

Exponent®
Engineering & Scientific Consulting

Rafael Coura Giacomin, Ph.D., P.E.

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Professional Profile

Dr. Giacomin is a distinguished materials engineer with extensive expertise in failure analysis, fractographic examination, and both laboratory and field analysis across a diverse range of materials. His comprehensive experience encompasses ferrous metallurgy, materials characterization, pipeline metallurgy, corrosion analysis, process control, statistical analysis for process improvement, failure analysis and prevention, defect detection, and degradation mechanism identification for a wide variety of materials. Dr. Giacomin provides technical support directly to industrial clients and serves as an expert consultant in legal and insurance matters.

His professional achievements include the development and training of steel refining (electric arc and ladle furnaces) standard operating procedures (SOPs), [GG1] process control parameter optimization, and quality assurance during the startup of a one-million-ton steelmaking plant for an Oil Country Tubular Goods (OCTG) manufacturer.

In the academic realm, Dr. Giacomin has spearheaded investigations into the mechanical properties and microstructure of innovative advanced high-strength steel grades aiming to create lightweight parts for the automotive industry. His research has resulted in improved methods for steel production.

Dr. Giacomin played a pivotal role in establishing a state-of-the-art hardware failure analysis lab in Redmond, WA. In this capacity, he conducted comprehensive reliability and root cause analysis investigations on Microsoft's microelectronic devices, prototype builds, and data center hardware. His responsibilities extended to leading in-depth failure investigations of data center facilities, addressing issues related to structural integrity, electrical systems, and HVAC operations. Additionally, he provided critical technical analysis and consulting services, significantly influencing and empowering design, manufacturing, and assembly teams to enhance their processes and outcomes.

Dr. Giacomin provided expert technical consulting and litigation support to insurance companies, various industries, and the legal community. He conducted thorough failure analysis and forensic engineering investigations on a wide range of materials and equipment, from large-scale industrial accidents and structural failures to small residential plumbing issues. His specialization in materials characterization, metallurgical testing, and corrosion analysis was instrumental in these investigations. He also performed meticulous scene documentation, evidence retrieval, laboratory examinations, background research, and report preparation. Additionally, he supported testifying experts in various legal matters, ensuring comprehensive and accurate technical insights.

Spearheaded investigations into the mechanical properties and microstructure of innovative steel grades, aiming to create high-strength, lightweight automotive components. His work involved pinpointing the precise process parameters and chemical compositions that lead to material embrittlement. This critical research played a key role in refining industrial practices and ensuring the production of defect-free cast products.

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Oversaw quality assurance for steelmaking products at a newly established one-million tons per year steel mill. Joining the team before the plant's startup, he played a crucial role in developing standard operating procedures (SOPs) and training operators as the mill came online. Post startup, he devised methods to ensure the cleanliness and mechanical properties of both new and existing steelmaking products through meticulous process data analysis and characterization testing. Dr. Giacomin managed a team of 2 supervisors and 17 lab technicians, leading a cross-functional team to reduce scrap material generation by over 50% at the start of steel production. Additionally, he led the quality team in optimizing testing methodologies, cutting chemical analysis time by 30%. He also coordinated a continuous improvement group focused on safety, successfully reducing the risk index (RPI) of workstations by over 50%, earning the “Stand-out Group” award.

Academic Credentials & Professional Honors

Ph.D., Material Science and Engineering, Carnegie Mellon University, 2019

M.S., Material Science and Engineering, Carnegie Mellon University, 2017

B.S., Chemical Engineering, Federal University of Minas Gerais, 2009

Licenses and Certifications

Professional Engineer Metallurgical and Materials (CA)

Prior Experience

Senior Failure Analysis Engineer, Microsoft, 2022-2023

Materials Engineer, Jensen Hughes, 2019-2020

Graduate Research Assistant, Carnegie Mellon University, 2015-2019

Upstream Quality Engineer, VSB, 2009-2015

Professional Affiliations

American Society for Materials (ASM)

Association for Iron and Steel Technology (AIST)

Languages

Portuguese

Spanish

Publications

Giacomin RC, et al. Effect of silicon on as-cast AHSS ductile to brittle transition temperature. Steel Research 2022; 93(11).

Giacomin RC, Webler BA. Effect of silicon on AHSS as-cast microstructure development and properties.

ISIJ International 2019; 59(5):858-864.

Giacomin RC, Becerril JM, Webler BA. Effect of chemical composition on AHSS as-cast microstructure and properties. Iron & Steel Technology October 2019.

Conference Proceedings

Giacomin RC, Webler BA. Effect of allotriomorphic ferrite thickness on advanced high-strength steel toughness. The Iron and Steel Technology Conference and Exposition — AISTech 2019, Pittsburgh, PA, USA, 2019, p. 2259 — 2270.

Giacomin RC, Webler BA, Yin H. A study on cracking mechanism of third generation of advanced high-strength steel slabs." The Iron and Steel Technology Conference and Exposition — AISTech 2018, Philadelphia, PA, USA, 2018, p. 2625 — 2636.

Poubel SCL, Germano LCA, **Giacomin RC**, Fujii T. Quality analysis of the first bar cast in the VSB steelmaking — Jeceaba. 48th Steelmaking, Casting and Non-Ferrous Metallurgy Seminar — ABM Week 2017, São Paulo, 2017, p. 653-661.

Mosbah S, Natarajan TT, Komolwit P, Webler BA, **Giacomin RB**. Experimental and numerical modeling of solidification grain structure and segregation in ingot casting process. 9th European Continuous Casting Conference, Vienna, Austria, 2017.

Giacomin RC, Becerril JM, Webler BA. As-cast microstructure evolution in AHSS grades and its effect on slab quality. International Symposium on New Developments in Advanced High-Strength Sheet Steels, Keystone, CO, USA, 2017, p. 209 — 221.

Giacomin RC, Barreto AFM, Fujii T, Chesseret L, Braz T. Improving steel cleanliness through deoxidation practice on EAF tapping. The Iron and Steel Technology Conference and Exposition — AISTech 2014, Indianapolis, IN, USA, 2014, p. 1641 — 1646.

Presentations

Giacomin RC, Webler BA. Effect of allotriomorphic ferrite thickness on advanced high-strength steel toughness. The Iron and Steel Technology Conference and Exposition — AISTech 2019, Pittsburgh, PA, 2019.

Giacomin RC, Webler BA. Mechanisms of 3rd generation of advanced high-strength steel slab embrittlement." ASM Pittsburgh Chapter Meeting, Pittsburgh, PA, 2019.

Giacomin RC, Webler BA. Mechanisms of 3rd generation of advanced high-strength steel slab embrittlement. AIST Southeast Chapter Meeting, Portsmouth, VA, 2018.

Giacomin RC, Webler BA. Mechanisms of 3rd generation of advanced high-strength steel slab embrittlement. AIST Philadelphia Chapter Meeting, York, PA, 2018.

Giacomin RC, Webler BA, Yin H. A study on cracking mechanism of third generation of advanced high-strength steel slabs. The Iron and Steel Technology Conference and Exposition — AISTech 2018, Philadelphia, PA, 2018.

Giacomin RC, Becerril JM, Webler BA. As-cast microstructure evolution in AHSS grades and its effect on slab quality." International Symposium on New Developments in Advanced High-Strength Sheet Steels, Keystone, CO, 2017.

Giacomin RC, Barreto AFM, Fujii T, Chesseret L, Braz T. Improving steel cleanliness through deoxidation

practice on EAF tapping. The Iron and Steel Technology Conference and Exposition — AISTech 2014, Indianapolis, IN, 2014.

Project Experience

Industrial Equipment

- Steel mold failure investigation: performed laboratory analysis and extensive literature research to determine root cause of failure steel molds used in metal casting facility.
- Reconstruction and investigation of silo collapse: conducted scene documentation, piece reconstruction, failure characterization, and analysis. Determined origin of failure and its root cause.
- International arbitration support for electric power plant equipment failures: provided technical assistance and literature research for international arbitration on poor performance of thermal electric plant equipment.
- Autoclave explosion investigation: coordinated fractographic study on explosion debris to find point of failure of high-pressure vessel in an airplane manufacturing facility.

Piping Systems

- Polypropylene pipe failure investigation: investigated the degradation and failure of polypropylene (PPR) pipes on 10+ projects across the US. Planned, coordinated, and executed laboratory tests and field work to determine cause and extent of failures.
- Copper pipe and fitting connection failure investigation: evaluated the impact of a freeze break event on the geometry of copper piping and fitting connections.
- Stress corrosion cracking of copper alloy investigation: conducted [GG1] numerous studies on stress corrosion cracking of brass plumbing components such as valves, fittings, and couplings.

Mechanical Systems

- Variable refrigerant flow (VRF) system failure analysis: evaluated and determined cause of failure of electronic expansion valves (EEV), compressors, and indoor units in numerous projects in the Pacific Northwest.
- Assessment of corrosion on HVAC system components: performed scene investigation, documentation, and analysis to establish the extent of corrosion on piping of HVAC components and provided potential mitigation steps.
- Corrosion of fasteners in HVAC system: conducted mechanical tests and statistical analysis to investigate cause of corrosion of steel fasteners in HVAC piping undergoing condensation.

Construction and Building

- Assessment of fastener corrosion on building cladding: conducted scene documentation, statistical analysis, and correlated concentration of failed fasteners with direction of trade winds.
- Aluminum structure collapse investigation: conducted failure analysis and characterization of aluminum beams and welds to find root cause of collapse of roof structure.

Consumer Electronics and Consumer Products

- Investigation of failed components in immersion cooled device: determined reasons for failure of data center components used in breakthrough cooling technology and provided inputs to mitigate the issue.
- Earbuds contact plating investigation: conducted lab analysis to evaluate and compare state-of-the-art electrical contacts on different earbud models and manufacturers. Findings empowered design team's decision on materials selection.
- General consumer electronic equipment analysis: conducted reliability and failure root cause analysis on numerous microelectronic devices, prototype builds, and data center hardware.

New Facilities Setup

- New failure analysis lab set up in Redmond, WA: specified equipment, selected suppliers, and created process documentation for new test facility which allowed the company to investigate and mitigate product issues without disclosing proprietary information.
- New lab set up and commissioning in Seattle, WA: designed workspace, wrote specifications, and developed instrumentation procedures for a new materials lab that allowed the company to cement its position as a leader on failure analysis in the Pacific Northwest.
- New lab set up and commissioning in Jeceaba, Brazil: designed workspace, wrote standard operation procedures (SOPs), trained analysts, and optimized analysis time in chemical analysis lab for a state-of-the-art steelmaking plant in Brazil.
- Steelmaking startup in Jeceaba, Brazil: developed SOPs and trained operators before the steelmaking mill startup. Ramped up product inspection and analysis during commissioning of the plant.

Additional Education & Training

Teaching Assistant, Carnegie Mellon University, 2016-2018

Computational Thermodynamics, Dr. Webler, Fall 2018

Structures of Materials, Dr. Sokalski, Fall 2017

Phase Relations and Diagrams, Dr. Porter, Spring 2017

Engineering the Materials of the Future, Dr. Heard, Fall 2016

Engineering the Materials of the Future, Dr. Heard, Spring 2016

Research Grants

Pennsylvania Infrastructure Technology Alliance, 2017-2018

Peer Reviews

Metallurgical and Materials Transactions B