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Engineering & Scientific Consulting

Steven MacLean, Ph.D., P.E.

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Professional Profile

Dr. MacLean is the Practice Director and a Principal of Exponent's Polymers and Chemistry Practice. His research is focused on the chemical and physical behavior of polymeric materials in end-use applications, with an emphasis on load-bearing components and structures. Dr. MacLean's specialties include part design and analysis, failure analysis, material selection and specification, formulation-structure-property relationships, testing, product development, and material technology assessments. He has studied various polymer failure mechanisms including stress overload, creep rupture, fatigue, environmental stress cracking, delamination and weathering. Throughout his career he has evaluated the suitability of materials for the automotive, sporting goods, medical and drug delivery device, consumer products, oil and gas, electrical, pipe, and construction industries. Dr. MacLean assists clients in assessing risk in all stages of product life including product qualification, reliability testing, quality control, and long-term field performance.

Dr. MacLean is well versed in product recall investigations led by the Consumer Product Safety Commission (CPSC), the National Highway Traffic Safety Administration (NHTSA) and the National Transportation Safety Board (NTSB). He is familiar with the processes of each federal agency regarding the investigation, analysis, and remedies of underperforming products and components. Dr. MacLean is also familiar with testing and material standards published by ASTM International, International Standards Organization (ISO), Underwriters Laboratories (UL), International Electrotechnical Commission (IEC) and the Society of Automotive Engineers (SAE) and others.

Over the past 30 years, Dr. MacLean has worked on a variety of finished goods produced from polymer and composite manufacturing processes including injection molding, compression molding, blow molding, blown film, rotational molding, extrusion, fiber spinning, thermoforming, calendaring, and laminating. In addition, he has investigated material systems which include secondary operations such as metallic plating, coatings, adhesives, paints and welding and conveyed his findings to entities including technical decision makers, government regulators, arbitrators and juries.

Dr. MacLean has extensive experience in intellectual property matters, specializing in patent infringement and validity assessments as well as trade secret and inventorship disputes. He also routinely assists clients with claim construction and Markman hearing preparation for complex IP matters. Dr. MacLean has provided testimony across a wide range of venues, including federal district courts, international arbitration panels, the International Trade Commission (ITC), and the Patent Trial and Appeal Board (PTAB).

Prior to joining Exponent, Dr. MacLean worked in industry at General Electric Aerospace, General Electric Plastics and SABIC where he held several technical and leadership positions of increasing responsibility. His responsibilities included product development, material formulation, processing and selection, testing for high-demand applications, product safety and compliance assessments, failure analysis, and intellectual property analysis.

Academic Credentials & Professional Honors

Ph.D., Materials Science, University of Rochester, 2007

M.S., Materials Science and Engineering, Rochester Institute of Technology, 2001

M.E., Mechanical Engineering, Rensselaer Polytechnic Institute, 1997

B.S., Mechanical Engineering, Rensselaer Polytechnic Institute, 1993

Tau Beta Pi

Pi Tau Sigma

Society of Plastics Engineers ANTEC Best Paper Award

Licenses and Certifications

Professional Engineer Mechanical, Arizona, #80192

Professional Engineer, Maryland, #41592

Professional Engineer, New York, #79001

Professional Engineer, Pennsylvania, #PE097089

Six Sigma Black Belt Certification (CSSBB)

Academic Appointments

Worcester Polytechnic Institute Department of Mechanical & Materials Engineering, Adjunct Professor, 2025

Prior Experience

Director, Global Agency Relations & Product Safety, SABIC Innovative Plastics, 2007-2011

Global Technical Manager, General Electric Plastics, 2003-2007

Six Sigma Black Belt, General Electric Plastics, 2001-2003

Senior Application Development Engineer, General Electric Plastics, 1998-2001

Plastic Design and Analysis Leader, General Electric Plastics, 1996-1998

Edison Engineer, Lockheed Martin Corporation, (Formerly General Electric Aerospace), 1994-1996

Professional Affiliations

Society of Plastics Engineers (SPE) Senior Member

SPE Medical Plastics Division Member

ASTM D20 Plastics Committee Member

Plastic Pipe Institute (PPI) Member

Publications

Vytiniotis A, MacLean S, Sykora, D. Laboratory testing and engineering analysis of an underground stormwater detention system. Proceedings, Geo-Congress, 2020.

Lyons C, Farzana A, MacLean S, Siskey R, Donthu, S. Environmental stress cracking failure of amorphous polymer materials. Society of Plastics Engineers - ANTEC, March 2019.

Ansari F, Lyons C, MacLean S, Siskey R, Donthu, S. Mechanical characterization and fractography of PC, ABS and PMMA - a comparison of tensile, impact and ESC fracture surfaces. Society of Plastics Engineers - ANTEC, May 2017.

Benight S, MacLean S, Garcia M, Moll, J. Microscopy of intentionally oxidized polypropylene-based mesh material. Society of Plastics Engineers - ANTEC, May 2016.

MacLean S, Lee C, Ledwith P, Moll J. Fractographic examination and tensile property evaluation of 3D printed acrylonitrile butadiene styrene (ABS). Society of Plastics Engineers - ANTEC, March 2015.

MacLean S, et al. Comparison of mass transit material flammability requirements and trends for aircraft and train applications in Europe and North America. Proceedings, Society of Plastics Engineers - ANTEC, April 2012.

MacLean S, et al. Comparison of mass transit material flammability requirements and trends for aircraft and train applications in Europe and North America. Proceedings, EUROTEC, 2011.

MacLean S, et al. Root cause investigation of cracked polycarbonate blender jars. Society of Plastics Engineers - ANTEC, May 2010.

MacLean S. Plastics, electronics and the environment: How new global regulations affect material choices. Kunststoffe International, September 2008,; 97-100.

MacLean S. Plastics, electronics and the environment: How new global regulations affect material choices. Telepati Aylik Telekom, March 2008; 74-77.

MacLean S, et al. Monolayer barrier for small engine fuel tanks. Plastics Technology Online June 2007.

MacLean S. Environmental effects of poly(phenylene ether) blends due to long-term exposure to potable hot water. Ph.D. Dissertation, University of Rochester, 2007.

Case R, Korzen A, MacLean S. The effects of recycling and heat history for select high polymers. Society of Plastics Engineers - ANTEC, May 2001.

Adedeji A, MacLean S, Torrey B, Baccaro L, Zuber P. Poly(phenylene ether) engineering thermoplastic provides creep resistance, toughness and fire resistance required for high performance pallets. Society of Plastics Engineers – ANTEC, May 2000.

Presentations

Budiansky A, MacLean S, Jing B, Fox R, Kreder M, Moll J. Microtomy of Extra-Large Polymer Samples. International Applications & Technologies Conference and Exposition – IMAT, October 2023.

Vytiniotis, A, MacLean, SB. Buried Plastic Reservoirs and Tanks - Out of Sight; But Are They Out of Mind? American Society of Civil Engineers, Continuing education for licensed professional engineers,

2018.

MacLean S, Moll J. The importance of polymer structure-property relationships in preventing failure in medical devices. Medical Grade Polymers Conference, Woburn, MA, 2015.

MacLean S. Fundamentals of plastics fractography. ANTEC, Cincinnati, OH, 2013.

MacLean S. Challenges associated with replacing metal with plastic. Material Science and Technology Conference, Pittsburgh, PA, 2012.

MacLean S, et al. Fractography of unfilled thermoplastic materials subjected to common mechanical failure modes. Material Science and Technology Conference, Pittsburgh, PA, 2012.

MacLean S. Common analytical techniques for failure analysis - A Resin Manufacturer's Perspective. ANTEC, Boston, MA, 2011.

MacLean S, et al. Plastic failure analysis and prevention expert panel. ANTEC, Boston, MA, 2011.

MacLean S. Root cause investigation of cracked polycarbonate blender jars. ANTEC, Orlando, FL, 2010.

MacLean S. Diffusion of potable hot water in poly(phenylene ether) blends. American Chemical Society Conference, Binghamton, NY, 2006.

MacLean S. Changes in polycarbonate and ABS mechanical properties due to multiple heat histories. Society of Plastics Engineers ANTEC, Dallas, TX, 2001 (with Korzen).

MacLean S. Yield Improvement for gas assist panels using statistical methods. Society for the Plastics Industry Conference, Vancouver, BC, 2000.

MacLean S. Design methodologies for metal to plastic conversion. General Electric Plastics Innovation Seminar, Columbus OH, 2000.

MacLean S. Fundamentals of polymer science. General Electric Plastics Customer Design Workshop, Pittsfield, MA, 1998, 1999.

MacLean S. Designing for injection molded parts. General Electric Plastics Customer Design Workshop, Pittsfield, MA, 1998, 1999.

MacLean S. Mechanical behavior of polymeric materials. General Electric Plastics Engineering Workshop, Pittsfield, MA, 1997.

