

**MATTHEW WAGENHOFER, PHD, PE, CFEI**

## **SUMMARY**

Dr. Wagenhofer is a practicing forensic engineer with over 20 years of experience conducting and participating in investigations encompassing a broad range of topics under the umbrella of mechanical engineering and materials performance accidents and failures. His expertise includes determining the role that materials and mechanical components play in such multidisciplinary events as fires, explosions, product failures, transportation accidents, business interruption losses, and personal injury and loss of life incidents.

## **EDUCATION**

University of Maryland, 2002 - Ph.D. Mechanical Engineering

University of Maryland, 1999 - M.S. Mechanical Engineering

University of Maryland, 1996 - B.S. Mechanical Engineering

## **PROFESSIONAL REGISTRATIONS AND CERTIFICATIONS**

Professional Engineer:

- District of Columbia #PE920286
- Maryland #40525
- Virginia #0402059087

EPA Section 608 Type I certified to practice Refrigerant Recycling, Recovery, and Reclamation

OSHA 10 Hour Outreach Training Program – General Industry

Certified Fire and Explosion Investigator, National Association of Fire Investigators

Bosch CDR Tool Technician Training by IPTM – Online, Certificate #12621055

OSHA 30 Hour Outreach Training Program – General Industry

## **PROFESSIONAL MEMBERSHIPS AND AFFILIATIONS**

American Society of Mechanical Engineers (ASME)

American Society for Testing and Materials (ASTM)

- Member, Committee E08 on Fatigue and Fracture
- Member, Committee E28 on Mechanical Testing
- Member, Committee E30 on Forensic Sciences
- Member, Committee E58 on Forensic Engineering
- Member, Committee F38 on Unmanned Aircraft Systems

National Society of Professional Engineers, Member

Natural Gas Claims and Litigation Association, Special Member

Transportation Research Board, Individual Affiliate

Lecturer, University of Maryland – Fall 2005

National Association of Fire Investigators (NAFI)

## **CONTINUING EDUCATION COURSES**

International Association of Arson Investigators, Inc. and CFITrainer.net

- The Scientific Method for Fire and Explosion Investigation, July 19, 2017.
- Introduction to Evidence, July 29, 2017.
- Residential Natural Gas Systems, August 19, 2017.
- Investigating Natural Gas Systems, August 19, 2017.
- Explosion Dynamics, August 20, 2017.
- International Association of Arson Investigators, Inc. and CFITrainer.net
- The Scientific Method for Fire and Explosion Investigation, May 23, 2019
- Introduction to Evidence, May 24, 2019.
- Residential Natural Gas Systems, August 19, 2017.
- Investigating Natural Gas Systems, August 19, 2017.
- Explosion Dynamics, August 20, 2017.
- Documenting the Event, April 23, 2018.
- Motor Vehicles: The Engine and the Ignition, Electrical, and Fuel Systems, October 12, 2018.
- Motor Vehicles: Transmission, Exhaust, Brake, and Accessory Systems, October 12, 2018.
- Investigating Motor Vehicle Fires, October 13, 2018.
- Fire Chemistry, May 24, 2019
- Physical Evidence at the Fire Scene, May 29, 2019
- Introduction to Fire Dynamics and Modeling, May 28, 2019
- Fire Protection Systems, May 30, 2019

Continuing Education & Development, Inc.

- Basic Direct Current (DC) Theory, January 27, 2019.
- Grounding System Theory and Practice, January 27, 2019.
- Corrosion: Overview, January 31, 2019.

Embry-Riddle Aeronautical University and Canvas Network

- Aviation 101, February 23, 2019.

Delft University of Technology and edX

- TUDF-FE01x: Forensic Engineering: Learning from Failures, February 18, 2019.

## **INVESTIGATIVE AREAS OF SPECIALTY**

Conducted and assisted in forensic investigations for the following fields:

- Automotive Engine Failures
- Bicycle Component Failures
- Carbon Monoxide Exposure
- Casting Failures
- Ceramics and Glasses Materials Analyses

- Commercial and Residential Fires and Explosions
- Continuous Caster Bearing Failures
- Corrosion-induced Circuit Breaker Failures
- Crane and Logging Truck Boom Failures
- Electric Power Generation and Distribution (up to 115-kV) Component Failures and Fires involving Transformers, Switching Equipment, Transmission Lines, Turbine Generators, and Cooling Towers
- FAA UAS Part 107 Commercial-use Waiver Application Support
- Fatigue and Overload Failures of Shafts and Fasteners
- Fire Protection Sprinkler Failures
- Fuel Gas Distribution Systems Failures and Fires
- Glass Panel and Window Glazing Failures
- Hand Truck Failures
- HVAC Air Handling and Scrubbing Equipment Failures and Fires
- HVAC Compressor Failures
- Industrial Accidents involving Shock, Electrocution, and Molten Metal
- Lithium Battery Fires
- Low-Temperature Creep Rupture Failure of a Ni-Cu Alloy
- Machine Guarding and Warning Analyses
- NDT of Coal-fired Electric Power Generation Plant and Oil/Gas Pipeline Components for Creep, Corrosion, and Crack Damage (Boilers, Piping, Tubing)
- Petroleum Tank Failures and Fires
- Pressure Vessel Ruptures and Explosions including Aerosol Paint Cans and SCUBA Tanks
- Product Design, Development, and Certification Analyses
- Quantitative, Physically-based Modeling of ASTM 1921 Temperature Dependent Ferritic Steel Fracture Toughness Behavior
- Residential Plumbing Failures
- Temperature and Rate-Dependent Structure-Property Relationships of Al-Mg Alloys
- Transportation (Aviation, Maritime, Automotive) Accident Analyses
- Vehicle Lift Failures
- Weld and Weldment Failures
- Workplace, Recreational and Consumer Product Injuries

## **CAREER HISTORY**

**Forcon International Corp.**, Richmond, VA - July 2018 to Present – Mechanical Engineer  
Conducting materials and mechanical engineering analyses for forensic investigations including, but not limited to, the aviation, construction, electric power, fuel gas, industrial equipment, consumer product, and medical device industries.

**RTI Group, LLC**

Stevensville, MD - January 2015 – June 2018

Director of Engineering and Research/ Forensic Engineering Investigator, Mechanical/Materials

Annapolis, MD and Stevensville, MD - September 2011 – January 2015

Director of Mechanical Engineering / Mechanical and Materials Failure Analyst

Annapolis, MD - September 2008 – September 2011

Mechanical / Materials Failure Analyst and Industrial / Utility Accident Reconstructionist

Investigated product and mechanical systems component failures in support of insurance claim analysis and civil litigation. Led multidisciplinary teams conducting root cause analyses of complex losses. Provided technical and administrative oversight to staff and contract engineer-led investigations and research efforts.

**Independent Mechanical/Materials Failure Consultant** – March 2005 – September 2008

Investigations included, but were not limited to, marine outdrive bolt failure, natural gas piping failure, automobile trailer hitch failure, residential plumbing failures (copper piping and valves), and residential HVAC failures.

**Independent Researcher** – September 2006 – September 2008

Efforts focused on developing grant proposals to fund research on the use of dislocation mechanics and dynamics to improve the mesoscale characterization of polycrystalline material behavior for multiscale, physically-based fracture models. This included both heterogeneous plasticity characterization as well as its influence on the initiation and propagation of cleavage fracture.

**Phoenix Engineering Associates, Inc.** - October 2002 – August 2006 - Senior Scientist

Research focused on the development of a physically-based mesoscale computational model of the transition region fracture behavior of ferritic steels. Within the framework of cracked infinite body geometry, dislocation mechanics techniques were used as a basis for quantifying mesoscale phenomena and generating stress and strain fields while local macroscale failure criteria combined with equilibrium analyses were used to compute fracture loads.

**Structural Integrity Associates** – May 2004 – March 2005 - Engineering Consultant

Engineer responsible for supporting existing projects and managing new projects related to core business of non-destructive evaluation and failure investigation of steel componentry used by the energy industry, especially power plant welds and piping. Responsible for analyzing existing technologies and developing new technologies to expand core services. Participated in field work at power plants and pipe lines in Maryland, North Carolina, and Utah.

**SEA Limited** – October 2002 – January 2004 - Project Engineer, Mechanical

Mechanical Engineer specializing in the deformation and fracture analysis of objects made of metals and polymers. Representative investigations included: continuous caster bearing failures; patent validity and infringement issues; plastic component failures; submarine propeller

bolt failure; logging truck boom failure; corrosion failure of circuit breakers; and automotive engine failures.

### **RESEARCH EXPOSURE**

Graduate Research Assistant, University of Maryland – January 1999 – October 2002

Master's Thesis Research, University of Maryland – September 1996 – December 1998

Graduate Teaching Assistant, University of Maryland – August 1996 - December 1998, September 2001 – May 2002

Undergraduate Research Assistant, University of Maryland – May 1995 – August 1996

### **HIGHLIGHTED PRESENTATIONS AND PANELS**

“Case Studies of Forensic Marine Investigations” presented to the Mid-Atlantic Mariners Club Fall Fest Meeting and Seminar, October 10, 2018.

“Eyes in the Sky: Working with Drones to Resolve Claims” presented to the Southeast Electric Exchange Claims Section 2018 Spring Meeting, April 12, 2018.

“Eyes in the Sky: Integrating Drones into Vehicle Accident Reconstructions” co-presented to the VADA 2017 Annual Meeting Products and Toxic Torts/Auto & Transportation Liability Breakout Session, October 12, 2017.

Panel Member, “Arbitrating the Case – Advocacy and Strategy” and “Arbitrating the Case – The Arbitrators Speak”, AViCON 2017, September 15, 2017.

“Let’s go to the videotape!; Engineering Analysis of Video Evidence” co-presented at AViCON 2017, September 14, 2017.

“Eyes in the Sky: Integrating Drones into the Natural Gas Industry” presented to the Natural Gas Claims & Litigation Association 2017 Annual Meeting, March 20, 2017; also presented at RTI’s Lecture Series, August 16, 2017.

“Introduction to the Forensic Investigation of Lithium Battery Failures at RTI” presented to the Battery Safety Council Forum, January 12, 2017.

“Lithium Batteries: The Good, the Bad, and the Regulatory” presented to the Chicago Bar Association Aviation Law Committee, December 7, 2016; also presented at RTI’s Lecture Series, May 19, 2017.

“If only it WAS elementary, Watson: Using Abductive and Inductive Reasoning in Forensic Investigations” presented at RTI’s Lunch and Learn Lecture Series, January 9, 2015.

“Animation and Its Use in Accident Investigations, Dispute Resolution, and Training” presented to The Nautical Institute’s Future of Simulation in the Maritime Industry Seminar, March 30, 2012.

“Radiation Primer” presented to Maersk Line, Limited, March 22, 2011.

### **KEY PUBLICATIONS AND CONFERENCES**

Erickson Kirk, M, W. Wagenhofer, P. Williams, Y. Shengjin, “Accounting for Crack Propagation in a Model to Predict Fracture Toughness in Ferritic Steels,” proceedings of PVP2009 ASME Pressure Vessel and Piping Division Conference, July 27-31, 2009 Prague, in the Czech Republic.

Erickson Kirk, M.A., M. Wagenhofer, “A Theoretically-based Statistical Model of Transition Toughness,” submitted to Proceedings of PVP2007, ASME Pressure Vessels and Piping Division Conference July 22-26, 2007, San Antonio, Texas, USA.

Wagenhofer, M., M. Erickson, "A Physically-Based, Quantitative Model of the Transition Region Fracture Behavior of Ferritic Steels," abstract accepted for the 34th ASTM National Symposium on Fatigue and Fracture Mechanics, November 16, 2003.

Wagenhofer, M. and Natishan, M. E., “A Model for Predicting the Fracture Toughness of Steels in the Transition Region from Hardness,” 33rd Symposium on Fatigue and Fracture, ASTM STP-1417, W. Reuter, and R. Piascik, Eds., American Society for Testing and Materials, West Conshohocken, PA, 2002.

Wagenhofer, M. and M. E. Natishan, “A Micromechanical Model for Predicting Fracture Toughness of Steels in the Transition Region,” 33rd Symposium on Fatigue and Fracture, ASTM STP-1417, W. Reuter, and R. Piascik, Eds., American Society for Testing and Materials, West Conshohocken, PA, 2002.

Natishan, M., Kirk, M., Gunawardane, H., and Wagenhofer, M., “More Information from a Hardness Test than You Ever Thought Possible,” Small Specimen Test Techniques: Fourth Volume, ASTM STP-1418, M. Sokolov, J. Landes, and G. Lucas, Eds., American Society for Testing and Materials, West Conshohocken, PA, 2001.

Wagenhofer, M., Gunawardane, H., and Natishan, M., “Yield and Toughness Transition Predictions for Irradiated Steels Based on Dislocation Mechanics,” 20th International Symposium on the Effects of Irradiation on Materials, ASTM STP-1405, S.T. Rosinski, M.L. Grossbeck, T.R. Allen, and A.S. Kumar, Eds., American Society for Testing and Materials, 2001.

Kirk, M. T., Natishan, M. E., Wagenhofer, M., “Microstructural Limits of Applicability of the Master Curve,” 32nd Volume, ASTM STP-1406, R. Chona, Ed., American Society for Testing and Materials, Philadelphia, PA, 2001.

Natishan, M.E., and M. Wagenhofer, "Dislocation Mechanics Basis and Stress State Dependency of the Master Curve Shape for Fracture Toughness," Fatigue and Fracture, Vol. 31, ASTM STP1389, ASTM, West Conshohoken, PA, June 2000.

Natishan, M. E., Wagenhofer, M., and Kirk, M. T., "Dislocation Mechanics Basis and Stress State Dependency of the Master Curve," Fracture Mechanics, 31st Symposium, ASTM STP 1389, K. Jerina and J. Gahallger, Eds., American Society for Testing and Materials, 1999.

Armstrong, R.W., G.P. Chambers, M.A. Erickson-Natishan, H.W. Sandusky, M. Wagenhofer and F.J. Zerilli, "Deformation Properties of Al-Mg Alloy 5086 in Laboratory and Explosive Tests," Materials Science Forum, Vols. 331-337, pp. 501-506, 2000.

Wagenhofer, M., M.E. Natishan and R.W. Armstrong, "Influence of Strain Rate and Grain Size on Yield and Serrated Flow in Al-Mg Alloy 5086," Scripta Mater., Vol. 41, No. 11, pp. 1177-1184, 1999.

Natishan, M.E. and M. Wagenhofer, "Conditions Causing Intergranular Cracking in High Strength Nickel-Copper Alloys," Fatigue and Fracture Mechanics: Twenty-Ninth Volume, ASTM STP 1332, T.L. Panontin and S.D. Sheppard, Eds., American Society for Testing and Materials, West Conshohocken, PA, 1999.

Natishan, M.E. and M. Wagenhofer, "Investigations of Stress Rupture Behavior of High Strength Nickel Alloys at Ambient Temperatures," TMS Winter meeting, February, 1997.