Exponent®
Engineering & Scientific Consulting

Dean Sage, Ph.D.

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Professional Profile

Dr. Sage is a metallurgical engineer specializing in failure analysis of welded components, with particular expertise in weld cracking, degradation mechanisms, and fracture behavior. His work spans a broad range of failure investigations involving implantable medical devices, aerospace and aviation structures, and other safety-critical components, frequently in support of product liability and litigation-related matters.

Dr. Sage has extensive experience in fractography, metallurgical failure analysis, advanced materials characterization, and microstructural evaluation in support of root cause analysis. His technical capabilities include metallography, mechanical testing, scanning electron microscopy (SEM), energy-dispersive X-ray spectroscopy (EDS), and electron backscatter diffraction (EBSD).

Prior to joining Exponent, Dr. Sage applied his metallurgical engineering expertise at other failure analysis companies, where he supported industrial investigations and litigation-related failure analyses involving welded structures and metallic components.

During his graduate research at The Ohio State University, Dr. Sage investigated liquid metal embrittlement (LME), a metallurgical degradation mechanism associated with weld cracking. His research utilized thermomechanical testing, microstructural characterization, and electron microscopy to characterize the phenomenon and propose a novel cracking mechanism.

Academic Credentials & Professional Honors

Ph.D., Welding Engineering, Ohio State University, 2022

M.S., Welding Engineering, Ohio State University, 2020

B.S., Materials Science and Engineering, University of Florida, 2016

B.S., Agricultural & Biological Systems Eng, University of Florida, 2016

Prior Experience

Consultant Metallurgist, EAG (formerly SEAL) Laboratories, 2025–2026

Sr. Materials Engineer, McSwain Engineering, 2023-2025

Professional Affiliations

American Welding Society

Publications

Sage D, Fink C. Understanding temperature and dwell time dependence of liquid metal embrittlement in austenitic stainless steel by liquid zinc and copper. Materialia 2022; 24:101502.

Lu Y, Sage D, Fink C, Zhang W. Dissimilar metal joining of aluminum to zinc coated steel by ultrasonic plus resistance spot welding – microstructure and mechanical properties. Science and Technology of Welding and Joining 2020; 25:25(3):218–227.

Project Experience

Dr. Sage has applied his expertise in a wide range of products and engineered systems, primarily in support of product liability, personal injury, and wrongful death litigation.

- **Medical Devices:** Conducted metallurgical failure analysis of implantable medical devices to identify manufacturing defects, processing faults, and material nonconformances that prevented products from passing quality control.

- **Consumer Products:** Performed failure analysis of consumer products including bicycles, electric skateboards, wheelchairs, and hunting tree stands, identifying failure modes, material defects, and contributing design and manufacturing factors.

- **Consumer Electronics:** Characterized microscopic laser welds in electronic components using electron microscopy and advanced materials characterization techniques to support failure investigations, quality control efforts, and research and development activities.

- **Automotive:** Examined automotive structural components and safety systems, assessing material properties, weld integrity, fracture mechanisms, and metallurgical microstructure.

- **Defense and Aerospace:** Provided materials characterization and microstructural evaluation of aerospace components in support of defense-related research and development, including assessment of weld quality and material performance.

- **Aviation:** Conducted metallurgical failure analyses of downed aircraft, ranging from light aircraft and helicopters to large military cargo aircraft, involving fracture analysis, microstructural evaluation of superalloy turbine components, and materials characterization.

- **Industrial Machinery:** Performed metallurgical failure analysis and root cause analysis of industrial machinery failures involving pressurized pneumatic tank trucks, pressure vessels, and intercoolers, which underwent rapid unscheduled disassembly due to weld discontinuities.

- **Industrial Facilities:** Investigated large-scale industrial facility failures, including paper mill explosions, refinery explosions, and wastewater treatment facility flooding events, with a focus on

metallurgical contributors, weld integrity, fracture mechanisms, and failure progression in support of incident reconstruction and litigation.

Peer Reviews

Journal of Materials Engineering and Performance