weathering acceleration factors for automotive coatings using exposure models. Polym Degrad Stabil 2000; 69.

Bauer DR. Perspectives on weatherability testing. J Coatings Technol 2002; 74(924).

Bauer DR. Application of failure models for predicting weatherability in automotive coatings. pp. 378–395. In: A Systems Approach to Service Life Prediction in Coatings. Bauer DR, Martin JW (eds), ACS Symposium Series 722, Oxford University Press, 1999.

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Mielewski DF, Bauer DR, van Oene H, Schmitz PJ. Weld line morphology of injection molded polypropylene. J Polymer Sci Engin 1998; 38.

Dickie RA, Bauer DR, Ward SM, Wagner DA. Modeling paint and adhesive cure in automotive applications. Progr Org Coat 1997; 31.

Bauer DR. Predicting in-service weatherability of automotive coatings: A new approach. J Coatings Technol 1997; 69.

Mielewski DF, Anturkar NR, Bauer DR. Estimation of diffusion and solubility coefficients for water and CO₂ in reaction injection molded parts. Polymer Compos 1996; 17.

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Bauer DR, Gerlock JL, Mielewski DF, Paputa Peck MC, Carter, III, RO. Photodegradation and Photostabilization of Urethane Crosslinked Coatings. *Indust Engin Chem* 1991; 30.

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Bauer DR, Gerlock JL, Mielewski DF. Photostabilization and photodegradation in organic coatings containing a hindered amine light stabilizer. Part VI. ESR measurements of nitroxide kinetics and mechanism of stabilization. *Polym Degrad Stabil* 1990; 28.

Gerlock JL, Bauer DR, Mielewski DF. Using nitroxide decay to study automotive topcoat enamel weatherability. *Free Rad Res Comm* 1990; 10.

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Hoke WE, Bauer DR, Ekkers J, Flygare WH. The measurement and interpretation of T_1 and T_2 in the inversion doublets of $^{15}\text{NH}_3$ and the rotational transitions of OCS. *J Chem Phys* 1976; 64.

Bauer DR, Opella SJ, Nelson DJ, Pecora R. Depolarized light scattering and carbon nuclear resonance measurements of the isotropic rotational correlation time of muscle calcium binding protein. *J Am Chem Soc* 1975; 97.

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Presentations

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Bauer DR, Baldwin JM, Ellwood KR. Correlation of laboratory tire endurance and rubber aging. Rubber Division Meeting, Cincinnati, OH, October 10, 2006.

Ellwood KR, Baldwin JM, Bauer DR. Numerical model for nitrogen tire inflation. Tire Society, Akron, OH, September 12, 2006.

Bauer DR, Adams JA, Saloka GS. Hydrolytic degradation in polymeric materials: Exposure testing and service life prediction of automotive components. American Chemical Society, San Francisco, CA, September 11, 2006.

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Bauer DR. Summary of coating characterization and properties. DSCT/EMU course on Coatings Characterization and Properties, Troy, MI, May 3, 1999.

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Bauer DR. Plastics research at Ford. Nissan Motors, Japan, October 28, 1998.

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Bauer DR. Coating rheology and cure. Kent State Course on Polymer Rheology, Kent, OH, April 17, 1998.

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Bauer DR. Application of failure models for predicting weatherability in automotive coatings. International Symposium on A Systems Approach to Service Life Prediction of Organic Coatings. Breckenridge, CO, September 17, 1997.

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Bauer DR. Paint application and paint weathering. Paint, Plastics, and Adhesives for Automotive Usage Short Course, University of Michigan, May 21, 1997.

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Bauer DR. Photooxidation and stabilization of coatings. PPG Industries Research Seminar, Allison Park, PA, March 28, 1995.

Bauer DR. Polymer additives: Needs and new directions for the automotive industry. Polymer Additives - 95, Chicago, IL, March 1, 1995.

Bauer DR. Performance issues for polymers in automotive applications. Symposium on Polymers in Critical Technologies, San Juan, Puerto Rico, November 19, 1994.

Bauer DR. Using chemistry to predict coating weatherability. Workshop on Photodegradation and Weatherability, Kent State University, Kent, OH, September 29, 1994.

Bauer DR. Paint application and paint weathering. Paint, Plastics and Adhesives for Automotive Usage Short Course, University of Michigan, May 23, 1994.

Bauer DR. Chemical approaches for evaluating automotive materials and test methods. Advanced Symposium on Automotive Materials Testing, DSET, Phoenix, AZ, November 11, 1993.

Bauer DR. Using chemistry to predict coating weatherability. Workshop on Photodegradation and Weatherability, Kent State University, Kent, OH, September 30, 1993.

Golovoy A, Cheung MF, Plummer HK, Bauer D. The influence of processing on the properties of rubber toughened polysulfone/poly(phenylene sulfide) blends. SPE 1993 ANTEC Meeting, New Orleans, LA, August 1993. Winner Best Paper Award, Alloys and Blends Special Interest Group.

Tao W, Golovoy A, Zinbo M, Bauer D. Recyclability of post-consumer plastic bumpers. SPE 1993 ANTEC Meeting, New Orleans, LA, August 1993.

Bauer DR. Chemical methods for predicting automotive coating weatherability. 205th National ACS Meeting, Denver, CO, April 1993.

Tao W, Golovoy A, Zinbo M, Bauer D. Long term durability of plastic bumpers, SAE - 1993 Congress, Detroit, MI, February 1993.

Bauer DR. Automotive recycling. Conference on Challenges Facing Materials Recycling, Washington DC, November 10, 1992.

Bauer DR. New methods for predicting paint weatherability. Workshop on Photodegradation and Weatherability, Kent State University, Kent, OH, October 13, 1992.

Mielewski DF, Anturkar NR, Bauer DR, Trevino L. Outgassing phenomenon in reaction injection molded parts. Polyurethanes 92, 34th Annual Technical Conf., New Orleans, LA, October 10, 1992.

Gerlock JL, Bauer DR, Mielewski DF. Hydroperoxide analysis as a means to screen coating weatherability under non-chemistry distorting exposure conditions. XVIIIth International Conference in Organic Coating Science and Technology, Athens, Greece, July 1992.

Mielewski DF, Anturkar NR, Bauer DR. The rheokinetics of RIM systems in solution. SPE ANTEC, Detroit, MI, May 6, 1992.

Bauer DR. Polymer chemistry. ASM Course on Plastics, March 1992.

Gerlock JL, Bauer DR, Mielewski DF. Using ESR, IR, NMR, HPLC, and hydroperoxide titrations to follow the photooxidation of coatings. Anachem 50th Anniversary Symposium, Farmington, MI, November 7, 1991.

Bauer DR. New methods for predicting paint weatherability. Workshop on Photodegradation and Weatherability, Kent State University, Kent, OH, September 26, 1991.

Bauer DR. Polymer chemistry and automotive coatings. Oakland University, September 11, 1991.

Cassatta JC, Bauer DR, Colvin A, Graham DJ, Carduner KR. Quality assurance of automotive electrocoat application by real time measurement of pH, conductivity, and solids. Advanced Coatings Technology Conference ESD/ASM, June 10, 1991.

Gerlock JL, Bauer DR, Mielewski DF. Predicting long-term durability and quality of automotive coatings. Advanced Coatings Technology Conference ESD/ASM, June 10, 1991.

Gerlock JL, Bauer DR, Mielewski DF. Hydroperoxide titration as a simple inexpensive means to screen the weatherability performance of automotive topcoat enamels. IUPAC meeting, Melbourne, Australia, February 19, 1991.

Bauer DR. Spectroscopic approaches to predicting paint weatherability. Workshop on Photodegradation and Weatherability, Kent State University, Kent, OH, October 20, 1990.

Gerlock JL, Bauer DR, Mielewski DF. Chemical assessments of coating durability. Courtald's Conference on Polymer Durability, Newcastle, England, September 27, 1990.

Bauer DR. Learning to predict paint durability using chemistry. SAE Materials Standard Committee, Southfield, MI, September 26, 1990.

Bauer DR. Some chemical aspects in the implementation of automotive coatings. 200th National ACS Meeting, Washington, DC, August 29, 1990.

Mielewski DF, Bauer DR, Gerlock JL. Determination of hydroperoxide concentrations in crosslinked polymeric coatings containing hindered amine light stabilizers. 200th National ACS Meeting, Washington, DC, August 29, 1990.

Bauer DR. Hindered amine light stabilizer chemistry. Ciba Geigy, Ardsley, NY, July 25, 1990.

Gerlock JL, Bauer DR, Mielewski DF. Differences in the photooxidation kinetics of acrylic/melamine and acrylic/urethane coatings. 33rd IUPAC Symposium on Macromolecules, Montreal, July 10, 1990.

Mielewski DF, Bauer DR, Gerlock JL. The Role of hydroperoxides in the photooxidation of crosslinked polymer coatings. 198th National ACS Meeting, Miami Beach, FL, September 12, 1989.

Bauer DR. Photodegradation and photostabilization of coatings. Short Course on Photodegradation and Stabilization of Polymers. Miami, FL, September 10, 1989.

Bauer DR. Network modeling using Miller-Macosko theory. Short Course on Crosslinked Polymers, West Point, NY, April 25, 1989.

Bauer DR. Photodegradation and photostabilization of coatings. Short Course on Photodegradation and Stabilization of Polymers. West Point, NY, October 27, 1988.

Bauer DR. Calculating network structure using Miller-Macosko theory: Networks with two crosslinking reactions. 195th National ACS Meeting, Toronto, June 8, 1988.

Gerlock JL, Bauer DR, Mielewski DF. Predicting the weatherability of flexible coatings: Photoinitiation rates in the real world. 195th National ACS Meeting, Toronto, June 7, 1988.

Bauer DR. Network modeling using Miller-Macosko theory. Short Course on Crosslinked Polymers, West Point, NY, April 15, 1988.

Bauer DR. Application of network structure theory to coatings. DuPont Conference on Crosslinking, Scanticon, Princeton, NJ, November 3, 1987.

Bauer DR. Network structure models: Theory and application. North American Thermal Analysis Conference, Washington DC, September 27, 1987.

Carter, III, RO, Bauer DR. Infrared methods for coating analysis. 194th National ACS Meeting, New Orleans, LA, September 3, 1987.

Carduner KR, Carter, III, RO, Zinbo M, Gerlock JL, Bauer DR. End-groups in acrylic copolymers. Part I. Identification of end-groups by carbon-13 NMR. 194th National ACS Meeting, New Orleans, LA, September 3, 1987.

Gerlock JL, Mielewski DF, Bauer DR, Carduner KR. End-groups in acrylic copolymers. Part II. Mechanisms of incorporation of end-groups and relationship to photoinitiation rates. 194th National ACS Meeting, New Orleans, LA, September 3, 1987.

Bauer DR. Photodegradation in thermoset coatings and stabilization by hindered amines. International Conference on Polymer Degradation and Stabilization, Lucerne, Switzerland, May 25, 1987.

Bauer DR. Network formation and degradation in urethane and melamine-formaldehyde crosslinked coatings. 193rd National ACS Meeting, Denver, April 6, 1987.

Bauer DR. Photodegradation, photostabilization and accelerated tests. AKZO Research, Bay City, MI September 24, 1986.

Bauer DR, Dean MJ, Gerlock JL. Photostabilization in two-package acrylic/urethane coatings. 192nd National ACS Meeting, Anaheim, CA, September 8, 1986.

Bauer DR. Photodegradation, photostabilization, and accelerated tests. Gordon Conference on Coatings, Plymouth, NH, August 15, 1986.

Gerlock JL, Dean MJ, Korniski TJ, Bauer DR. Formaldehyde release from acrylic-melamine coatings during photolysis and the mechanism of photoenhance crosslink hydrolysis. 191st National ACS Meeting, New York, NY, April 14, 1986.

Bauer DR, Dickie RA, Koenig JL. Cure and photodegradation of two-package acrylic/urethane coatings. 191st National ACS Meeting, New York, NY, April 14, 1986.

Bauer DR, Gerlock JL, Briggs LM, Riley T. Degradation and stabilization of organic coatings containing hindered amines. 190th National ACS Meeting, Chicago, IL, September 10, 1985.

Bauer DR, Dickie RA. Application of network structure models to optimization of bake conditions for thermoset coatings. 189th National ACS Meeting, Miami, FL, May 1, 1985.

Gerlock JL, Bauer DR, Briggs LM. Using nitroxide kinetics to predict service life in coatings. 189th National ACS Meeting, Miami, FL, May 1, 1985.

Bauer DR, Briggs LM. Rheological models for predicting flow in high solids coatings. Cleveland Society for Coatings Technology, Cleveland, OH, March 13, 1985. Winner, Best Talk of Conference.

Bauer DR. Cure and network formation in automotive topcoats. Polymer and Coatings Department, North Dakota State University, Fargo, ND, February 20, 1985.

Bauer DR. Degradation of automotive topcoats. Polymer and Coatings Department, North Dakota State University, Fargo, ND, February 20, 1985.

Gerlock JL, Bauer DR, Briggs LM. ESR studies to predict rates of coating photodegradation. Tenth International Conference in Organic Coating Science and Technology, Athens, Greece, July 1984.

Bauer DR. FTIR and solid state C-13 NMR studies of cure and degradation in acrylic-melamine coatings. Glidden Coatings and Resins, Strongsville, OH, April 1984.

Bauer DR, Dickie RA, Koenig JL. Magic angle spinning C-13 NMR of acrylic-melamine coatings. 187th ACS National Meeting, Division of Polymeric Materials: Science and Engineering, St. Louis, MO, April 1984.

Gerlock JL, Bauer DR, Briggs LM. ESR determination of nitroxide kinetics during photodegradation of acrylic-melamine coatings. 187th ACS National Meeting, Division of Polymeric Materials: Science and Engineering, St. Louis, MO, April 1984.

Bauer DR. Characterization of acrylic-melamine coatings by magic angle C-13 NMR. University of Detroit, Detroit, MI, February 1984.

Bauer DR. Degradation chemistry in acrylic-melamine coatings. Ciba-Geigy, Basil Switzerland, July 1983.

Bauer DR. Mechanism of flow control by dispersed polymer particles in high solids paints. Ninth International Conference in Organic Coatings Science and Technology. Athens, Greece, July 1983.

Bauer DR. Rheology and flow control in high solids paints. Cleveland Society for Coatings Technology, Cleveland, OH, April, 1983.

Bauer DR, Briggs LM. Infrared spectroscopic studies of degradation in crosslinked networks: Photoenhanced hydrolysis of acrylic-melamine coatings. 185th ACS National Meeting, Division of Organic Coatings and Plastics, Seattle, WA, March 1983.

Bauer DR, Briggs LM, Dickie RA. Effect of crosslinked polymeric microparticles on the rheology of high solids coatings. 184th ACS National Meeting, Division of Organic Coatings and Plastics, Kansas City, MO, 1982.

Gerlock JL, Van Oene H, Bauer DR. Nitroxide kinetics: A novel technique for assessing polymer UV weatherability. 184th ACS National Meeting, Division of Organic Coatings and Plastics, Kansas City, MO, 1982.

Bauer DR. Network structure and cure response in acrylic-melamine coatings. FOCUS Meeting, Detroit Paint Society, May 1982.

Bauer DR. Cure response in thermoset coatings: A network structure approach. Great Lakes Polymer Conference, Detroit, MI, February 1982. Also presented at Marshall Labs, DuPont, Philadelphia, PA, October 1981.

Bauer DR. Hydrodynamic properties of dilute and concentrated latexes: A study by quasielastic light scattering. University of Illinois, Urbana, IL, October 1981.

Bauer DR. Degradation of organic coatings. I. Hydrolysis of melamine formaldehyde/acrylic copolymer films. Advances in the Stabilization and Controlled Degradation of Polymers, New Paltz, NY, June 1981.

Bauer DR, Dickie RA. Crosslinking chemistry and network formation in melamine formaldehyde/acrylic copolymer films. Gordon Conference on Chemistry and Physics of Coatings and Films, Plymouth State College, New Hampshire, June 1981.

Bauer DR, Dickie RA. Cure response in melamine formaldehyde/acrylic copolymer crosslinked coatings. Advances in Coating Science and Technology, University of Detroit, May 1981.

Bauer DR, Budde GF. Crosslinking chemistry and network structure in organic coatings. III. Single component high solids acrylics. 180th ACS National Meeting, Division of Organic Coatings and Plastics, Las Vegas, NV, 1980.

Bauer DR. Effects of aggregation on the hydrodynamics of concentrated latexes: A study by quasielastic light scattering. 53rd Colloid and Surface Science Symposium, Rolla, MO, 1979.

Bauer DR, Ullman R. The contraction of polystyrene molecules in dilute solution below the theta temperature. 178th ACS National Meeting, Polymer Division, Washington DC, 1979.

Bauer DR, Dickie RA. Crosslinking chemistry and network structure in organic coatings. I. Cure of melamine formaldehyde acrylic copolymer films. 178th ACS National Meeting, Division of Organic Coatings and Plastics, Washington DC, 1979.

Bauer DR, Dickie RA. Crosslinking chemistry and network structure in organic coatings. II. Effect of catalysis on cure of melamine formaldehyde acrylic copolymer films. 178th ACS National Meeting, Division of Organic Coatings and Plastics, Washington DC, 1979.

Bauer DR. Hydrodynamic properties of dilute and concentrated polymer latexes: A study by quasielastic light scattering. 176th ACS National Meeting, Division of Colloid and Surface Science, Miami, FL, 1978.

Bauer DR, Brauman JI, Pecora R. Depolarized Rayleigh scattering and ^{13}C NMR measurements of anisotropic reorientation of aromatic compounds in solution. n ACS National Meeting, Division of Colloid and Surface Science, Los Angeles, CA, 1974.

Editorial Review Boards

Editorial Review Board, Journal of Coatings Technology and Mattiello Lecture Selection Committee (2001–2005)

Prior Experience

Research Laboratory, Ford Motor Company, 1977–2006

Professional Affiliations

- Member Sigma Xi
- Member American Chemical Society