

## Craig J. Schroeder | Principal Materials Engineer, P.E.

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### Professional Summary:

Metallurgical engineer with nearly 30 years of industrial experience including foundry process engineering, aerospace forge shop engineering, power transmission metallurgical and failure analysis, commercial laboratory consulting and engine manufacturing material and failure analysis experience.

Craig's areas of expertise include:

- Materials: Carbon & Low Alloy Steels, Stainless Steels, Aluminum Alloys Cast Iron, Titanium, Nickel
- Industries: Foundry, Automotive, Forging, Mining, Power Transmission, Transportation, Aerospace, Electronics, Agriculture, Small Engines
- Processes: Metal Casting, Heat Treating, Plating, Welding, Forging, Corrosion Evaluation, Quality Assurance, Powder Metals, Additive Manufacturing
- Testing: Visual Inspection, Metallography, Scanning Electron Microscopy/Energy Dispersive X-Ray Spectroscopy (SEM/EDS) Analysis, X-Ray Analysis, CT Scanning
- Management: Failure Analysis Project Management & Training, SEM/EDS Laboratory, Materials Laboratory

### Licenses and Certifications:

Professional Engineer - Wisconsin, 35712-006, Sep 2002

### Project Experience:

#### **Briggs & Stratton, Wauwatosa, WI** **Mechanical Failure**

After an engine had failed in the field, the fractured crankshaft was delivered to Craig for analysis. The crankshaft fractured lengthwise through the crankpin, a failure not previously witnessed in the organization. Craig performed a lengthy and detailed analysis to trace the cause of the fracture to a small radius in the oil passage that served as a site for stress concentration and initiated a high-cycle fatigue-related fracture.

#### **Element Materials Technology, New Berlin, WI** **Manufacturing Process Issue**

A complex manufacturing problem, utilizing powder, resulted in a dispute between the manufacturer of the powder and the company that utilized the powder to manufacture a specific grade of titanium alloy. Craig utilized scanning electron microscopy (SEM), to characterize the size and shape of the particles to help determine whether they met specification. The results of the analysis led to a favorable outcome for the client.

### **Rexnord Technical Services, West Milwaukee, WI Research**

Craig led a research project investigating the benefits of furnace tempering versus induction tempering in elevator chain pins. The research included the analysis of residual stresses at the case-core interface of the induction hardened pins. The results of the research indicated that furnace tempering reduce the amount of tensile residual stresses in this region and helped improved the life of the elevator chain product.

### **Court Qualifications/ Depositions:**

Litigation CV available upon request.

### **Professional Experience:**

EFI GLOBAL, INC, Cedarburg, WI  
Engineering consulting firm.

PRINCIPAL MATERIALS ENGINEER | 2023 - PRESENT

Performs forensic engineering investigations utilizing nearly three decades of materials engineering experience to provide clients with valuable information to make informed decisions. The extensive background in failure analysis includes projects serving major insurance companies, adjusters, attorneys, defense contractors, manufacturers, and municipalities. Conducts analyses on fractures, corrosion, metals, plastics & ceramics, electrical arcing and overheating evidence, fireplace and chimney fires, explosions, and various other investigations. Performs investigations in the field and helps manage the facilities of the EFI Global Milwaukee Laboratory which includes a metallurgical / materials testing suite and Scanning Electron Microscope (SEM) with an energy dispersive x-ray spectrometer (EDS).

BRIGGS & STRATTON, Wauwatosa, WI  
Small engine and power generation company.

MATERIALS ENGINEER IV | 2020-2023

Responsible for managing the materials laboratory and projects that provide failure analysis, metallurgical testing, and design consulting services. Provided evaluation and consultation regarding component failures, heat treatment, material properties, process improvement, and corrosion problems.

- Completed over 250 metallurgical failure investigations.
- Consolidated and managed the materials and corrosion laboratories.

ELEMENT MATERIALS TECHNOLOGY, New Berlin, WI  
Commercial materials testing and consulting laboratory.

SENIOR ENGINEER, METALLURGY | 2008-2020

Responsible for managing projects that provide failure analysis, metallurgical testing, and consulting services. Provided evaluation and consultation regarding heat treatment, material properties, process improvement, and corrosion problems. Conducted on-site evaluation of failures and manufacturing process problems. Supported raw material suppliers, manufacturers, and end users of metallic materials with investigations and problem solving.

REXNORD TECHNICAL SERVICES, Milwaukee, WI  
Commercial material testing and consulting laboratory.

**MATERIALS ENGINEER | 2000-2008**

Responsible for managing projects that provide failure analysis, research and development, product development, metallurgical testing, and consulting services. Provided evaluation and consultation regarding heat treatment, material properties, process improvement, and corrosion problems. Supported all divisions, including Engineered Chain, Coupling, Seal, Bearings, TableTop and Geared Products. Performed metallurgical evaluations and failure investigations for companies outside of Rexnord on products including agricultural knives, shafts, fasteners, and a variety of other components.

**LADISH CO., INC., Cudahy, WI**

Forge shop that produced steel, titanium and nickel forgings for the aerospace industry.

**METALLURGICAL ENGINEER | 1997-2000**

Responsible for the development and maintenance of systems for quality control, production process control, metallurgical and heat treatment control, customer service and purchase material control.

**AMCAST AUTOMOTIVE, Cedarburg, WI**

High production aluminum permanent molding supplier for the automotive industry.

**PROCESS ENGINEER | 1995-1997**

Responsible for new product development, quality planning, quality systems improvement, process control improvement, and metallurgical control.

### Specialized Education:

Principles of Failure Analysis, ASM International, 2001  
Microstructure of Ferrous Alloys, ASM International, 2001  
Stainless Steels, ASM International, 2003  
Heat Treatment of Steel, ASM International, 2002  
Titanium and Its Alloys, ASM International, 1999  
Electroplating, ASM International, 2005

### Education:

Master of Science, Materials Engineering, University of Wisconsin-Milwaukee, Milwaukee, WI  
2002.  
Bachelor of Science, Materials Engineering, University of Wisconsin-Milwaukee, Milwaukee, WI  
1997.

### Affiliations:

ASM International  
ASM Failure Analysis Society, Board Member, Journal of Failure Analysis and  
Prevention Associate Editor | Sep 2017-Sep 2020

ASM Technical Books Committee | Sep 2015-Aug 2018  
Vice-Chairman | Sep 2016-Aug 2017; Chairman | Sep 2017| Aug 2018  
ASM Handbook Committee | Sep 2015-Aug 2018  
Vice Chairman | Sep 2016-Aug 2018; Chairman Sep 2018-Sep 2020  
Green Belt - Design for Six Sigma, American Foundry Society (AFS)  
Foundry Education Foundation (FEF)  
American Society of Mechanical Engineers (ASME)

## Publications:

**Volume Editor. ASM Handbook Volume 12. Fractography.** ASM International. Materials Park, OH. 2024  
**"Fractography in Failure Analysis."** ASM Handbook Volume 12. Fractography. ASM International. Materials Park, OH. 2024.  
**"Rolling Contact Wear."** ASM Handbook Volume 18. Friction, Lubrication and Wear Technology. Editor. ASM International. Materials Park, OH. January 2017  
**"Impact Wear."** ASM Handbook Volume 18. Friction, Lubrication and Wear Technology. Editor. ASM International. Materials Park, OH. January 2017  
**"Metallurgical Failure Analysis of Power Transmission Components."** Randall Publications, LLC., Power Transmission Engineering Magazine, April, 2016  
**"The Case of the Flaked Nickel Plating."** NACE International, CoatingsPro Magazine, March, 2016  
**"Failure Analysis of a Fractured Pin."** ASM and Springer, Advanced Materials and Processes, October, 2015  
**"Metallurgical Failure Analysis of a Fractured Steam Control Valve Stem."** ASM and Springer, Journal of Failure Analysis and Prevention, June, 2015  
**"Your Medical Device Has Failed – Now What?"**. UBM Canon: Medical Device and Diagnostics Industry (MD+DI) Magazine Online, December 10, 2014  
**"Gear Failure Analysis." Component Failure Analysis.** Editor, ASM-MEI. Materials Park, OH. October, 2014  
**"Metallurgical Failure Analysis of a Fractured Sleet Scraper Spring."** ASM and Springer, Journal of Failure Analysis and Prevention, November, 2013  
**"Ductile Fracture." How Components Fail.** Editor, ASM. Materials Park, OH. October 2013  
**"The Case of the Fractured Hitch: A Study in Metallurgical Failure Analysis."** ASME, ME Magazine, April, 2010  
**"Metallurgical Failure Analysis Helps Prevent Future Failures."** SAE International, Truck & Bus Engineering Online, December, 2009  
**"Evaluation of Residual Stresses in Induction Tempered Versus Furnace Tempered Steel Rod."** Master's Thesis, University of Wisconsin-Milwaukee, May 2002

## Presentations

Schroeder, Craig. *Failure Analysis of Small Engine Components. Failure Analysis Society (FAS) Session Chair, IMAT Conference, Detroit, MI. October 2023.*  
Schroeder, Craig. *Fractography of Small Engine Components. Failure Analysis Society (FAS) Session Chair, IMAT Conference, New Orleans, LA. September 2022.*  
Schroeder, Craig. *The Relationship between Fractography and Metallography. Joint International Metallographic Society (IMS) and Failure Analysis Society (FAS) Session, IMAT Conference, St. Louis, MO. September 2021.*



Schroeder, Craig. *Metallurgical Failure Analysis of a Fractured Coupling. Unusual Failures Session, MS&T Conference, Portland, OR. September 2019.*

Schroeder, Craig. *Metallurgical Failure Analysis of a Fractured Chain Link Weld. Manufacturing Related Failures – Welding Joining Failures Session, MS&T Conference, Columbus, OH. October 2018.*

Schroeder, Craig. *Metallurgical Failure Analysis.* [seminar] Madison, WI. August 24, 2013; Madison, WI.

Schroeder, Craig. *Metallurgical Failure Analysis.* [seminar] Madison, WI. May 2012; Madison, WI.

Schroeder, Craig. *Coatings for Corrosion and Wear Resistance.* [seminar] New Berlin, WI. January 2011.

Schroeder, Craig. *Failure Analysis.* [seminar] Society of Mechanical Engineers. West Allis, WI. May 2007.