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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 Polymer Science and Materials Chemistry Practice. His research is focused on the chemical and physical behavior of polymeric materials in end-use applications.

Dr. MacLean's specialties include part design and analysis, failure analysis, material specification, formulation-structure-property relationships, testing, as well as patent and trade secret analysis. 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 development, reliability testing 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).

Over the past 25 years, Dr. MacLean has worked on a variety finished goods produced from polymer and composite manufacturing processes including injection molding, compression molding, blow molding, blown film, rotational molding, extrusion, fiber spinning, thermoforming, calendering, and laminating. In addition, he has investigated material systems which include secondary operations such as metallic plating, coatings, adhesives, paints and welding.

Prior to joining Exponent, Dr. MacLean spent 16 years in the polymer manufacturing industry at General Electric (GE) Plastics and SABIC where he held several technical and leadership positions of increasing responsibility. His responsibilities included material development, processing and selection, testing for high-demand applications, product safety 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

Six Sigma Black Belt Certification (CSSBB)

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 (Senior Member)

SPE Failure Analysis & Prevention Group - Board Member and Treasurer

ASTM D20 Plastics Committee Member

Plastic Pipe Institute (PPI) Member

Publications

Vytiniotis A, MacLean, 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. Proceedings, ANTEC, 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. Proceedings, ANTEC,

2017.

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

MacLean SB, et al. Fractographic examination and tensile property evaluation of 3D printed acrylonitrile butadiene styrene (ABS). Proceedings, ANTEC, 2015.

MacLean SB, et al. Fractographic examination of failures in polycarbonate and polyoxymethylene due to impact, tensile, fatigue and creep mechanisms. Proceedings, ANTEC, 2013.

MacLean SB, et al. Comparison of mass transit material flammability requirements and trends for aircraft and train applications in Europe and North America. Proceedings, ANTEC, 2012.

MacLean SB, 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 SB, et al. Root cause investigation of cracked polycarbonate blender jars. Proceedings, ANTEC, 2010.

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

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

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

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

MacLean SB, et al. The effects of recycling and heat history for select high polymers. Proceedings, ANTEC 2001.

MacLean SB, et al. Poly(phenylene ether) engineering thermoplastic provides creep resistance, toughness and fire resistance required for high performance pallets. Proceedings, ANTEC 2000.

Presentations

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

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

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

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

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

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

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

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

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

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

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

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

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

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

