JASON R. BABCOCK, Ph.D.
SENIOR MANAGING CONSULTANT
DIRECTOR, CHEMISTRY

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Dr. Jason Babcock is highly experienced in chemistry and materials engineering consulting, specializing in the application of science, technology, and laboratory testing to solve unique problems and to perform forensic analysis. Dr. Babcock possesses a broad general chemistry knowledge that is invaluable to understanding the interaction of materials on a molecular level. He has extensive experience designing and building experimental apparatus and performing analytical testing of a wide variety of substances, interpreting the results, and providing detailed reports summarizing the findings. His practical experience includes performing testing to determine the strength, physical, chemical, and wear properties of ceramics, metals, composites, plastics, and polymers. Dr. Babcock has a Doctorate in Inorganic Chemistry, a M.S. and B.A. in Chemistry and conducted Postdoctoral research in Materials Engineering.

In addition to his consulting work, Dr. Babcock is the Director of the Chemistry practice within ESi, managing personnel with chemistry backgrounds, projects, and laboratory facilities across multiple offices nationwide.

Areas of Specialization

Failure Analysis
Chemical Analysis
Material Compatibility
Plastics, Polymers, and Rubbers
Environmental Effects on Materials
Building Materials
Technical Litigation
Mechanical Testing
Composite Materials
Gas and Water Plumbing and Distribution
Toxin Exposure, Air Sampling, and Asbestos
Paint and Coatings
Water Chemistry

Education

Ph.D., Inorganic Chemistry, University of Chicago, 1998 M.S., Inorganic Chemistry, University of Chicago, 1995 B.S., Chemistry, Illinois Wesleyan University, 1994

Professional Affiliations/Honors

American Society for Testing and Materials (ASTM)
Voting Member of Committees C11 – Gypsum and Related Building Materials, C16 – Thermal Insulation, D01 Paint and Related Coatings, Materials, and Applications, D11 – Rubber and Rubber-Like Materials, D20 – Plastics, and D22 – Air Quality

American Chemical Society
Member

American Ceramic Society
Member

Association of Consulting Chemists and Chemical Engineers
Member

ASM International
Member

Positions Held

Engineering Systems Inc., Aurora, Illinois
Director of Chemistry Practice, 2020 - present
Senior Managing Consultant, 2017 - present

Green Light Industries, West Chicago, Illinois
Co-Founder / Chief Scientist, 2006 - present

Caulfield Engineering, Naperville, Illinois
Principal Scientist, 2014 - 2017

ITC Experts, Inc., Sugar Grove, Illinois
Director of Chemistry & Materials, 2011 – 2014

Packer Engineering, Inc., Naperville, Illinois
Senior Consultant, 2008 – 2011

Waubonsee Community College, Sugar Grove, Illinois
Adjunct Professor, 2007

Ultramet, Inc., Pacoima, California
Senior Research Scientist, 2000 - 2006

Northwestern University, Department of Materials Engineering, Evanston, Illinois
Postdoctoral Research Associate, 1998 - 2000

Continued Education

Hazard Specific Training: Corrosives, Irritants, Sensitizing Chemicals, Agents Which Damage Skin and Mucous Membranes
Argonne National Lab, IL, January 2009

Electrical Safety Awareness and Training (NFPA 70E Standard)
Argonne National Lab, IL, January 2009

Hydrofluoric Acid Safety
Argonne National Lab, IL, January 2009

Solid Propellant Rocket Propulsion
Polaris Propulsion, Mojave Test Area, CA, October 2004

Automotive Catalytic Converter Technology
SAE, Detroit, MI, April 2003

Academic Honors

Alumni Academic Scholarship, 1990-1994
Outstanding Undergraduate Research Award, 1994

Project Experience Highlights

Consumer Products

- Utilized polymer chemistry expertise to conduct failure analyses of a wide variety of plastic products such as plumbing components, foams, and coatings.
- Investigated effects of water chemistry on plastic materials failures, metal corrosion, and consumer health issues.
- Conducted chemical analysis for components or contaminants in various consumer products. In some cases, this also required air sampling to detect these constituents or particulates released.
- Tested products for the presence of asbestos and whether that material could be released during typical use.
- Assisted client with confirmation of chemical incompatibility between food product and hydrocarbon- containing packaging that led to significant product loss.
- Led a multidisciplinary investigation into the contamination of warehouse inventory exposed to a natural gas leak.

Construction Materials

- Investigated properties of spray polyurethane foam (SPF) insulation ranging from flame spread properties, fire retardant identity and concentration, effect of application variables on foam properties, and nature of off-gassing.
- Conducted failure analysis of polymer- and cementitious-based multi-layer flooring system applied to concrete subfloors.
- Investigated the cause and origin of symptoms related to problem Chinese drywall. Designed and carried out experiments that demonstrated whether or not samples of drywall possess these problematic characteristics. Invented a minimally invasive, portable field test to identify problem drywall using a ¼" core sample.
- Performed testing of limestone starting material and gypsum product from large scale flue gas desulfurization system recently installed in coal-fired power plant. Assisted client in root cause determination of problems encountered in the system due to impurities found in starting material.
- Invented new fire-retardant formulation for construction related product currently moving toward plant trials with targeted company-wide implementation.
- Studied potential leaching of water-soluble components from asphalt shingles and the potential effects of these leachates on various roof structures.

Analytical Testing and Research

- Carried out proof pressure and helium leak testing of stainless-steel filters that are currently in use on the International Space Station.
- Developed and characterized method for the preparation of nanoporous silicon structures to be used for solid phase storage of hydrogen in alternative energy applications.
- Co-invented system being developed and trialed to demonstrate the ability to produce oxygen from simulated lunar soil with support of a lunar base the ultimate goal.
- Investigated the gasification of various feedstocks, including biomass, municipal solid waste, and discarded consumer products, as a means for alternative energy generation.
- Expert in the use and implementation of the following analytical techniques, among others: SEM/EDS, FTIR, Auger Electron and X-ray Photoelectron Spectroscopy, NMR, GC, GC/MS, HPLC, GPC, ICP, XRD, DSC, TGA, various mechanical testing and evaluation of thermal properties.

Patents

G.P. Jackson, **J.R. Babcock**, and J.M. Zlotnicki, “Catalytic Smog Reduction,” United States Patent 8475751 B2, July 2, 2013.

G.P. Jackson, **J.R. Babcock**, and J.M. Zlotnicki, “Hydrogen Extraction,” United States Patent Application 20100035103, February 11, 2010.

J.R. Babcock and A.J. Fortini, "Decomposition of Organic Azides," United States Patent 7338540, March 4, 2008.

J.R. Babcock, A.J. Fortini, and M.J. Wright, "Self-Adjusting Propellant Decomposition Catalyst," United States Patent Application 20080064913, November 20, 2005.

M.A. Alvin and **J.R. Babcock**, "Metal Gas Separation Membrane," United States Patent 7018446, September 24, 2003.

Selected Publications/Presentations

R.P. Hsung, **J.R. Babcock**, et al., “Thiophenol Protecting Groups for the Palladium-Catalyzed Heck Reaction: Efficient Synthesis of Conjugated Arylthiols,” Tetrahedron Lett. **36** (1995), 4525-4528.

R. Xi, **J.R. Babcock**, and L.R. Sita, “A Thermal Reductive-Elimination Route to Perbutylated Cyclopolystannanes,” Organometallics **15** (1996), 2849-2851.

L.R. Sita, **J.R. Babcock,** and R. Xi, “Facile Metathetical Exchange between Carbon Dioxide and the Divalent Group 14 Bisamides M[N(SiMe3)2]2 (M = Ge and Sn),” J. Am. Chem. Soc. **118** (1996), 10912.

J.R. Babcock and L.R. Sita, “Highly Branched, High Molecular Weight Polystannane from Dibutylstannane via a Novel Dehydropolymerization/Rearrangement Process,” J. Am. Chem. Soc. **118** (1996), 12481-12482.

J.R. Babcock and L.R. Sita, “Facile Preparation of Unsymmetric Carbodiimides via in situ Tin(II)-Mediated Heterocumulene Metathesis,” J. Am. Chem. Soc. **120** (1998), 5585-5586.

J.R. Babcock, R.W. Zehner, and L.R. Sita, “A Heterocumulene Metathesis Route to Cd[ESiMe3]2 and Passivated CdE (E = S and Se) Nanocrystals,” Chem. Mater. **10** (1998), 2027-2029.

L.R. Sita and **J.R. Babcock**, “Rapid Access to Dimethylcyclopentadienyltitanium(IV) Amidinate, (C5R5)TiMe2[NR1C(R2)NR3] (R = H and Me; R2 = Me), Libraries,” Organometallics **17** (1998), 5228-5230.

J.R. Babcock, et al., “Syntheses, Structural Characterizations and Heterocumulene Metathesis Studies of New Monomeric Bis(trimethylsilylamido)tin(II) Derivatives,” Organometallics **18** (1999), 4437-4441.

J.R. Babcock, et al., “Double Heterocumulene Metathesis of Cyclic Bis(trimethylsilylamido) stannylenes and a New Route to Tethered Bimetallic Bisamidinates from the Resulting α,ω-Biscarbodiimides,” Organometallics **18** (1999), 5729-5732.

J.A. Belot, A. Wang, N.L. Edleman, **J.R. Babcock** et al., "Metal-Organic Chemical Vapor Deposition Of Metal Oxides: From Precursor Synthesis To Thin Films," Mater. Res. Soc. Symp., **574** (1999) 37-43.

A. Wang, N.L. Edleman, **J.R. Babcock**, T.J. Marks, M.A. Lane, P. Brazis, C.R. Kannewurf, "Metal-Organic Chemical Vapor Deposition of In-Zn-Sn-O and In-Ga-Sn-O Transparent Conducting Oxide Thin Films," MRS Symposium Series, 2000, **607**, 345-352.

J.R. Babcock, et al., "Polydentate Amines As CVD Precursor Ancillary Ligands. Epitaxial MgO Thin Film Growth Using A Highly Volatile, Themally- And Air-Stable Magnesium Precursor," Adv. Mater. (Chem. Vap. Depos.) **6** (2000), 180-183.

J.R. Babcock, et al., "Transparent Conducting CdO Thin Film Growth Using a Highly Volatile, Thermally and Air- Stable Cadmium Precursor" Adv. Mater. (Chem. Vap. Depos.) **7** (2001),239-242

A. Wang, **J.R. Babcock**, N.L. Edleman, A.W. Metz, M.A. Lane, R. Asahi, V.P. Dravid, C.R. Kannewurf, A.J. Freeman, T.J. Marks, "Indium-Cadmium-Oxide Films Having Exceptional Electrical Conductivity and Optical Transparency. Clues for Optimizing Transparent Conductors" Proc. Nat. Acad. Sci. **98** (2001) 7113- 7116.

J.R. Babcock, et al., "Plasma-Assisted MOCVD Growth of Superconducting NbN Thin Films Using Nb Dialkylamide and Nb Alkylimide Precursors," Adv. Mater. (Chem. Vap. Depos.) **7** (2001) 25-28.

J.R. Babcock, et al., "Development and Implementation of New Volatile Cd and Zn Precursors for the Growth of Transparent Conducting Oxide Thin Films via MOCVD," Mater. Res. Soc. Symp. **623** (2000) 317-28.

M. Yan, Y. Koide, **J.R. Babcock**, P.R. Markworth, J. A. Belot, T. J. Marks, R.P.H. Chang, "Selective-area atomic layer epitaxy growth of ZnO features on soft lithography-patterned substrates" Appl. Phys. Lett. **79** (2001) 1709-11.

R. Asahi, **J.R. Babcock**, V.P. Dravid, N.L. Edleman, A.J. Freeman, C.R. Kannewurf, M.A. Lane, T.J. Marks, A.W. Metz, A. Wang, "First-principles calculations for understanding high conductivity and optical transparency in InxCd1-xO films," Thin Solid Films **411** (2002) 101-105.

N.L. Edleman, J.A. Belot, A.W. Metz, **J.R. Babcock**, A.M. Kawaoka, J. Ni, M.V. Metz, C.J. Flschenriem, C.L. Stern, L.M. Liable-Sands, A.L. Rheingold, P.R. Markworth, R.P.H. Chang, M.P. Chudzik, C.R. Kannewurf, T.J. Marks, "Synthesis and Characterization of Volatile, Fluorine-Free β-Ketoiminate Lanthanide MOCVD Precursors and Their Implementation in Low Temperature Growth of Epitaxial CeO2 Buffer Layers for Superconducting Electronics," Inorg. Chem. **41** (2002) 5005-5023.

R. Asahi, **J.R. Babcock**, N.L. Edleman, D.R. Kammler, D. Ko, M.A. Lane, A.W. Metz, A. Wang, M. Yan, R.P.H. Chang, V. Dravid, A.J. Freeman, C.R. Kannewurf, T.J. Marks, T.O. Mason, K.R. Poeppelmeier, "New Transparent Conducting Oxides. Progress in Understanding Cadium-Containing Bulk and Thin-Film Materials," in V.K. Kapur, R.D. McConnell, D. Carlson, G.P. Caesar, A. Rohatgi, J. Smith, Eds. "Photovoltaics for the 21st Century," Electrochemical Society, Washington, D.C., 2001, pp. 333-348.

J.R. Babcock, P.R. Brazis, N.L. Edleman, C.R. Kannewurf, M.A. Lane, T.J. Marks, A. Wang, "Growth, Microstructure, Charge Transport, And Transparency Of Random Polycrystalline And Heteroepitaxial Metalorganic Chemical Vapor Deposition-Derived Gallium-Indium-Oxide Thin Films" J Mater Res. **17** (2002) 3155-3162.

J.R. Babcock and A.J. Fortini, "Catalysts and Catalyst Substrates for Advanced Monopropellants," Final Report (ULTRA-TR-01-3223), Contract F04611-00-C-0042, Ultramet for Air Force Research Laboratory, Propulsion Directorate, Edwards AFB, CA, February 2001.

J.R. Babcock, "Nanostructured Thermal Barrier Coatings for Turbine Engines," Final Report (ULTRA-TR-01-3348), Contract DAAH10-01-C-0013, Ultramet for U.S. Army Aviation and Missile Command, Aviation Applied Technology Directorate, Fort Eustis, VA, January-June 2001.

J.R. Babcock, B.E. Williams, and J.W. Brockmeyer, "Oxide Interfaces For Carbon Fiber Reinforced Ceramic Matrix Composites," presented at the ACerS 26th Conference on Composites, Materials and Structures, Cocoa Beach/Cape Canaveral, FL, January 28-31, 2002.

J.R. Babcock, B.E. Williams, and J.W. Brockmeyer, Diep Trinh, "Oxide Interfaces For Carbon-Fiber Reinforced Ceramic Matrix Composites," presented at the ACerS 26th Conference on Composites, Materials and Structures, Cocoa Beach/Cape Canaveral, FL, January 28-31, 2002.

A.J. Fortini, and **J.R. Babcock**, "Low Temperature Catalysis of Organic Azides," presented at the JANNAF 30th Propellant Development & Characterization Meeting, Colorado Springs, CO, 3/18/02.

B.E. Williams, J.W. Brockmeyer, and **J.R. Babcock**, "Melt Infiltrated Ceramic Matrix Composites For Ultrahigh Temperature Applications" presented at the National Space and Missile Materials Symposium, Houston, TX, 6/02.

A.J. Fortini and **J.R. Babcock**, "Advanced Monopropellant Catalysts," Final Report (ULTRA-TR-02-3365), Contract DAAH01-01-C-R097, Ultramet for U.S. Army Aviation and Missile Command, Propulsion and Structures Directorate, Redstone Arsenal, AL, February-December 2001.

J.R. Babcock and B.E. Williams, "Economical Fabrication of Thick-Section Ceramic Matrix Composites," Final Report (ULTRA-TR-02-3503), Contract NAS8-01142, Ultramet for NASA Marshall Space Flight Center, Huntsville, AL, November 2001-May 2002.

J.R. Babcock, G. Ramachandran, B.E. Williams, J.W. Brockmeyer, "Carbon Fiber-Reinforced, Melt-Infiltrated Ceramic Matrix Composites For Ultrahigh Temperature Applications," presented at the ACerS 27th Conference on Composites, Materials and Structures, Cocoa Beach/Cape Canaveral, FL, January 30, 2003.

J.R. Babcock, G. Ramachandran, B.E. Williams, J.W. Brockmeyer, "Fabrication of Thick-Section Melt Infiltrated Ceramic Matrix Composites," presented at the National Space and Missile Materials Symposium, San Diego, CA, June 26, 2003.

J.R. Babcock and B.E. Williams, "Fabrication of Ceramic Matrix Composite Blisks from Near-Net Shape Preforms," Final Report (ULTRA-TR-03-3750), Contract DAAH10-03-C-0033, Ultramet for Army/Aviation & Missile Command, Ft. Eustis, VA, January 2003-July 2003.

J.R. Babcock, "Development of Components for the Next Generation Space Shuttle," Keynote Address at the John Wesley Powell Student Research Conference, Illinois Wesleyan University, April 2003.

J.R. Babcock and B.E. Williams, "Multilayer Fiber Interfaces for Improved Environmental and Slip in Carbon-Fiber CMCs," Final Report (ULTRA-TR-03-3762), Contract NAS8-03010, Ultramet for NASA Marshall Space Flight Center, Huntsville, AL, January 2003-July 2003.

J.R. Babcock, "Cubic Phase-Stabilized Zirconia Thermal Barrier Coatings Applied via a Novel CVD Route," Final Report (ULTRA-TR-03-3749), Contract DMI-0231685, Ultramet for the National Science Foundation, Arlington, VA, January 2003-July 2003.

J.R. Babcock, R. Benander, A. Fortini, A. Duffy, "Chemical Vapor Deposition Of Cubic Phase Yttria-Stabilized Zirconia Thermal Barrier Coatings," 55th Pacific Coast Regional & Basic Science Division Fall American Ceramic Society Meeting, Oakland, CA, 10/20/03.

J.R. Babcock, B.E. Williams, G. Ramchandran, and M.R. Effinger, "Recent Advances In The Development Of Thick-Section Melt-Infiltrated C/SiC Composites," presented at the ACerS 28th Conference on Composites, Materials and Structures, Cocoa Beach/Cape Canaveral, FL, January 26, 2004.

J.R. Babcock, B.E. Williams, G. Ramchandran, and M.R. Effinger, "Multilayer Fiber Interfaces For Improved Environmental Resistance And Slip In Carbon Fiber Reinforced Composites," presented at the ACerS 28th Conference on Composites, Materials and Structures, Cocoa Beach/Cape Canaveral, FL, January 27, 2004.

S. Sharafat, N. Ghoniem, **J.R. Babcock**, B.E. Williams, "Cellular Foams: A Potential Innovative Solid Breeder Material for Fusion Applications," Fusion Science & Technology **47** (2005) 886-889.

J.R. Babcock, B.E. Williams, G. Ramchandran, and M.R. Effinger, "Multilayer Fiber Interfaces For Improved Environmental Resistance And Slip In Carbon Fiber Reinforced Composites," presented at the ACerS 29th Conference on Composites, Materials and Structures, Cocoa Beach/Cape Canaveral, FL, January 25, 2005.

J.R. Babcock, B.E. Williams, G. Ramchandran, and M.R. Effinger, "Fabrication Of Thick-Section Melt-Infiltrated C/SiC Composites," presented at the ACerS 29th Conference on Composites, Materials and Structures, Cocoa Beach/Cape Canaveral, FL, January 25, 2005.

J.R. Babcock, G. Ramchandran, T.R. Stewart, and B.E. Williams, "Fabrication Of Thick-Section Melt-Infiltrated C/SiC Composites," presented at the ACerS 30th Conference on Composites, Materials and Structures, Cocoa Beach/Cape Canaveral, FL, January 24, 2006.

J.R. Babcock, A.T. Allen, B.E. Williams, D.V. Trinh and M.R. Effinger, "Multilayer Fiber Interfaces For Improved Environmental Resistance And Slip In Carbon Fiber Reinforced Composites," presented at the ACerS 30th Conference on Composites, Materials and Structures, Cocoa Beach/Cape Canaveral, FL, January 25, 2006.

J.R. Babcock, G. Ramachandran, B.E. Williams, and R. Benander, "Economical Fabrication of Thick-Section Ceramic Matrix Composites," NASA Tech Briefs **34** (2010) 36

P. Schubert and **J.R. Babcock**, "Advances in Synthesis of Porous Silicon for Hydrogen Storage," 5th World Hydrogen Technologies Convention, Shanghai, China, September 14, 2013.

J. Kasper, G. Lloyd, and **J. Babcock**, "Is a Chemical Innocent Until Proven Guilty? The Artificial Turf Debate," National Forum for Environmental & Toxic Tort Issues, Chicago, IL, September 28, 2018.

J.R. Babcock, M.E. Weiss, D.B. Edwards, D.E. Duvall, and A.R. Shah, "Carbonyl Index Depth Profiling via Micro FTIR," MS&T Technical Meeting and Exhibition, Portland, OR, September 30, 2019.

E.L.S. Solomon, A.M. Pettinger, **J.R. Babcock**, S.A. Sanders, J.L. McDougal, "Corrosion of Sulfur Removal Tanks Used in the Processing of Landfill Gas," J. Fail. Anal. and Preven. 21 (2021) 711-718

J.R. Babcock and M.E. Weiss, "FTIR Imaging via FPA in the Characterization of Polymers," IMAT Technical Meeting and Exhibition, ASM International, New Orleans, LA, September 14, 2022.

J.R. Babcock, M.E. Weiss, and. G. Nagalia "Failure Analysis of Spray Polyurethane Foam (SFP) Insulation," IMAT Technical Meeting and Exhibition, ASM International, Detroit, MI, October 18, 2023.

J.R. Babcock, M.E. Weiss, G. Nagalia, J.P. Sommer, M.S. Ebert "Characterization of Over 50-Year-Old Polyethylene Natural Gas Distribution Pipe," IMAT Technical Meeting and Exhibition, ASM International, Cleveland, OH, October 1, 2024.