Gaurav Nagalia

MS
Senior Consultant

Mr. Nagalia is a senior consultant and failure analysis investigator specializing in polymer engineering, applying forensic methodologies to systematically analyze and resolve failures in plastic and elastomeric components, coatings, adhesives, and composite systems. His investigative approach identifies failure modes, diagnoses root causes, and provides data-driven recommendations to enhance material performance and reliability.

He conducts service life assessments and chemical interaction studies, evaluating how polymers degrade under mechanical, thermal, chemical, and environmental stressors. With expertise in material chemistry and processing techniques, he applies ASTM and ISO standards alongside advanced characterization methods including FTIR, DSC, TGA, and SEM-EDS to analyze polymer composition, degradation behavior, and failure mechanisms.

Mr. Nagalia's forensic expertise serves manufacturers, insurance claims, and litigation matters involving product liability, personal injury, and patent infringement cases. As an active member of ASM International and the Society of Plastics Engineers (SPE), he contributes to ASM Handbooks, presents at technical conferences, serves as a member of the Failure Analysis Society (FAS) programming committee, chairs the polymer session during IMAT technical conference, and serves as a Board Member of the SPE Chicago Section.

Education

MS, Materials Science & Engineering. University of Texas. 2014

BE, Polymer Engineering. University of Pune. 2012

Positions Held

Engineering Systems Inc., Aurora, Illinois

- Senior Consultant, 2026–Present
- Senior Staff Consultant, 2018–2025

Don Bosco Technical Institute, Rosemead, California

- Materials Science Instructor, 2016–2018

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Areas of Specialization

- Root Cause Investigation
- Failure Analysis
- Laboratory Examination
- Material Characterization
- Fractography
- Mechanical Testing
- Non-destructive Testing
- Performance Testing
- Chemical Compatibility Testing
- Service Life Assessment
- Service Life Prediction
- Product Design
- Product Development
- Material Selection
- Specialty Materials Analysis-Coatings, Adhesives, Textiles

UNG Inc., Valparaiso, Indiana

- R&D Materials Engineer, 2015–2016

University of Texas, Arlington, Texas

- Graduate Research Assistant, 2012–2015

DSM, Pune, Maharashtra

- Plastics Engineer Intern, 2011

Continuing Education

- **Annual Technical Conferences** – ASM International IMAT and SPE ANTEC, 2019–Present
- **Principles of Failure Analysis** – ASM International, November 2021
- **Root Cause Analysis** – J.E. Lincoln and Associates LLC, November 2020

Professional Affiliations/Honors

American Society of Materials International (ASM International)

- Co-chair, FAS Programming Committee, IMAT 2023–Present
- Author, ASM Handbook Volume 11B Chapter Article, 2022
- Member, Failure Analysis Society (FAS), 2022–Present

Society of Plastics Engineers (SPE)

- Board of Directors, SPE Chicago Section, 2021–Present
- Member, Product Design and Development Division (PD3), 2018–Present

Association for Materials Protection and Performance (AMPP)

- Member, 2025 – Present

American Society for Testing and Materials International (ASTM International)

- Member, Committee C14 – Glass and Glass Products, 2021–Present
- Member, Committee D17 – Plastic Piping Systems, 2019–Present
- Member, Committee D20 – Plastics, 2019–Present

Project Experience

Investigations

Aerosol Can Failure Investigation

A newly purchased aerosol can, containing a multi-surface cleaner, was being utilized in a kitchen of a home residence when it slipped and fell on a carpeted floor causing the can to ricochet around before hitting and causing injury to plaintiff. The investigation involved conducting a non-destructive examination of the subject, testing of exemplar cans, performing comparative computed tomography (CT) scanning, and review of relevant technical literature. From this investigation, it was determined the subject can have a manufacturing defect that resulted in the failure incident. This defect was observed to be an insufficient crimp between the valve component and the can body resulting in separation of these components during impact and release of propellant and product cleaning mixture turning the can into a projectile with sufficient kinetic energy to do harm. This analysis was utilized by counsel to successfully settle and resolve the legal matter that had arisen consequently.

Spray Foam Insulation Investigation

Residential home construction was halted during installation of spray foam (SPF) insulation due to allegations of high levels of volatile organic compounds (VOCs) being released from the SPF causing an unsafe environment. This matter was investigated to provide the client with technical assistance. As part of this investigation, conducted review of file material related to the construction, review of applicable engineering standards, review of product data sheets, conducted a forensic examination which included an on-site inspection, testing of the air sampled from the interior of the incomplete residential construction site as well as testing of SPF sampled during the on-site inspection. Based on this investigation, no evidence of improper installation of SPF in the subject residence was identified. While there were some VOCs identified from the foam samples, they were none found in the air samples collected. The foam was determined to be a polyurethane material and from characterization data, it was determined to be fully cured and free of defects.

Polymer Clothing Laboratory Examination

An alleged rail car impact was claimed to be a cause of a fatality. In support of this claim, counsel for the deceased provided opinions based on photographs of deceased clothing. An investigation was launched and as a part of it, a laboratory examination of the subject clothing including a nylon safety vest as well as review of relevant technical literature was conducted. The examination involved visual examination for macro-observations, stereomicroscopy of areas of interest as well as the fibers, yarns and weave formed by the intertwining fiber yarns in the subject clothing, and chemical analysis of fibers, and residues located on subject clothing using FTIR. The analysis of data obtained from this examination found there was no evidence of blunt force damage on the subject clothing to support the claims that were made and thus, there was no merit to the opinions offered by the opposing counsel. The analysis of the subject polymer clothing was a major part of the investigation and led to successful settlement and resolution to the litigation matter.

Failure Analysis

Medical Device Failure Analysis

A health care testing manufacturing company was having quality issues due to imperfections such as surface cracking developing in a manufactured component used in COVID-19 PCR Rapid test equipment during early stages of COVID pandemic in 2021 halting production and causing a backlog of inventory resulting in a loss of over hundred thousand dollars daily. These cassettes were made of injection molded polystyrene having a biaxial oriented polystyrene (BOPS) film welded on the outer surface. Failure analysis conducted included visual examination and polymer characterization of multiple cassettes. Based on the analysis, it was concluded that the cracking was illusionary and due to wrinkling in the film layer attributed to welding process issues, but cassette body remained intact and free of defects. This analysis helped the client navigate the production quality issues and make crucial decisions to improve their welding process and resume production.

60-Inch HDPE Pipe Failure Analysis

Failure in the form of both circumferential and longitudinally oriented cracking of subsurface storm water drainage pipelines made of high-density polyethylene (HDPE) having corrugations on the outside surface and having an internal diameter of 60 inches resulted in collapse of surface roads leading to investigation and remediation efforts. Analysis of sections of the failed pipes was conducted to assist with this investigation. From this analysis, material degradation or embrittlement of the HDPE material due to chemical attack or UV exposure was ruled out. The failure in the pipe sections was concluded to be a result of corrugations being stressed due to long-term mechanical loading resulting in circumferential cracking. The loading got transferred onto thin walled inside liner component, stressing the liner resulting in buckling and eventual failure from slow crack growth failure mechanism.

Chemical Transfer Hose Failure Analysis

A composite chemical transfer hose that was being used daily for approximately 10 months had failed in service due to a tear developing through the wall at the outlet end, resulting in a chemical leak. Failure analysis of this subject hose included conducting a visual examination, stereomicroscopy, fractography, material characterization, review of product literature, and a review of installation and assembly guidelines. The root cause of the failure was determined to be a consequence of installation-related practices leading to the development of higher-than-expected stress within the hose wall consistently over regular intervals of time for a period of ten months. This analysis enabled the client to take immediate action and correct installation practices and provide appropriate training to users.

Viton Gasket Hose Failure Analysis

A full-face Viton fluorocarbon gasket that was part of a rail tank car manway system fitting plate assembly was failing resulting in leakage of hydrochloric (HCl) fumes that the tank car was transporting. The failure analysis involved conducting material characterization, mechanical testing, a stress analysis to determine the appropriate torque values for bolting the gasket to fitting plate, and review of investigative reports by other parties. Based on this analysis, the main leak site was identified to be located at a crack in the Ultra-high molecular weight polyethylene (UHMWPE) liner at a weld fusion joint. It was concluded that weep channels within the fitting plate acted as passages for the leaking HCl fumes causing continuous chlorine exposure

resulting in surface degradation and wear deformation of the Viton gasket. This analysis enabled the client to take immediate action and redirect efforts in addressing the main failure.

Material Selection

Mini Cooler Material Selection

During a six-month timeframe, assisted an industrial client in conducting material selection of phase change materials (PCMs) as part of product development of a mini cooler product designed to be used for holding biological samples at specific cryogenic temperatures and protect from temperature fluctuations. Multiple phases involved conducting material characterization of competitor products and systems, physical testing of sub-components, conducting literature research on PCMs, conducting material, thermodynamics, and heat transfer analysis, conducting a market survey to locate vendors with comparable PCMs in the North America marketplace, and building and conducting performance testing on protypes with candidate PCMs. This overall analysis resulted in selection of appropriate materials providing optimized performance for the intended application supported by scientific test data.

Publications

"Systematic Investigation of Elastomeric Gasket Failures: Three Case Studies Demonstrating Diverse Root Causes and Prevention Strategies", **G. Nagalia**, G. J. Novak, L. M. Ginsberg, Journal of Failure Analysis and Prevention, 1805–1819 (2026). https://doi.org/10.1007/s11668-026-02460-3, May 2026

"A Study of CPVC Fire Suppression Sprinkler Pipe Chemical Compatibility with Common Plasticizers Found in Wires and Cables," A.R. Shah, E.D. Bain, and **G. Nagalia**, Society of Plastics Engineers ANTEC® 2025 Conference Proceedings, Philadelphia, PA, March 2025.

"Micrographs of Polycarbonate Fracture Morphology at -20°C and Room Temperature (Digital Stereomicroscopy and SEM Images)". A.R. Shah, **G. Nagalia**, J.P. Sommer, M.S. Ebert, In ASM Handbook Volume 12A: Atlas of Fractographs, ASM International, 2025; https://doi.org/10.31399/asm.hb.v12a.9781627085007, February 2025

"Wear Failures of Plastics," **G. Nagalia**, ASM Handbook, Characterization and Failure Analysis, ASM International, Vol. 11B, https://doi.org/10.31399/asm.hb.v11B.a0006850, February 2022

"Failure Analysis of Products with Plastic to Metal Threaded Connections," **G. Nagalia**, A.R. Shah, Society of Plastics Engineers, ANTEC® 2021: The Virtual Edition Conference Proceedings, May 2021

"Failure Analysis of Polymer Coating Systems," **G. Nagalia**, A.R. Shah, D.B. Edwards, Society of Plastics Engineers, ANTEC® 2020: The Virtual Edition Conference Proceedings, Mar 2020

"Compressive Strength and Microstructural Properties of Fly Ash- Based Geopolymer Ceramic Composite," **G. Nagalia**, Y. Park, A. Abolmaali, and P. Aswath, Journal of Materials in Civil Engineering, Vol28, Issue 12, https://doi.org/10.1061/(ASCE)MT.1943-5533.0001656, December 2016.

Presentations

“The Alcohol Wipe Test as a Non-Destructive Inspection Technique**”**, J.R. Babcock, E.E. Wright, **G. Nagalia**, ASM International IMAT 2026, Québec City, Canada, September 2026

"Refuting Plaintiff's Theories through Competent Forensic Investigation," **G. Nagalia**, Illinois Defense Counsel (IDC) Webinar, Illinois Defense Counsel, August 5, 2026.

“Failure Analysis Insights from IMAT 2025: Environmental Stress Cracking & Elastomeric Gasket Failures”, **G. Nagalia**, Panelist at ASM International Failure Analysis Society Webinar, March 11, 2026. (Co-presented with Dr. Stefanie Liffland, Exponent)

“Gas Distribution System Polymer Component Investigation Case Studies”, **G. Nagalia**, Nicor Gas Public Utilities Meeting, ESi-Aurora, January 2026

“Decoding Elastomeric Gasket Failures Across Industrial Applications: A Multi-Case Study Investigation”, **G. Nagalia**, ASM International IMAT 2025, Detroit, MI, October 2025

“A Study of CPVC Fire Suppression Sprinkler Pipe Chemical Compatibility with Common Plasticizers Found in Wires and Cables,” A.R. Shah, E.D. Bain, and **G. Nagalia**, Society of Plastics Engineers ANTEC® 2025, Philadelphia, PA, March 2025.

“Polymer Composite Ladder Failure Analysis” **G. Nagalia**, Werner Co. Counsel Meeting, ESi-Aurora, March 2025

“Importance of Standard Test Methods in Investigations of FRP Composite Ladders,” **G. Nagalia**, A.R. Shah, E.H. Knox, and P.D. Umberger, ASM International IMAT 2024, Cleveland, OH, September 2024.

“Characterization of Over 50-Year-Old Polyethylene Natural Gas Distribution Pipe,” J.R. Babcock, M.E Weiss, and **G. Nagalia**, ASM International IMAT 2024, Cleveland, OH, September 2024.

“Plastic Failure Analysis and Material Selection,” **G. Nagalia**, College of Fine & Applied Arts, University of Illinois Urbana-Champaign, Champaign, IL, March 2024.

“Failure Analysis of TPU Gaskets used in Hydraulic Fluid Systems,” **G. Nagalia**, L.N. Meissner, J.R. Babcock, A.R. Shah, ASM International IMAT 2023, Detroit, MI, October 2023.

“Failure Analysis of Spray Polyurethane Foam (SPF) Insulation,” J.R. Babcock, M.E. Weiss, and **G. Nagalia**, ASM International IMAT 2023, Detroit, MI, October 2023.

“Failure Investigation of a Nickel-Metal Hydride Battery Cell,” B.M. May, J.G. Jordan, L.M. Marsh, M.A. Lewis, and **G. Nagalia**, ASM International IMAT 2023, Detroit, MI, October 2023.

“Failure of Plastic Components Caused by Response to COVID-19 Pandemic,” **G. Nagalia**, ASM Minnesota Chapter Meeting, Minneapolis, MN, November 2022.

“Failure of Plastic Components Caused by Response to COVID-19 Pandemic,” **G. Nagalia**, E.D. Bain, and A.R. Shah, ASM International IMAT 2022, New Orleans, LA, September 2022.

“Identification of Mixed In-Service Automotive Fluids Inside a CVT and Differentials,” E.J. Manuel, and **G. Nagalia**, ASM International IMAT 2022, New Orleans, LA, September 2022.

“Failure Analysis of Products with Plastic to Metal Threaded Connections,” **G. Nagalia** and A.R. Shah, Society of Plastics Engineers, ANTEC® 2021: The Virtual Edition, May 2021.

“Failure Analysis of Polymer Coating Systems,” **G. Nagalia**, A.R. Shah, and D.B. Edwards, Society of Plastics Engineers, ANTEC® 2020: The Virtual Edition, March 2020.

“Development and Analysis of Fly Ash Based Geopolymer Concrete,” **G. Nagalia** and P. Aswath, ASM North Texas Annual Conference, Houston, TX, November 2013.