



Exponent[®]
Engineering & Scientific Consulting

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Professional Profile

Dr. Ganot specializes in failure analysis and failure prevention of engineered components and systems. His specific expertise includes metallurgy, materials science, fracture/fractography, and design.

Dr. Ganot has leveraged this expertise on numerous failure analysis investigations relating to metal and material failures in a wide variety of industries and components. These include: oil and gas, industrial machinery and equipment, building and construction, automotive, commercial and residential plumbing, medical devices, consumer electronics/products, and sporting goods. As a Certified Welding Inspector, he also has analyzed failed welds both large and small that are associated with components in these industries. A common theme among Dr. Ganot's work is the use of fractography, microscopy, metallurgical analyses, and mechanical testing techniques to identify the root cause of a failure. He also applies a multi-disciplinary approach to solving unique and complex problems by utilizing Exponent's broad and deep expertise in other practice areas. He has extensive processing, microstructural, and property development expertise. Dr. Ganot has conducted many failure analyses utilizing optical and scanning electron microscopy, computed tomography (CT), metallurgical analyses, microhardness, nanoindentation, analytical modeling, and novel mechanical testing techniques.

Prior to joining Exponent, he was 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. He is well-versed in thin film metrology techniques, including SEM, AFM, and electron backscatter diffraction (EBSD).

Academic Credentials & Professional Honors

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

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

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

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

2013 Graduate Student Life Award, Columbia University

Licenses and Certifications

Licensed Metallurgical Engineer, California, #MT1981

Licensed Professional Engineer, New York, #096866

Certified Welding Inspector (CWI), American Welding Society, #16020161

Publications

Birringner 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, Efron 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.

Presentations

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

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

Ganot GS, Van der Wilt PC, Efron HK, Turk BA, Chung UJ, Chitu AM, Limanov AB, Im JS. Mechanism of twin formation in excimer-laser-induced lateral solidification 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

Medical Devices

Dr. Ganot has performed failure analyses of dozens of medical devices. He has also assisted medical device manufacturers with engineering analysis associated with the relevant regulatory bodies. Some selected examples of medical device investigations are as follows:

- 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: has 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. He 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-release failures.

- Surgical tools: has evaluated fractured orthopedic surgical tools that have failed during use, and has also helped manufacturers design and test surgical tools used in prostate surgery. Dr. Ganot has also performed failure analyses on medical lasers and the associated laser/optics systems.

Oil & Gas, and Piping Systems

Dr. Ganot has performed hundreds of dozens 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 are:

- 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 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 building.

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 his sports-related work is 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.

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 physics to determine the cause of failures. A sample of this work follows.

- 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: has 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 also 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 had initiated and propagated, which was 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.

Construction and Building

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

- 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 investigation: investigation into a crane failure, which caused loss of life. 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.
- 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.

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 are listed below.

- Consumer electronics: Dr. Ganot has analyzed a multitude of display-related fractures (in both glass and other brittle materials) found 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.
- 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.

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, drinking glasses, beer and other other 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 manufactures on test protocols as well as manufacturing methods.
- Sprinkler glass bulbs (see above)
- Automotive glass: analyzed alleged excessive fractures in windshields and panoramic sunroofs.
- Shower enclosures: investigated the cause of alleged spontaneous failure of shower enclosures