

Exponent®
Engineering & Scientific Consulting

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Professional Profile

David Anderson, Ph.D., P.E., CFEI, CVFI, is a principal engineer in the Thermal Sciences practice and director of the Atlanta office at Exponent. He has over twenty years of post-graduate experience, specializing in thermal-fluid systems, engineered systems, and failure analysis. He helps manufacturers, suppliers, and legal teams resolve complex technical disputes involving internal combustion engines, emissions systems, industrial equipment, and product failures across automotive, industrial, consumer products, and energy sectors.

Overview

Dr. Anderson's work focuses on the performance, reliability, and failure of engineered systems involving heat transfer, fluid flow, and energy conversion. He applies fundamental engineering principles and data-driven analysis to evaluate system behavior under real-world operating conditions. His work integrates system-level analysis with component-level evaluation to identify root causes of failure, assess the influence of design and operating conditions, and develop technically grounded conclusions in engineering, regulatory, product liability, and intellectual property matters.

Engine Systems and Industrial Equipment

Dr. Anderson conducts failure analysis and performance evaluation of internal combustion engines and associated systems across a wide range of applications, including on- and off-road vehicles, backup power generation, pumping and compression systems, and other industrial equipment. His work involves identifying root causes of component- and system-level failures, evaluating operating conditions and design constraints, and supporting product development, warranty, and product liability investigations across transportation, power generation, and industrial sectors. He has also evaluated complex failure and performance issues in matters involving alleged design defects in engine and engine system components.

Automotive Systems and Emissions

Building on his experience in engine systems and prior work for a diesel engine OEM, Dr. Anderson evaluates the performance and compliance of automotive emissions control systems and engine calibration strategies. His work includes analysis of aftertreatment systems such as selective catalytic reduction (SCR), lean NOx traps (LNT), diesel particulate filters (DPF), and exhaust gas recirculation (EGR), as well as evaluation of emissions performance using both dynamometer and on-road measurements (e.g., PEMS). He has supported regulatory and litigation matters involving emissions compliance, including evaluation of the engineering justification of various auxiliary emission control strategies.

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Thermal and Fluid Systems

Dr. Anderson analyzes heat transfer and fluid flow in engineered systems across industrial, consumer, and specialty applications. His work includes evaluation of thermal performance, energy efficiency, and system behavior under real-world operating conditions. He has applied experimental measurement, analytical modeling, and data interpretation to assess a broad range of materials, products, processes, and systems involving heat transfer, thermodynamics, phase change, and fluid transport.

Product Failure and Hazard Evaluation

Dr. Anderson investigates the performance and failure of industrial equipment and consumer products, including battery-powered devices and systems involving thermal or process hazards. His work often involves analysis of system operation, controls, and environmental conditions to determine root causes of failure and assess design and operational risks in the context of product liability and safety evaluations.

Fire and Explosion Investigation

As a Certified Fire and Explosion Investigator (CFEI), Dr. Anderson investigates fires, explosions, and other thermal incidents across a range of industrial, consumer, and transportation applications. His work focuses on determining origin and cause, evaluating ignition sources and fuel packages, and assessing the role of system design, operation, and failure in incident development. Dr. Anderson also leverages his engine and automotive experience as a Certified Vehicle Fire Investigator (CVFI) to evaluate vehicle fires and post-collision fire events, including analysis of fuel systems, electrical systems, and component failures that may contribute to fire initiation and propagation.

Expert Witness and Testifying Experience

Dr. Anderson has been retained as a testifying expert in U.S.-based and international matters involving complex product failures and related disputes across automotive, industrial, and consumer applications. He has prepared expert opinions and technical analyses, including rebuttal evaluations, in support of arbitration and litigation proceedings in multiple jurisdictions. His analyses are used to independently evaluate technical claims, assess root causes, and inform the resolution of complex engineering disputes. He has also provided expert testimony in an intellectual property matter involving engine-related technologies.

Dr. Anderson’s publications list and examples of project experience are provided at the end of this curriculum vitae.

Academic Credentials & Professional Honors

Ph.D., Mechanical Engineering, Georgia Institute of Technology, 2015

M.S., Mechanical Engineering, Georgia Institute of Technology, 2013

B.S., Mechanical Engineering, North Carolina State University, 2005

Georgia Institute of Technology Leadership Fellow, 2013-2015

Sam Nunn Security Fellow, 2013

National Defense Science and Engineering Graduate Fellowship, 2012

IPST Paper Science and Engineering Fellowship, 2011

G.W. Woodruff School of Mechanical Engineering Presidents' Fellowship, 2010

North Carolina State University John T. Caldwell Scholarship, 2001

Licenses and Certifications

Professional Engineer, Georgia, #PE041588

Certified LabVIEW Associate Developer (CLAD)

Six Sigma Green Belt Certification (CSSGB)

Certified Vehicle Fire Investigator (CVFI)

Certified Fire and Explosion Investigator (CFEI)

Prior Experience

Graduate Research Assistant, Georgia Institute of Technology, 2010-2015

Freshman Grand Challenges Facilitator, Georgia Institute of Technology, 2014-2015

Visiting Researcher, RTI International, 2013

Visiting Researcher, Air Force Research Laboratory, 2011

Product Development Engineer, Caterpillar Inc., 2005-2010

Professional Affiliations

American Society of Mechanical Engineers—ASME (member)

American Institute of Chemical Engineers—AIChE (member)

National Association of Fire Investigators—NAFI (member)

SAE International—formerly Society of Automotive Engineers (member)

Patents

U.S. Patent No. 12,501,954: Multilayered Multifunctional Heat-Management Material, December 23, 2025 (Beckham HB, Johnson RL, Anderson DM).

U.S. Patent No. 10,988,379: Reactor for Steam Reforming and Methods of Use Thereof, April 27, 2021 (Fedorov AG, Anderson DM).

U.S. Patent Application No. 18/889,166: Multilayered Multifunctional Heat-Retention Material, filed September 18, 2024 (Beckham HB, Johnson RL, Anderson DM, Marshall P, Stark D, Leroy A).

Publications

Leroy A, Anderson DM, Marshall P, Stark D, Beckham HW. Exploring the role of skin pigmentation in the thermal regulation of polar bears and its implications in the development of biomimetic outdoor apparel. Textiles 2024; 4(4): 507-520.

Anderson DM, Oelker AM, Beckham HW. Thermal Analysis of Textiles. In: Analytical Methods for a Textile Laboratory, Fourth Edition. American Association of Textile Chemists and Colorists, Research Triangle Park, NC, pp 349-373, 2023.

Berry EG, Bezecny J, Acton M, Sulmonetti TP, Anderson DM, Beckham HW, Durr RA, Chiba T, Beem J, Brash DE, Kulkarni R, Cassidy PB, Leachman SA. Slip versus Slop: A Head-to-Head Comparison of UV-Protective Clothing to Sunscreen. Cancers 2022; 14(3):542.

Anderson DM, Fessler JR, Pooley MA, Seidel S, Hamblin MR, Beckham HW, Brennan JB.Infrared radiative properties and thermal modeling of ceramic-embedded textile fabrics. Biomedical Optics Express 2017; 8(3):1698-1711.

Anderson DM, Yun TM, Kottke PA, Fedorov AG. Comprehensive analysis of sorption enhanced steam methane reforming in a variable volume membrane reactor. Industrial & Engineering Chemistry Research 2017; 56(7):1758-1771.

Pooley, MA, Anderson DM, Beckham HW, Brennan JB. Engineered emissivity of textile fabrics by the inclusion of ceramic particles. Optics Express 2016; 24(10):10556-10564.

Anderson DM, Nasr MH, Yun TM, Kottke PA, Fedorov AG. Sorption-enhanced variable-volume batch-membrane steam methane reforming at low temperature: Experimental demonstration and kinetic modeling. Industrial & Engineering Chemistry Research 2015; 54(34):8422-8436.

Yun TM, Kottke PA, Anderson DM, Fedorov AG. Theoretical analysis of hydrogen production by variable volume membrane batch reactors with direct liquid fuel injection. International Journal of Hydrogen Energy 2015; 40(25):8005-8019.

Yun TM, Kottke PA, Anderson DM, Fedorov AG. Experimental investigation of hydrogen production by variable volume membrane batch reactors with modulated liquid fuel introduction. International Journal of Hydrogen Energy 2015; 40(6):2601-2612.

Yun TM, Kottke PA, Anderson DM, Fedorov AG. Power density assessment of variable volume batch reactors for hydrogen production with dynamically modulated fuel introduction. Industrial & Engineering Chemistry Research 2014; 53(47):18140-18151.

Anderson DM, Kottke PA, Fedorov AG. Thermodynamic analysis of hydrogen production via sorption-enhanced steam methane reforming in a new class of variable volume batch-membrane reactor. International Journal of Hydrogen Energy 2014; 39(31):17985-17997.

Gittens RA, Olivares-Navarrete R, Cheng A, Anderson DM, McLachlan T, Stephan I, Fedorov AG, Rupp F, Geis-Gerstorfer J, Sandhage KH, Boyan BD, Schwartz Z. The role of titanium surface micro/nanotopography and wettability on the differential response of human osteoblast lineage cells. Acta Biomaterialia 2013; 9(4):6268-6277.

Anderson DM, Gupta MK, Voevodin AA, Hunter CN, Putnam SA, Tsukruk VV, Fedorov AG. Using amphiphilic nanostructures to enable long-range coalescence and surface rejuvenation in dropwise condensation. ACS Nano 2012; 6(4):3262-3268.

Proceedings and Presentations

Anderson DM. Science That Shapes Vehicle Technologies: Navigating the Future of Warranty Management. ENG's 11th Annual Automotive Warranty Management Summit, Barcelona Spain, June 2023.

Anderson DM, Dillon SE, Goodman A, Paris D, Mercado-Corujo H. Live Burn Data Analysis and

Rundown. DRI Fire Science and Litigation Seminar, Washington DC, September 2021.

Jokar A, O'Hern S, Anderson DM, Cundy M, Ogle R. Flammable Refrigerants: Performance Comparison, Safeties and Lessons Learned. Proceedings, ASHRAE Winter Conference, art no. AT-2019-C063, Atlanta, GA, 2019.

O'Hern SC, Stern MC, Anderson DM, Ibarreta A, Myers TJ. Analysis of combustible dust flash fires on personal protective equipment. Proceedings, Hazards 27, Institute of Chemical Engineers, Birmingham, UK, May 2017.

Anderson DM. Heat Transfer in Textiles: Using fundamental principles to design better products. Industrial Fabrics Association International Expo 2016, Charlotte NC, October 2016.

Anderson DM. Textiles and radiant heat: facts and misconceptions. American Association of Textile Chemists and Colorists Spring Meeting, May 2016.

Morrison DR, Anderson DM, Smyth SA, Hetrick TM. Understanding the fire risks of eCigarettes, vapes, and mods. Proceedings, DRI Product Liability Conference, New Orleans, LA, February 2016.

Anderson DM, Nasr MH, Yun, TM, Kottke PA, Fedorov AG. Sorption-enhanced CHAMP reactor for distributed steam methane reforming. 3rd International Education Forum on Environment and Energy Science, Perth, Australia, December 2014.

Anderson DM, Kottke PA, Yun TM, Fedorov AG. Sorption-enhanced variable volume membrane reactor for hydrogen production from methane: modeling and experimental characterization. 2014 AIChE Annual Meeting, Atlanta, GA, November 2014.

Anderson DM, Kottke PA, Fedorov AG. Sorption-enhanced CHAMP class reactor for low temperature, distributed hydrogen production from natural gas. 2nd International Education Forum on Environment and Energy Science, Huntington Beach, CA, December 2013.

Anderson DM, Kottke PA, Fedorov AG. Hydrogen production from natural gas via sorption-enhanced variable volume batch-membrane reactors. 2013 AIChE Annual Meeting, San Francisco, CA, November 2013.

Anderson DM, Fedorov AG. Improved CHAMP-class reactors enabling a sustainable route to hydrocarbon processing for mobile and distributed power generation. 1st International Education Forum on Environment and Energy Science, Waikoloa, HI, December 2012.

Kottke PA, Anderson DM, Fedorov AG. Condensation enhancement with micro and nano-structured amphiphilic surfaces. 2012 Power MEMS Workshop, Atlanta, GA, December 2012.

Anderson DM, Gupta MK, Voevodin AA, Hunter CN, Putnam SA, Tsukruk VV, Fedorov AG. Mechanisms of condensation on amphiphilic nanostructured surfaces. ASME 3rd Micro/Nanoscale Heat & Mass Transfer International Conference, Atlanta, GA, March 2012.

Anderson DM, Gupta MK, Voevodin AA, Hunter CN, Putnam SA, Tsukruk VV, Fedorov AG. Controlling water condensation in energy systems using nanostructured surfaces. 4th International Forum on Multidisciplinary Research and Education in Energy Sciences, Honolulu, HI, December 2011.

Berry EG, Bezecny J, Acton M, Sulmonetti TP, Anderson DM, Beckham HW, Durr RA, Chiba T, Beem J, Brash DE, Kulkarni R, Cassidy PB, Leachman SA. Slip versus Slop: A Head-to-Head Comparison of UV-Protective Clothing to Sunscreen. Cancers 2022; 14(3):542.

Project Experience

A representative sampling of example project experience across Dr. Anderson's practice areas is listed below.

Engine Systems and Industrial Equipment

- Investigated the failure of various internal combustion engines used in backup power generation, transportation, marine, and stationary pumping/compressing applications
- Performed root cause analyses and evaluated warranty data for both core engine and ancillary systems and components, including matters involving alleged design and/or manufacturing defects
- Assessed defect claims associated with the design, construction, and operation of industrial equipment, including pumps, boilers, dryers, heat exchangers, HVAC systems, and separation equipment
- Evaluated the design, operation, and failure of compressed gas storage and transport systems, including compressed natural gas (CNG) and hydrogen systems used in virtual pipeline applications
- Analyzed engine and fuel system technologies in the context of an intellectual property dispute involving alleged infringement, including technical analysis of system design and operation relative to claim elements

Automotive Systems and Emissions

- Analyzed emissions data collected using portable emissions measurement systems (PEMS) to evaluate on-road emissions performance and fuel consumption relative to dynamometer-based certification test cycles
- Assessed the engineering justification for emission control strategies — including dosing of urea, modulation of exhaust gas recirculation rates, fuel injection timing in response to operating conditions, and aftertreatment component regeneration strategies — on various diesel engines used in on-road vehicles, ranging from passenger vehicles to heavy-duty transportation and industrial platforms
- Advised engine OEMs on emissions system design, calibration, and control strategies for products in development, including evaluation of alignment between proposed control approaches and regulatory disclosures
- Developed methodologies to identify, screen, and restrict the sale of aftermarket automobile parts that could be used to defeat the emissions control systems of diesel and gasoline engines

Thermal and Fluid Systems

- Evaluated the reduction in energy absorption of roofing materials due high albedo (i.e., solar reflective) coatings and estimated the potential energy savings in various climate regions
- Quantified the solar absorptive and thermal emissive behavior of foil coatings used in an unmanned lunar landing module to regulate surface temperatures

- Audited the infrared thermal imaging inspection program used to proactively address maintenance issues in electrical transmission and distribution equipment by identifying thermal anomalies prior to component failure
- Assessed residual moisture in building materials after storm-related water intrusion using moisture meters (both pin-type and pinless) and infrared thermography
- Evaluated and developed strategies to prevent the formation and sublimation of frozen droplets due to residual moisture present during a vacuum sterilization process
- Conducted heat transfer measurements on textile products to evaluate potential claims of intellectual property infringement
- Developed a methodology to make and analyze thermal emissivity measurements on various textile products including garments, pain patches, and kinesiology tape
- Designed and executed custom test methodologies to evaluate the thermal and moisture management performance of outdoor apparel
- Evaluated the protection against ultraviolet light provided by solar-protective garments in direct comparison to that offered by sunscreen at various coating thicknesses

Product Failure and Incident Investigations

- Performed a root cause analysis on the failure of a medical pump and conducted a design of experiments to assess sensitivities to deviations in operating conditions
- Investigated thermal burn injuries that occurred due to exposure to either low (e.g., cryotherapy) or high temperatures and the efficacy of thermal protective garments
- Investigated fires involving a range of battery-powered consumer products
- Advised equipment manufacturers in the transition to low global warming potential (GWP) flammable natural refrigerants by conducting testing, analysis, and quantitative risk assessments of the potential for flash fires, jet fires, overpressure, and explosions
- Investigated fatalities involving exposure to hazardous environments including carbon dioxide, carbon monoxide, and inert nitrogen
- Analyzed the operation and PLC controls of various industrial equipment (e.g., furnaces, boilers, valves and piping systems, etc.) to investigate the causes of explosions, flash fires, and/or unintentional chemical releases
- Investigated vehicle and engine fires, including incidents involving post-collision fuel releases of fuel, ignition of vehicle components and/or contents, and engine component failures
- investigated flash fires involving propane or butane grills, stoves, and/or fireplaces in apartment complexes, personal residences, and portable cooking equipment