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Engineering & Scientific Consulting

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Professional Profile

Dr. Gabriel Ganot specializes in failure analysis of engineered components and systems. His specific areas of expertise include metallurgy, materials science, welding, corrosion, and fracture analysis. He consults in these areas directly with industry partners, and when called upon, testifies as a technical expert in litigation and international arbitration forums.

Overview

Dr. Ganot's work focuses on the performance of materials and metals and investigating numerous types of failures across multiple industries. He applies science and engineering fundamentals (such as fractography, fracture mechanics, microscopy, metallurgical analyses, and mechanical testing) to identify the root cause of failures. Holding a Certified Welding Inspector (CWI) certification, Dr. Ganot analyzes failed welds in a variety of components and settings. Additionally, he has expertise in the use and application of many codes and industry standards (for example, API, AWS, ASME, ASTM, among others) relevant in various contexts. Dr. Ganot incorporates a multidisciplinary approach to solving unique and complex problems by leveraging Exponent's breadth and depth of expertise in other technical areas.

Oil & Gas, Pipelines, and Process Piping

Dr. Ganot has investigated failures in oil and gas systems, including transmission and distribution lines, process piping, and refinery equipment. He has evaluated process piping in other applications, such as wastewater treatment facilities, HVAC systems, and residential/commercial plumbing. In this area, he has analyzed failure mechanisms such as stress corrosion cracking, hydrogen embrittlement, fatigue, welding-related effects, and corrosion, among others. Generally, his analysis involves integrating both destructive and nondestructive examinations and applying relevant standards and codes (such as API-5C API 1104, API 579, ASME B31.3, ASME BPVC Section IX, among others).

Energy, Infrastructure, and Construction

Dr. Ganot has conducted extensive investigations into energy and power-generating equipment, industrial machinery, and large structures. In the energy sector, he has evaluated rotating machinery (turbines, pumps), diesel engines, and wind turbine generators. He has also performed failure investigations involving automotive components, industrial equipment, and machinery, including automobiles, forklifts, cranes, elevators, and other fabricated assemblies. In the built environment, Dr. Ganot has analyzed failures, metallurgical, and welding issues in civil and structural systems, including bridges, steel frame buildings, structural steels, reinforcing bars, and fastened connections. His work generally considers the relationship between the materials used, the fabrication method, and in-service loading conditions.

Welding and Welded Connections

As a CWI, Dr. Ganot has analyzed numerous welds in both large and small components. These include structural welds in buildings, process piping, and pressure vessels, all the way down to microscopic welds used in medical devices and consumer electronics. His investigations focus on weld metallurgy, weld practice, and inspection; for example, analysis of weld discontinuities, residual stress effects, in-service degradation mechanisms, and review of radiographic/ultrasonic inspection records. He has specific experience in the relevant codes and standards relating to weld procedures and inspections, including AWS D1.1, ASME BPVC Section IX, among others.

Medical Devices

Dr. Ganot has performed failure investigations of orthopedic implants, surgical instruments, stents, catheters, and other medical devices. These devices typically consist of stainless steel, titanium, and Nitinol alloys. Throughout these projects, a common theme is evaluating the interplay between patient factors, surgical factors, and the component itself.

Consumer Products and Consumer Electronics

Using his broad understanding of materials and mechanics, Dr. Ganot has also investigated a variety of consumer products and consumer electronics (including household items and appliances, handheld and power tools, recreational/sporting goods, cell phones, payment devices, and others). This work typically focuses on root-cause investigations into potential safety and recall issues as well as product liability.

Glass and Glazing

In addition to bulk metals, Dr. Ganot also has significant experience in the failure and fracture of glass products and components. These include windows/glazing, insulating glass units (IGUs), and consumer and industrial glass products (such as bottles, drinkware, and chemical handling products), among others. His analyses typically focus on the identification of the origin and cause of fracture, and what role environmental and/or manufacturing factors had in the root cause(s) of failure.

Professional Background

Dr. Ganot guest lectures on failure analysis at UC Davis and serves as a reviewer for the Journal of Failure Analysis and Prevention. He also teaches courses for The American Society of Materials (ASM International) on metallurgy, failure analysis, and mechanical testing. Prior to joining Exponent, he was a Graduate Research Assistant at Columbia University where he received his doctoral degree in 2012, focused on material processing for advanced microelectronics. Additional examples of project experience are provided below. When he is not consulting on metallurgical-related issues, Dr. Ganot is Coach Gabe for his sons' Little League baseball teams.

Academic Credentials & Professional Honors

Ph.D., Materials Science and Engineering, Columbia University, 2012

M.S., Materials Science and Engineering, Columbia University, 2007

B.S., Integrated Business and Engineering, Lehigh University, 2006

B.S., Materials Science and Engineering, Lehigh University, 2006

2013 Graduate Student Life Award, Columbia University

Licenses and Certifications

Professional Engineer Metallurgical, California, #1981

Professional Engineer Metallurgical, Louisiana, #PE.0048755

Professional Engineer, New York, #96866

Professional Engineer Metallurgical, Texas, #146086

American Welding Society Certified Welding Inspector (CWI)

Prior Experience

Prior to joining Exponent, Dr. Ganot was a Graduate Research Assistant at Columbia University, where he received his doctoral degree in 2012 specializing in semiconductor processing with an emphasis on thin film technologies, particularly laser crystallization and defect formation in thin films. Dr. Ganot's thesis work dealt with the crystallization of semiconductor thin films for use in advanced liquid crystal displays (LCDs), active matrix organic light-emitting diode (AMOLED) displays, three-dimensional integrated circuits (3D-ICs), and solar cells. This included the fabrication of thin-film-based structures in a cleanroom environment, laser-based melt-mediated crystallization, and subsequent microstructural analysis. As a result, he is well-versed in thin film metrology techniques, including SEM, AFM, and electron backscatter diffraction (EBSD).

Professional Affiliations

ASM International

ASTM International, ASTM Committee A01 Steel, Stainless Steel and Related Alloys

- A01.02 Structural Steel for Bridges, Buildings, Rolling Stock, and Ships
- A01.05 Steel Reinforcement
- A01.05.01 Reinforcing Bars
- A01.09 Carbon Steel Tubular Products
- A01.22 Steel Forgings and Wrought Fittings for Piping Applications and Bolting Materials for Piping and Special Purpose Applications
- A01.22.01 Bolting

Publications

Slone C, Mostaed E, Cline C, Kaplowitz D, Ganot G, James B, Aguiar D. Copper contamination cracking in a pipeline repair weld. Journal of Failure Analysis and Prevention 2024; 24:794 — 804.

- **Selected as Best Paper of 2024 in Journal of Failure Analysis and Prevention**

Malito, L.G., Bowers, M.L., Briant, P.L., Ganot, G.S. and James, B., 2022. Fatigue Fracture of Nitinol. Journal of Failure Analysis and Prevention, 22(2), pp.441-445.

Birringer RP, Ganot GS, James BA. Failure analysis of internal fixation medical devices: Overview and case studies. Journal of Failure Analysis and Prevention 2016; 16:849-857

Ganot GS, Van der Wilt PC, Effron HK, Turk BA, Chung UJ, Chitu AM, Limanov AB, Im JS. Mechanism of twin formation in excimer-laser-induced lateral solidification of Si films. MRS Proceedings 2012, Vol.1426.

K. Omori, Ganot GS, Chung UJ, A.M Chitu, Limanov AB, Im JS. Flash-lamp-induced lateral solidification of thin Si films. MRS Proceedings 2011, Vol. 1321.

Im JS, Monica Chahal, van der Wilt PC, Chung UJ, Ganot GS, Chitu AM, Kobayashi N, Ohmori K, Limanov AB. Mixed-phase solidification of thin Si films on SiO2. J Cryst Growth 2010; 312:2775.

Book Chapters

Stewart JR, Ganot GS, Slone CE, James BA, Roepke CT. Fractography of Weldments. ASM Metals Handbook Volume 12. 2024; 441 – 449

Malito LG, Bowers ML, Briant P, Ganot GS, James B. Fractography of Nitinol. ASM Metals Handbook Volume 12. 2024; 430-440

Bowers, M, Ganot, G, Malito, L, Kondori, B, Anyanwu, E, Svedlund, F, James, B, “Failure Analysis of Medical Devices,” Analysis and Prevention of Component and Equipment Failures. ASM Handbook, Volume 11A, ASM International, 2021, p. 736 – 753

Presentations

Ganot GS, James B. Failure analysis of orthopedic implants. Materials Science & Technology 2018.

Ganot GS, Birringer RP, James B. Failure analysis of bone plates and screws. Materials Science & Technology 2014.

Ganot GS, Van der Wilt PC, Effron HK, Turk BA, Chung UJ, Chitu AM, Limanov AB, Im JS. Mechanism of twin formation in excimer-laser-induced lateral solidifcation of Si films. 2012 Spring MRS Meeting, San Francisco, CA, 2012.

Ganot GS, Chung UJ, Limanov AB, Im JS. Analysis of pulsed-laser-induced melting and solidification of high-aspect-ratio Si rods. Poster presentation, 2011 Spring MRS Meeting, San Francisco, CA 2011.

Ganot GS, Deep M, Van der Wilt PC, Chung UJ, Chitu AM, Limanov AB, Im JS. Laser crystallization of Si films for fabrication 3-D integrated circuits. 2008 Fall MRS Meeting, Boston, MA, 2008.

Project Experience

Oil & Gas, and Piping Systems

Dr. Ganot has performed dozens of failure analysis investigations of liquid and gas transmission pipelines and components, pipeline systems in petrochemical processing plants, deepwater oil drilling machinery, and other piping systems. A few examples of this work include:

- Ongoing transmission integrity management: direct cause failure analyses associated with cut-out for cause piping components for a large utility operator.
- Hydrotest failure analysis: conducted failure analyses to determine the cause of ruptured gas pipelines that occurred during hydrotesting.

- In-service rupture: Dr. Ganot has conducted several failure analyses of fatal in-service gas transmission pipeline ruptures, and participated in the reporting to NTSB and PHMSA.
- Fire at Taiwan semiconductor processing facility: analysis of pipeline and flange components that lead to a toxic gas rupture, and subsequent explosion at a semiconductor processing facility.
- Saskatchewan Oil Refinery explosion: Dr. Ganot performed a root cause investigation into the cause of a gas leak in a pipe in the oil refinery, which ultimately caused an explosion and severe property damage.
- Bank of America Building water leak: investigated the cause of a failed copper tube solder joint that resulted in extensive flooding and damage.
- Corrosion and leaks in building plumbing systems: Dr. Ganot has investigated the corrosion-induced leaking of HVAC-related plumbing systems in several residential and commercial buildings.
- Liquefied natural gas (LNG) facility: evaluated the causes of corrosion and materials degradation observed during commissioning of an LNG module in the state of Louisiana. Dr. Ganot provided testimony in this matter for an ICC Arbitration.
- Wastewater treatment plant: evaluated the non-destructive examination of welds performed in conjunction with various stainless steel pipelines, and the necessity (or lack thereof) of weld repairs at a facility in the state of Texas. Dr. Ganot testified in this matter, which was for an AAA Arbitration.

Construction and Buildings

Dr. Ganot has analyzed failures in construction equipment and building materials that have caused loss of life, property damage, and production time. A few examples include:

- Analysis of machinability of bridge steels: Construction on a bridge was allegedly proceeding slower than anticipated, and the possibility that the type of steel used on the bridge was materially different from that specified was alleged. Dr. Ganot performed a detailed machinability analysis on the various steels in question to determine the impact that various parameters such as yield strength and tensile strength had on machining operations.
- Crane investigations: Investigation into several crane failures, resulting in loss of life. In one case a personnel basket was dropped from a crane, resulting in two fatalities. The precise sequence of steps that led to the drop was established, including mechanical failures and human error. In another instance, Dr. Ganot evaluated the welds within portions of the crane to evaluate whether the welds contributed to the crane collapse.
- Reinforcing bar materials: Dr. Ganot has performed several analyses of steel reinforcing bar (rebar) and reinforcing bar splices that are often used in modern construction.
- Mechanical, electrical, plumbing (MEP) related failures: Dr. Ganot has examined various aspects of these systems in both residential and commercial buildings, including plumbing pipeline and fixture failures, water treatment procedures, and materials analysis.
- Transbay Transit Center (San Francisco, California): Dr. Ganot evaluated the cause of fracture within bottom flange of a structural tapered plate girder (TPG). The bottom flange consisted of a welded connection of two 4-inch-thick steel plates. The discovery of this fracture resulted in the closure of several major roadways and delayed the opening of the Transit Center. Dr. Ganot provided testimony in relation to this matter U.S. District Court (Northern District of California).

- Brass connectors and components: Performed failure analyses on brass cartridges used in residential sink hardware to determine the cause of fracture, among other brass components.

Sporting Goods

As an avid sports enthusiast, Dr. Ganot has a keen interest in the materials, and materials-related failures of sports equipment. A representative list of sports-related work includes the specific examples below:

- Footballs: Dr. Ganot was one of the lead authors of Exponent's technical report regarding the NFL's investigation concerning footballs used during the AFC Championship Game on January 18, 2015 (aka "Deflategate").
- Bicycles: Dr. Ganot has examined many fractured bicycles and bicycle components that have allegedly caused injury to their riders. These components include forks, frames, seat-posts, pedal cranks, bolts, and handlebars, among others.
- Fractured firearm component: fracture analysis of slide on a firearm that was alleged to have broken during use
- Exercise equipment: Dr. Ganot has evaluated the failures of in-home and commercial gym equipment including exercise bands, exercise balls, and steel cables associated with weight-lifting machines.
- Failure analysis of fractured aluminum motorcycle frame: A motorcycle that was used in a stunt show fractured adjacent to a weld, leading to alleged injury of the rider. Dr. Ganot performed an extensive fractographic and metallurgical analysis to determine the cause of fracture.

Industrial Equipment

Dr. Ganot has examined metallurgical and materials-related failures for numerous components used in industrial systems from small metal fasteners to large turbine blades. These investigations combined materials science, mechanical engineering, and engineering mechanics to determine the cause of failures. Selected examples of this work include:

- Bolts and fasteners: Dr. Ganot has examined fractures of many steel (and other) bolts and fasteners used in a wide variety of applications from automotive components to the construction of railway lines. Of particular interest in many of these investigations is the role of manufacturing technique, installation parameters (specifically pre-load) as they affect fatigue performance, and the potential for hydrogen embrittlement in high strength bolts.
- Turbine engines and other rotating machinery: Evaluated the fracture and failure mechanism of blades used in turbine engines typically utilized in power plants. The investigations often center around potential design or manufacturing issues associated with the turbine systems and materials.
- Weld analysis for structural supports system: Performed a weld analysis on truss support system used to hold a surveillance tower. Finite element analysis (FEA) in conjunction with a review of the relevant OSHA standards was performed to analyze various loading conditions.
- Fire sprinklers: Dr. Ganot has evaluated failures associated with unintended activations of various types of fire sprinklers. These include the metallurgical issues associated with fusible link sprinklers, and the cause of failure and time to fracture of glass bulbs used as triggering elements.

- Elevator winch shaft: Performed a fractographic analysis on a 6-inch diameter fractured winch shaft that caused an elevator incident. A large fatigue crack initiated and propagated, caused by excessive loads due to misalignment of the shaft axis.
- Pressure vessels: Dr. Ganot has performed failure analysis on a variety of failed pressured vessels that have resulted in injury/loss of life and/or property damage. These include water heater expansion tanks, fire suppression equipment, boilers, and other industrial pressure vessels.
- Ball bearings and races: Performed failure analysis on many ball bearing and related components, used in industrial machinery, automotive, and aviation components.
- Industrial gas valve: Failure analysis of an allegedly leaking valve used on a chlorine gas cylinder, that allowed the release of chlorine gas.
- School bus leaf spring analysis: Dr. Ganot performed a failure analysis of leaf springs that were fracturing in school buses. This work involved laboratory-based metallurgical analyses and field inspections of fleets of school buses. Dr. Ganot presented the findings of this work to NHTSA.

Medical Devices

Dr. Ganot has performed failure analyses of many medical devices. He has also assisted medical device manufacturers with the engineering analysis associated with relevant regulatory bodies. Selected examples include:

- Orthopedic implants: Dr. Ganot has analyzed fractures on dozens of various orthopedic devices, including artificial hips and knees, bone plates, screws, and other various prostheses.
- Needles: Conducted metallurgical analyses on surface and mechanical properties of needles and hypotubes, as well as examined the effect of manufacturing and processing on resultant properties. Dr. Ganot has also evaluated the mechanics of skin puncture forces associated with various needles.
- Catheters: Dr. Ganot has helped manufacturers develop catheters before they are brought to market, as well as analyze post-market failures.
- Surgical tools: Evaluated fractured orthopedic surgical tools that have failed during use and helped manufacturers design and test surgical tools used in prostate surgery. Dr. Ganot has also performed failure analyses on medical lasers and associated laser/optics systems.

Consumer Electronics and Consumer Products

Dr. Ganot has conducted failures analyses of consumer electronics and consumer products for both industrial and legal clients. Examples of these investigations include:

- Consumer electronics: Dr. Ganot has analyzed a multitude of display-related fractures (in both glass and other brittle materials) in various consumer electronics devices. He has also analyzed failures associated with various microelectronics components such as solder balls, MEMs devices, and thin film transistors. Selected additional examples are provided below.
- Consumer products: Dr. Ganot has performed failure analyses on a wide variety of consumer products such as toaster ovens, garden tools, teapots and tea kettles, washing machines, coffee makers, stovetops and ovens, chainsaws, sports water bottles, patio furniture, and aerosol cans, among others. Selected additional examples are provided below.

- Solar cells: Performed a microstructural evaluation of the material stack up of solar cells in relation to a potential IP-infringement matter. This work involved transmission electron microscopy (TEM), SEM, ToF-SIMS, and other materials characterization techniques.
- Solar panel junction boxes: Evaluated solder joints that were cracking due to excessive current flowing through the joint. Dr. Ganot's work involved re-creation testing of exemplar junction boxes to re-produce the failures, microstructural analysis, and mechanical testing.
- Electronic mobile payment devices: Dr. Ganot evaluated the internal corrosion of the microelectronics associated with table-top mobile payment devices at restaurants. It was determined that cleaning chemicals caused corrosion within the interior of the device, which resulted in electrical shorts. This work was in association with an ICC Arbitration.
- Flexible water hoses: Dr. Ganot has evaluated the fracture of flexible stainless steel water hoses (e.g., the type used in residential applications connecting the water supply to toilets and sinks). In several cases, stress corrosion cracking caused degradation of the stainless steel sheath, leading to ultimate fracture of the line.

Glass and Ceramics

Dr. Ganot has examined dozens of fractured glass and ceramic components to determine the cause of failure. Specific examples include:

- Consumer glassware: Glass tea infusers, glass coffee pots, glass French presses, drinking glasses, beer and drinking bottles, and other similar products.
- Displays in consumer electronics (see above): Analyzed the failure of numerous LCD and OLED displays in laptops, smartphones, tablets, and other electronic devices. Tested glass strength and helped device manufactures reduce field failures.
- Architectural glazing: Dr. Ganot has investigated fractures of decorative building glass, large security windows for industrial applications, and other architecturally related glazing. Investigated instances of fogging and other malfunctions in insulated glass units (IGUs).
- Ballistic glass: Analyzed performance issues associated with NIJ-rated glass panels for use in military and police force applications. Investigated compliance with relevant codes and advised the manufacturers on test protocols as well as manufacturing methods.
- Glass used in solar panels: Identified causes of fracture in solar panel glass and assessed the likelihood of damage caused by hail of various sizes and velocities.
- Sprinkler glass bulbs: See above.
- Automotive glass: Analyzed alleged excessive fractures in windshields and panoramic sunroofs.
- Shower doors and enclosures: Investigated the cause of alleged spontaneous failure of shower enclosures.