Robert J. Cooley

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Senior Staff Consultant

Robert J. Cooley is a senior staff consultant with ESi. As a licensed professional engineer in the state of Minnesota, he holds a BS in materials science engineering with a decade of experience in metallurgical engineering, materials science, and failure analysis. His failure analysis projects include a wide range of industries, including transportation (automotive, aviation, rail, and marine), plumbing components (faucets, couplings/fittings, hose bibs, copper pipes, valves, etc.), fire suppression systems (sprinklers, pipes, and couplings), manufacturing components, food and beverage storage, and more. These projects cover a wide range of alloy systems, including cast iron, steel, copper, brass, and aluminum.

Mr. Cooley has expertise in analytical methods including optical microscopy, metallography, scanning electron microscopy (SEM) with energy dispersive X-ray spectroscopy (EDS), X-ray fluorescence (XRF), hardness, optical emission spectrometry (OES), Fourier Transform Infrared (FTIR) spectroscopy, digital radiography, CT scanning, and more. His intimate familiarity with these techniques allows him to consider the context and greater meaning behind the data, providing relevant recommendations based on the findings.

Mr. Cooley works with industrial clients, insurance professionals, and attorneys, with a focus on presenting clear and thorough analyses.

Education

B.S., Materials Science and Engineering (Magna Cum Laude).
Michigan Technology University. 2015

Licenses & Certifications

- State of Minnesota P.E. License 60011

Positions Held

Engineering Systems Inc., Plymouth, Minnesota

- Senior Staff Consultant, 2022 – Present

Contact Information

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Areas of Specialization

- Corrosion Analysis
- Failure Analysis and Fractography
- Metallurgical Evaluation
- Materials Joining and Plating
- Scanning Electron Microscopy
- Nondestructive Evaluation
- Lab & Inspection Services

Element Materials Technology, St. Paul, Minnesota

- Metallurgical Engineer, 2016 – 2022

Huron Casting, Inc., Pigeon, Michigan

- Intern Metallurgist, May 2014 – August 2014

Engel Metallurgical, Sauk Rapids, Minnesota

- Intern/Metallurgical Technician, May 2012 – August 2012, May 2013 – August 2013

Professional Affiliations/Honors

ASM International

- Member, 2021 – Present

ASM Minnesota Chapter

- Board of Directors, 2023 – Present

Project Experience

Carbon and Alloy Steels

Failure Analysis of a Carbon Steel Spring

- A carbon steel spring failed prematurely during testing in a laboratory setting. The spring was welded to a steel plate as part of an assembly. The fracture morphology at the origin consisted of a mixture of intergranular fracture and dendritic solidification structure, and the remainder of the fracture morphology was transgranular cleavage. A metallographic cross section through the origin revealed the microstructure at the fracture origin consisted of untempered martensite with dendritic shrinkage, while the bulk microstructure was pearlitic. A small blister in the galvanized and chromated coating on the wire surface was found at the origin location. It was concluded that the blister, localized melting, and martensite transformation were caused by weld spatter from the welding operation used to join the spring to the plate prior to coating.

Stainless Steels

Cracking of Stainless Steel Castings

- Austenitic stainless steel sand castings cracked in service at a steel mill in an environment with a reportedly sulfur-rich environment. The castings exhibited a splintered wood-like fracture morphology, leaving splinters oriented perpendicular to their parallel surfaces which met at mid-thickness. Fractography revealed the “splintering” to be the separation of large primary solidification dendrites. Electrolytic etching of polished metallographic specimens revealed indications of sensitization. The castings were found to have approximately four times the maximum carbon content allowed by the alloy specification. Sensitization of austenitic stainless steel typically requires extended exposure to temperatures in the approximate range of

800-1600°F, but limiting exposure in this temperature range may be insufficient to prevent sensitization in an alloy with such excessive carbon content which may occur during cooling following the sand casting process.

Copper and Copper Alloys

Investigation of Two Failed Brass Fittings

- Two brass fittings made by the same manufacturer and installed by the same installer at the same home failed within a short duration from each other. The failed fittings were made from 70/30 leaded brass. One fitting separated completely, while the other only leaked. The separated fitting was examined and showed clear evidence of stress corrosion cracking (SCC). The investigation showed that the fittings were substantially overtightened, imparting them with unnecessary tensile stresses which rendered them susceptible to SCC.

Aluminum and Aluminum Alloys

Corrosion Evaluation of Anodized Aluminum

- A material change was made to a component in an espresso machine application, changing a component material from stainless steel to anodized aluminum. The component began rapidly corroding in service. Due to concerns surrounding proprietary machine design, little background and design information was provided. The evaluation revealed general corrosion caused by cleaning products which are known to be severely corrosive to aluminum alloys even when anodized, supported by literary sources. A change of cleaning products or a reversion of the material change was recommended.

Investigation of Formability Issues in Non-Heat Treatable Aluminum Alloy Sheet

- Aluminum alloy sheet in the H32 temper being purchased from multiple mill sources exhibited significantly varied performance when subjected to a 90-degree bending process. Some material bent cleanly while other material tore or fractured when bent. An investigation was requested to determine the cause of the difference in bending performance. Tensile testing confirmed all material met the required tensile properties. Metallography revealed that problematic material lots exhibited grain structures with high aspect ratios, elongated parallel to the rolling direction, while the non-problematic lots exhibited fine, equiaxed grain structures parallel to the rolling direction. The difference in grain structure and corresponding bending performance was attributed to the wide range of thermomechanical processing allowable by the relevant specifications in order to achieve the desired tensile properties.

Presentations

“Field Evaluation of Treated Lumber by Use of X-ray Fluorescence Spectroscopy”, M.E. Weiss, L.C. Meissner, **R.J. Cooley**, presented at the 2025 IMAT Conference, Detroit, MI, October 22, 2025.

“Failure Analysis of Prefinished Engineered Hardwood Flooring after Large Splinter Injury”, M.E. Weiss, L.C. Meissner, **R.J. Cooley**, presented at the 2025 IMAT Conference, Detroit, MI, October 22, 2025.

“Evaluation of Sintered Tungsten Carbides by Destructive and Nondestructive Methods”, L.C. Meissner, **R.J. Cooley**, presented at the 2025 IMAT Conference, Detroit, MI, October 22, 2025.

“Be Careful Walking the Dog: An Orthopedic Leg Brace Failure,” D.E. Alexander, **R.J. Cooley**, E.E. Wright, presented at the 2024 IMAT Conference, Cleveland, OH, October 3, 2024