Exponent®
Engineering & Scientific Consulting

Blake Whitley, Ph.D., P.E., CWI

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Professional Profile

Dr. Blake Whitley applies his expertise as a metallurgical engineer to help clients solve problems across a broad range of materials challenges. These include working directly with industry, and, when needed, within the product liability and technical expert litigation spaces.

Dr. Whitley is a licensed Professional Engineer who applies engineering principles and standards to assist clients with failure analysis, fracture mechanics, corrosion, heat treatment, materials processing, and advanced characterization techniques across a range of industries. His work frequently supports industrial failures and accidents, mining operations, heavy equipment, energy production and distribution, oil and gas infrastructure, rotating equipment, water utilities, automotive, locomotive, marine applications, and metals production. Dr. Whitley is also a Certified Welding Inspector.

He has worked on matters involving government agencies including the Occupational Safety and Health Administration (OSHA), Mine Safety and Health Administration (MSHA), National Transportation Safety Board (NTSB), and the Consumer Product Safety Commission (CPSC) on cases involving operator safety, mining incident assessments and risk mitigation, transportation safety, and consumer product recalls.

Technical Committee & Professional Involvement

Dr. Whitley serves on multiple American Welding Society (AWS) technical committees including Structural Welding (AWS D1), Welding in Marine Construction (AWS D3), Brazing and Soldering (AWS C3), and Testing and Inspection of Welds (ISO/TC 44/SC 5). He serves as Co-Chair of the Fractography Session for the Failure Analysis Society through ASM International. He also serves on the ASTM International Committees for Non-Destructive Evaluation (NDE), Fatigue and Fracture, and the Joint ASTM/NACE Committee on Corrosion. Dr. Whitley served as technical reviewer for the ASM Handbook chapters on “X-ray Spectroscopy in Failure Analysis” and “Scanning Electron Microscopy” in Vol. 11: Failure Analysis and Prevention.

Experience in Primary Metals Development

Prior to joining Exponent, Dr. Whitley worked as a Senior Metallurgical Engineer with ATI Specialty Materials. During that time, he served as Technical Lead on multiple next generation alloy development efforts for the aerospace and jet engine market. His primary focus at ATI was powder-based nickel superalloy development, with supporting roles in titanium alloy development and high-speed steel process optimization. Dr. Whitley oversaw projects from initial concept, through the Research & Development phase, and into full-scale manufacturing.

Academic Credentials & Professional Honors

Ph.D., Metallurgical and Materials Engineering, Colorado School of Mines, 2017

B.S., Metallurgical Engineering, University of Alabama, 2012

Tau Beta Pi, Engineering Honor Society

AWS Testing and Inspection of Welds (ISO/TC 44/SC 5)

ASTM Committee on Non-Destructive Evaluation (ASTM E07)

ASTM Committee on Fatigue and Fracture (ASTM E08)

Joint ASTM/NACE Committee on Corrosion (ASTM J01)

Bodycote Best Paper in Heat Treating Award

ASM Rocky Mountain Chapter Executive Board Member

Licenses and Certifications

Professional Engineer Metallurgical, Arizona, #79116

American Welding Society Certified Welding Inspector (CWI)

Prior Experience

Senior Research & Development Engineer, ATI Specialty Materials, 2017-2018

Graduate Student Instructor, Colorado School of Mines, 2012-2017

Metallurgical Engineering Intern, ALSTOM Power, Summer 2011 & Summer 2012

Professional Affiliations

American Welding Society (AWS)

ASM International, Failure Analysis Society (FAS)

ASTM International

Association for Iron and Steel Technology (AIST)

Publications

Hudgins A, Roepke C, James B, Kondori B, Whitley BM. Failures of pipelines. ASM Handbook, Volume 11A, Analysis and Prevention of Component and Equipment Failures, 2021.

Speer JG, Whitley BM, Kaster SL, Findley KO, Matlock DK, De Moor E. Selected developments in Nb-Microalloyed forgings for induction hardening, and pearlitic wire rod. Technology in Metallurgy, Materials, and Mining, São Paulo, 2020.

Whitley BM, Speer JG, Cryderman R, Klemm-Toole J. Understanding microstructural evolution during rapid heat treatment of Microalloyed steels through computational modeling, Advanced Physical

Simulation, and Multiscale Characterization Techniques, Journal of Materials Engineering and Performance, 2019.

Speer JG, Whitley BM, Kaster SL, Findley KO, Matlock DK, De Moor E. Selected developments in Nb-Microalloyed long products and forgings, 11th International Rolling Conference, 2019.

Whitley BM, Speer JG, Cryderman RL, Goldstein RC, Findley KO, Matlock DK. Effects of Microalloy additions and thermomechanical processing on Austenite Grain size control in induction-hardenable medium carbon steel bar rolling. International Conference on Processing & Manufacturing of Advanced Materials Processing, Fabrication, Properties & Applications (Thermec), Materials Science Forum 2016; 879:2094–2099.

Cryderman R, Whitely B, Speer J. Microstructural evolution in Microalloyed steels with high-speed thermomechanical bar and rod rolling. International Federation of Heat Treatment and Surface Engineering, Proceedings of the 23rd IFHTSE Congress, 2016.

Whitley BM, Araujo AL, Speer JG, Findley KO, Matlock DK. Analysis of microstructure in hot torsion simulation, materials performance and characterization. ASTM 2015; 4(3):307–321.

Whitley BM, Easter CT, Cryderman RL, Speer JG. Thermomechanical simulation and microstructural analysis of Microalloyed medium carbon bar steels. Advances in Metallurgy of Long and Forged Products 2015; 48–58.

Whitley BM. Novel three-dimensional modeling technology for advanced simulation, printing, and casting of A356 impeller. International Journal of Metalcasting 2013.

Technical Presentations

Whitley BM, James B. Analysis of fractured structural components from a train impact. International Materials, Applications & Technology Conference, 2025.

Whitley BM, Getsinger D. Best practices for root cause analysis of turbines in the context of a potential dispute. 7F Turbine Users Group Annual Conference, 2025.

Anderson K, Whitley BM. Applying the scientific method in the failure analysis process. Guest Lecture, The University of Alabama, 2025

Whitley BM, Stewart J. Weld cracking on igniter tips between alloy 625 and 310 stainless steel. International Materials, Applications & Technology Conference, 2024.

Whitley BM, Sathe A. Failure analysis of an overhead crane coupling. International Materials, Applications & Technology Conference, 2024.

Whitley BM. Principles of materials engineering failure analysis. Guest Lecture, Failure Analysis & Prevention, Arizona State University, 2023.

Whitley BM, Speer JG, Cryderman RL, Findley KO. Effects of thermomechanical processing, Microalloying, and rapid heat treatment on microstructural development, carbonitride precipitation, and mechanical behavior of medium carbon steels. Materials Science & Technology Conference, 2019.

Whitley BM, Antolovich B, Wilwert L. Progress toward developing and producing a precipitation-hardened martensitic steel alloy for engine shafts. ATI technical presentation, 2018.

Whitley BM, Coury FG, Foltz J, Philips N, Avallone J. Relationships between the thermodynamic and thermomechanical behavior of a niobium-based refractory alloy for rocketry applications. ATI technical presentation, 2018.

Whitley BM, Minisandram RS, Shelton J. Pilot scale development of next generation nickel powder disk alloys. ATI Technology Conference, 2017.

Tabei A, Whitley BM, McDevitt E. Development of a conversion process for burn resistant Ni-based superalloy. ATI Technology Conference, 2017.

Whitley BM, Speer JG, Cryderman RL. Processing factors associated with post-induction grain size refinement in medium carbon steels. Invited talk, Semi-annual Review Conference of the Advanced Steel Processing and Products Research Center, 2017.

Whitley BM, Speer JG, Cryderman RL, Goldstein RC, Findley KO, Matlock DK. Effects of Microalloy additions and thermomechanical processing on Austenite Grain size control in medium carbon steel bar rolling. International Conference on Processing & Manufacturing of Advanced Materials Processing, Fabrication, Properties & Applications (Thermec), 2016.

Whitley BM, Easter CT, Cryderman RL, Speer JG. Thermomechanical simulation and microstructural analysis of Microalloyed medium carbon bar steels. International Symposium on New Developments in Long and Forged Products (AIST), 2015.

Whitley BM, Speer JG. Physical simulation of the thermo-mechanical rolling process. Invited Lecture at the Institute of Roll Design Conference, 2015.

Whitley BM, Speer JG, Cryderman RL. Thermomechanical processing of Microalloyed bar steels for induction hardened components. Invited Lecture for the Gerdau Metallurgical Research & Development Department, 2014.

Whitley BM, Cryderman RL. Simulating induction hardening on a laboratory scale for analysis of microstructural evolution. Lecture to the Induction Engineering Team at Inductoheat, 2014.

Whitley BM, Nastac L. Novel three-dimensional printing technology for advanced modeling and casting of A356 impeller. Materials Science & Technology Conference, 2011.

Whitley BM. Casting smarter, not harder: advanced modeling and casting of an aluminum 356 impeller. Invited Lecturer for Introduction to Materials Course, 2011.

Whitley BM, Castleberry K, Murphy A, Freeman B. A356 impeller: a prototype part cast in a silica sand-furan mold. American Foundry Society Meeting, 2011.

Project Experience

Dr. Whitley has applied his engineering expertise to help clients solve problems and mitigate risks in a variety of settings. Examples of the industries he serves are provided below:

Mining and Heavy Equipment

Much of Dr. Whitley's experience has focused on industrial failures of heavy equipment in the mining and metals production industries. Select examples include:

- Mining Equipment Failures: Dr. Whitley has investigated failed ball mill trunnion bearings, ball mill liners and bolts, in-ground crushers, conveyor systems and backstops, a roof bolter, and hydraulic excavating equipment. His analysis of mining equipment failures includes fatigue failures, damage and fractures due to impact loading, gouging, abrasion, erosion, overheating, improper fit-up and improper splice curing, corrosion, lubrication issues, installation errors, and

exposure to heat and fire. This work has included dye penetrant inspection to identify early-stage fatigue cracks in rotating equipment.

- Hydraulic jack failure: Dr. Whitley led an on-site inspection and laboratory analyses following a fatality at a mining site involving the ejection of a pressure relief valve (PRV) from a hydraulic cylinder. Dr. Whitley worked in conjunction with MSHA, utilizing computed tomography (CT) X-ray analysis to understand the root cause of the failure incident.
- Overhead crane failures: Dr. Whitley has analyzed failures of overhead crane components including wear failure of gear teeth and fatigue failure of lifting shackles.
- Fractured pump shafts: Dr. Whitley has led analyses of failed pump shafts including fatigue failures of case-hardened steel shafts.
- Duct burner failures: Dr. Whitley has conducted materials characterization and welding assessments for structural support structures and duct burners in gas-burning power plants. Metallurgical analyses included assessments of microstructural changes experienced by materials at elevated temperature.
- Jet engine failure: Dr. Whitley investigated the catastrophic failure of a prototype jet engine which failed due to improper heat treatment of nickel-based superalloy components.

Welding, Brazing, and Inspection

Dr. Whitley is a Certified Welding Inspector and has inspected and analyzed numerous welds and brazes using visual inspection, non-destructive inspection, and destructive laboratory testing methodologies. This analysis frequently involves review of welding procedure specifications (WPS), welding procedure qualification records (WPQR), welder qualifications, weld and braze fabrication practices, welding codes, weld and braze failures, specific weld and braze process steps, and weld repairs. Dr. Whitley has experience interpreting and applying welding codes including AWS D1.1, AWS D15.1, ASME BPVC Section VIII, ASME Section IX, API 1104, and BS 7608.

- Cooling coils and heat exchangers: Dr. Whitley has led investigations of cooling coils with braze cracking and leaks at dissimilar metal braze joints at a combined cycle power plant. This work included borescope inspection to verify braze penetration. He has also conducted fabrication site quality audits.
- Rotating Component Welds: Dr. Whitley has assessed welding procedures, weld fabrication, weld inspection records, cracking, weld repairs, and non-destructive testing of welds in rotating equipment including ball mills and rotary kilns.
- Cancer Treatment Targets: Dr. Whitley conducted braze assessments for specialized multi-component ‘targets’ used in cancer radiology treatment.
- Railroad Welds: Dr. Whitley has inspected and analyzed structural welds on locomotives and cab cars. His work includes assessing weld qualifications, mechanical testing, visual inspection results, ultrasonic testing results, and weld collision performance. Dr. Whitley’s project work in railroad incidents includes an instance of derailment and NTSB involvement.

Energy & Utilities

Dr. Whitley has experience leading investigations of failures in gas turbines, electrical transmission, water utilities processing and storage facilities, solar and wind energy, and novel power generation strategies including nuclear fusion.

- Gas turbine investigations: Dr. Whitley has investigated multiple gas turbine failures supporting both utilities and OEMs. His work includes inspecting turbine filter houses, screening, engine

compressors, and hot sections. Analyses have included catastrophic turbine blade liberations, foreign object debris (FOD) damage, domestic object debris (DOD) damage, shaft corrosion, turbine blade fatigue cracking, and bearing failures.

- Boilers, pressure vessels, and heat exchanger leaks: Dr. Whitley has inspected boilers and heat exchangers with metallurgical failures. His work has analyzed failures due to graphitization, over-pressurization, acid exposure, pitting corrosion, defective welding, fatigue cracking, corrosion fatigue, erosion, and stress corrosion cracking.
- Electrical systems: Dr. Whitley analyzed materials in electrical systems including high-voltage transmission lines, residential distribution, and marine shore power connections. This work has included analyses of material degradation due to arcing/melting, corrosion, and human interference.
- Water cooling towers: Dr. Whitley has inspected cooling towers experiencing coil leaks. Analysis revealed corrosive attack and localized pitting due to elevated chloride concentrations.
- Arsenic removal tank failures: Dr. Whitley analyzed environmental degradation of stainless steel laterals in arsenic removal tanks, revealing microbially induced corrosion (MIC) failures.
- Solar energy: Dr. Whitley conducted field inspections of hundreds of PV solar units, followed by laboratory tear-down inspections of failing solar panel actuators. Gearbox components experienced corrosion due to environmental exposure and eventually experienced mechanical failures.
- Wind turbines: Dr. Whitley has analyzed failed wind turbine components including gearboxes and bearings.
- Nuclear fusion – Dr. Whitley has assisted clients with the development of austenitic stainless steels for nuclear fusion applications. His work included optimization of steel forging operations and analysis of microstructure-property relationships at cryogenic temperatures.
- Linear Generators: Dr. Whitley has investigated weld processes and fractures on exhaust manifolds for onsite power generation systems.

Pipelines & Infrastructure

Dr. Whitley has inspected pipes and tubes including carbon steels, stainless steels, cast irons (including ductile iron pipe), copper and copper alloy tubing, and polymeric piping in the contexts of failure analysis and prevention. His work has included investigations of stress corrosion cracking, hydrogen embrittlement, corrosion under insulation, pitting corrosion, and over-pressurization events. He has previously served on the Pipe & Tube Technical Committee for the Association for Iron and Steel Technology (AIST).

- Ductile Iron Pipe (DIP): Dr. Whitley has led multiple investigations into failures and leaks of ductile iron piping including bell-and-spigot piping in a residential construction and an underwater pipeline failure.
- Failures of Oil & Gas Piping: Dr. Whitley has worked on failures of pipelines carrying hot crude oil, gasoline, liquid natural gas (LNG), and other chemical species. He has investigated failure mechanisms in piping including fatigue cracking, weld defects, corrosion under insulation (CUI), and third party mechanical damage. Dr. Whitley's work has included review of in-line inspection (ILI) records and cathodic protection records.
- Ruptured HDPE Tailings Pipes: Dr. Whitley has analyzed failed tailings pipes for mines in which high density polyethylene (HDPE) pipe segments experienced overload ruptures due to over-pressurization.

- Plumbing Pipe Failures: Dr. Whitley has investigated multiple failures involving water leaks of commercial and residential water systems including faucets, sprinkler systems, and plastic piping.