Exponent®
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Manuel Garcia-Leiner, Ph.D.

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Professional Profile

Dr. Garcia-Leiner's research and professional interests include structure-property relationships and processing of polymeric systems. Dr. Garcia-Leiner has extensive experience in the development, formulation, scale-up, quality testing and large-scale industrial manufacturing of polymer/plastics. He has assisted clients in all stages of product life from product development, to end-use evaluation and long-term field performance. Dr. Garcia-Leiner has extensive practical experience in traditional polymer processing applications such as extrusion, co-extrusion, injection molding, compression molding, blow molding, rotational molding, fiber spinning and thermoforming. In addition, his experience includes novel processing techniques including additive manufacturing/3D printing, high performance composites processing (thermoplastics and thermosets) as well as development, formulation and processing of polymeric systems with unique properties for various applications.

During his career, Dr. Garcia-Leiner has evaluated, developed, and patented industrial materials used for building and construction, electronics and displays, food packaging, biomedical, aerospace, oil and gas, tire and rubber, modified asphalt, point of purchase, signs, sports technology, and alternative energy technologies such as wind and photovoltaic applications.

Dr. Garcia-Leiner has also assisted several clients as a testifying expert in litigation and international arbitration matters in areas related to polymers, plastics, rubbers and elastomers, and their use in multiple applications and technologies.

Prior to joining Exponent, Dr. Garcia-Leiner spent almost a decade in the plastics industry at Arkema where he held several R&D positions among various business units. His areas of focus included the development, scale-up, life service prediction, manufacturing, and commercialization of acrylic systems for light management applications and novel multi-layer screen composite systems. During his industrial career, Dr. Garcia-Leiner held team leadership positions of increased responsibility in the areas of polymer rheology, fluoropolymers, thermoplastic elastomers, as well as high performance polymers including polyketones (PEEK, PEKK, PEK, PEKEKK) and their composites for high-end applications.

Dr. Garcia-Leiner’s is proficient in a variety of analytical techniques, and his academic research includes polymer nanocomposites and polymeric foams obtained via solvent assisted polymer processing, as well as the synthesis and rheological characterization of functionalized elastomers through anionic polymerization and hydrogenation techniques.

Academic Credentials & Professional Honors

Ph.D., Polymer Science and Engineering, University of Massachusetts, Amherst, 2004

M.S., Polymer Science and Engineering, University of Massachusetts, Amherst, 2000

M.Eng., Chemical Engineering–Polymers, Universidad Nacional Autónoma de México, 1999

B.S., Chemical Engineering–Polymers, Universidad Nacional Autónoma de México, 1997

National Academy of Engineering, Frontiers of Engineering, 2009

Materials Research Society (MRS), Graduate Student Award, 2003

Society of Plastics Engineers (SPE), Composites Division, PerkinElmer Scholarship Award, 2003

Fulbright Scholarship, Doctoral Studies, University of Massachusetts at Amherst 1999-2004

Universidad Nacional Autónoma de México (UNAM), Medalla Antonio Caso, Best Student-Chemical Engineering Graduate Program, 1997-1999

Academic Appointments

Drexel University, Biomedical Engineering, Invited Lecturer

Colorado State University, Chemical and Biological Engineering Department and School of Advanced Materials Discovery, Invited Lecturer

Prior Experience

Senior Research Scientist-Team Leader, Arkema, 2009-2012

Research Scientist, Arkema, 2007-2009

Scientist, Arkema, 2004-2007

Professional Affiliations

American Chemical Society—ACS (Member since 2000)

Society of Plastics Engineers—SPE (Member since 2003)

ASTM International (Member since 2013)

Languages

French (France)

Spanish

Patents

United States Patent - US 8,163,827 B2. White, Light Diffusing Thermoplastic Composition, Issued April 24, 2012 (with J. Reilly, J. Bradley, and J. Kryven)

Related International Patent Publications include:

Canadian Patent CA2629843 C, May 2013 (Granted)

European Patent EP1948726 B1, May 2012 (Granted)

United States Patent Application US2008/0242786 A1, October 2008

Mexican Patent Application MX2008006256 A, July 2008

World Patent Application (PCT) WO2007/058810 A3, August 2007

Taiwanese Patent Application TW200726809 A, July 2007

World Patent Application (PCT) WO2007/058810 A2, May 2007

United States Patent - US 8,357,744 B2. White, Light Diffusing Thermoplastic Composition, Issued January 22, 2013 (with J. Reilly, J. Bradley, and J. Kryven)

Related International Patent Publications include:

Spanish Patent ES2386976 T5, June 2016 (Granted)

European Patent Application EP1948726 B2, March 2016 (Granted)

United States Patent Application US2012/181489 A1, July 2012

United States Patent - US 8,208,204 B2. Multi-layer Screen Composites, Issued June 26, 2012 (with J. Reilly)

Related International Patent Publications include:

European Patent EP2107966 B1, June 2017 (Granted)

Chinese Patent CN101646557 B, September 2013 (Granted)

Korean Patent Application KR20160075775 A, June 2016

Korean Patent Application KR20150074013 A, July 2015

Australian Patent Application AU2008214177 B2, July 2012

Japanese Patent Application JP2010518426 T2, May 2010

Indian Patent Application IN05001DN2009 A, March 2010

United States Patent Application US20090316261 A1, December 2009

Korean Patent Application KR20090108117 A, October 2009

Mexican Patent Application MX2009008078 A1, August 2009

Taiwanese Patent Application TW200846186 A, December 2008

World Patent Application (PCT) WO2008/097733 A2, October 2008

Australian Patent Application AU2008214177 A1, August 2008

World Patent Application (PCT) WO2008/097733 A2, August 2008

United States Patent - US 9,587,107 B2, Heat Treated Polymer Powders, Issued March 7, 2017 (with

C. Bertelo, A. DeCarmine, and S. Defelice)

Related International Patent Publications include:

Japanese Patent JP6041806 B2, December 2016 (Granted)

Chinese Patent CN103140527 B, August 2015 (Granted)

United States Patent Application US2013/0323416 A1, December 2013

European Patent Application EP2627687, August 2013

Canadian Patent Application CA2812758 A1, December 2012

World Patent Application (PCT) WO2012/047613 A1, April 2012

Indian Patent Application IN02695DN2013, November 2014

United States Patent – US 10,519,309 B2, Heat Treated Polymer Powders, Issued December 31, 2019 (with C. Bertelo, A. DeCarmine, and S. Defelice)

Related International Patent Publications include:

United States Patent Application US2011/053368, Sep 2011

United States Patent Application US2017/0198134 A1, July 2017

United States Patent – US 11,046,847 B2, Heat Treated Polymer Powders, Issued June 29, 2021 (with C. Bertelo, A. DeCarmine, and S. Defelice)

Related International Patent Publications include:

United States Patent Application US2020/0109279 A1, April 2019

United States Patent US 10,087,295 B2: Films and Membranes of Poly(aryl ketones) and methods of casting the same from solution, issued October 2, 2018 (with C. Roger, J.A. Laffitte, and J. Boyer)

Related International Patent Publications include:

Japanese Patent JP6141263 B2, June 2017 (Granted)

Chinese Patent CN103562268 B, Dec 2016 (Granted)

United States Patent Application US2014/0088234 A1, March 2014

European Patent Application EP2714771, September 2014

World Patent Application (PCT) WO2012/166340 A1, December 2012

Indian Patent Application IN10049DN2013, January 2015

United States Patent US 10,563,028 B2: Films and Membranes of Poly(aryl ketones) and methods of casting the same from solution, issued February 18, 2020 (with C. Roger, J.A. Laffitte, and J. Boyer)

Related International Patent Publications include:

United States Patent Application US2012/037893 A1, May 2012

United States Patent Application US2018/0371192 A1, December 2018

United States Patent US 10,899,047 Rotomolding Processes for Poly(aryl ketones) and other high temperature polymers, issued January 26, 2021 (with B. Clay)

Related International Patent Publications include:

United States Patent Application US2015/0079378 A1, March 2015

Danish Patent DK2830845 T3, July 2018 (Granted)

Spanish Patent ES2671500 T3, June 2018 (Granted)

European Patent EP2830845 B1, April 2018 (Granted)

Canadian Patent Application CA2868460 A1, October 2013

Portuguese Patent Application PT2830845 A1, July 2018

World Patent Application (PCT) WO2013/148081 A1: October 2013

United States Patent Application US2020/0157299 A: Films and Membranes of Poly(aryl ketones) and methods of casting the same from solution, May 2020 (with C. Roger, J.A. Laffitte, and J. Boyer)

United States Patent Application US20210292544-A1: Heat Treated Polymer Powders, September 2021 (with C. Bertelo, A. DeCarmine, and S. Defelice)

United States Patent Application US2007/0072994 A1: Die-cuttable Acrylic Sheet, March 2007 (with L. Cohen, E. Grimes, R. Miller, and J. Reilly)

Related International Patent Publications include:

Canadian Patent CA2521583 C, July 2013 (Granted)

World Patent Application (PCT) WO2008/156984 A1: Use of Cyclodextrins in Controlled Architecture Polymer Synthesis, December 2008, (with F. Mehlmann, R.K. Prud'homme, M. Herrera-Alonso, and L. Fu)

Publications

Book Chapters

Garcia-Leiner M, Ghita O, McKay R, Kurtz SM, Additive Manufacturing of Polyaryletherketones in PEEK BIOMATERIALS HANDBOOK, Second Edition, Elsevier Inc. 2019.

Peer-reviewed papers

Garcia-Leiner M, Streifel B, Başgül C, MacDonald DW, Kurtz SM. Characterization of polyaryletherketone (PAEK) filaments and printed parts produced by extrusion-based additive manufacturing. Polymer International, Vol 70, Num 8, 1128-1136, August 2021. DOI 10.1002/pi.6231.

Gladman AS, Garcia-Leiner M, Sauer-Budge AF, Emerging polymeric materials in additive manufacturing for use in biomedical applications. AIMS Bioengineering, 6 (1): 1–20. DOI: 10.3934/bioeng.2019.1.1

Garcia-Leiner M. Characterization of PEEK filaments for extrusion-based AM processes. Abstracts of Papers of the American Chemical Society 2019 April; 3085096.

Garcia-Leiner M, Reitman MTF, El-Hibri MJ, Roeder RK. Structure-property relationships in commercial polyetheretherketone resins. Polymer Engineering & Science 2016. doi:10.1002/pen.24472

Xicohtencatl-Serrano H, García-Leiner M, Herrera-Nájera R. Synthesis and characterization of SBEBS with star-like shape produced by partial hydrogenation of SBS using catalysts prepared with bis(cyclopentadienyl) titanium(IV) dichloride and n-butyllithium. Polymer Engineering and Science, Published online: 20 OCT 2013, DOI: 10.1002/pen.23796.

Herrera-Alonso M, Garcia-Leiner M, McCarthy TJ, Lesser AJ. Semicrystalline polymer nanocomposites using chemically designed compatibilizers and supercritical CO2-assisted polymer processing. Abstracts of Papers of the American Chemical Society 2004 Sept; 228.

Garcia-Leiner M, Lesser AJ. Polymer nanocomposites prepared by supercritical carbon dioxide-assisted polymer processing. Abstracts of Papers of the American Chemical Society 2004 Apr; 227.

Garcia-Leiner M, Lesser AJ. CO2-assisted polymer processing: A new alternative for intractable polymers. Journal of Applied Polymer Science 2004; 93:1501-1511.

Garcia-Leiner M, Lesser AJ. Polymer nanocomposites prepared by supercritical carbon dioxide-assisted polymer processing. Polymer Preprints 2004; 45(1): 520-521.

Garcia-Leiner M, Lesser AJ. Intercalation in polymer-clay nanocomposites promoted by supercritical carbon dioxide. Abstracts of Papers of the American Chemical Society 2003 Sept; 226(389), Part 2:519-520.

Garcia-Leiner M, Lesser AJ. Polymer-clay nanocomposites prepared in supercritical carbon dioxide. Abstracts of Papers of the American Chemical Society 2003 Mar; 225(55), Part 2:668-669.

Garcia-Leiner M, Song J, Lesser AJ. Drawing of ultrahigh molecular weight polyethylene in the presence of supercritical carbon dioxide. Journal of Polymer Science Part B: Polymer Physics 2003; 41(12):1375-1383.

Garcia-Leiner M, Manero O, Herrera R. Rheological characterization and modeling of end-functionalized polybutadienes. Rheologica Acta 2003; 42(1-2):171-183.

Presentations

Garcia-Leiner M, Streifel B, Kurtz SM, MacDonald DW, and Başgül C., Characterization of polyaryletherketone (PAEK) filaments and printed parts produced by extrusion-based additive manufacturing. 2023 SPE Annual Technical Conference ANTEC, Denver, CO, March 27-30, 2023.

Garcia-Leiner M. Characterization of PEEK filaments for Fused Filament Fabrication (FFF). 4th International PEEK Meeting, Washington D.C., April 25-26, 2019.

Garcia-Leiner M. Characterization of PEEK filaments for extrusion-based AM processes. ACS Spring 2019 National Meeting, Division of Polymer Chemistry, General Topics: New Synthesis & Characterization of Polymers, Orlando, FL March 31-April 3, 2019.

Garcia-Leiner M. Understanding Structure and Property of PAEK Polymers and Their Application in Additive Manufacturing Processes. ACS Fall 2018 National Meeting, Division of Polymer Chemistry,

Industrial Innovations in Polymer Science Symposium, Boston, MA August 19-23, 2018.

Garcia-Leiner M. Poly(aryletherketone) (PAEK) polymers in additive manufacturing: understanding process, structure and property. 3rd International PEEK Meeting, Washington D.C., April 27-28, 2017.

Garcia-Leiner M. Understanding structure and property of high performance polymers in additive manufacturing processes. Materials Research Society (MRS) Fall Meeting and Exhibit, Science-Enabled Advances in Materials- and Manufacturing-Technologies (PM3) symposium, Boston, MA, November 27 - December 2, 2016.

Garcia-Leiner M, Dennies DP, Yardimci A. High performance polymers in additive manufacturing processes: understanding process, structure and property. Microscopy and Microanalysis Conference (M&M 2015), AM Symposium, Portland, OR, August 2-6, 2015.

Garcia-Leiner M. High performance polymers: Understanding structure and property in light of new manufacturing technologies. Society of Plastics Engineers (SPE) Medical Plastics Minitec, Malvern, PA, November 6, 2014.

Garcia-Leiner M, Clay B, Ricou P. High performance polymers in selective laser sintering processes: Understanding structure and property. ACS Fall 2014 National Meeting, San Francisco, CA August 10-14, 2014.

Garcia-Leiner M. Discussion Panel, Economic Consideration of Additive Manufacturing. Metal Additive Manufacturing Workshop, University of Connecticut (UCONN) Storrs, CT, April 17, 2014.

Garcia-Leiner M. High performance polymers: New options and manufacturing technologies. Society of Plastics Engineers (SPE) Medical Plastics Minitec, Brooklyn Park, MN, March 27, 2014.

Garcia-Leiner M. How and why plastic systems fail: Lessons for developing durable polymeric systems. National Science Foundation (NSF) Workshop, Life Performance of Polymer-based Engineering Materials, Arlington, VA, March 13-14, 2014.

Ricou P, Clay B, Garcia-Leiner M. Characterizing process induced crystal modifications in Poly(etherketoneketone) (PEKK) by scattering techniques. 62nd Annual Conference on Applications of X-Ray Analysis, Denver, CO, August 5-9, 2013.

Garcia-Leiner M, Clay B, Ricou P. Polymorphism in Poly(etherketoneketone) (PEKK) high performance thermoplastics. 2013 SPE Annual Technical Conference ANTEC, Paper #1587076, Cincinnati, OH, April 21-24, 2013.

Garcia-Leiner M. PEKK - Poly(etherketoneketone) high performance polymers. Invited Speaker, SPE Society of Plastics Engineers - Philadelphia Section, King of Prussia, PA, February 22, 2012.

Moeller G, Cherian Z, Arora D, Garcia-Leiner M. Mechanical properties measurements of viscoelastic materials with an atomic force microscope. 34th Annual Meeting of the Adhesion Society 2011, Savannah, GA, February 13-16, 2011.

Herrera-Alonso M, Garcia-Leiner M, McCarthy TJ, Lesser AJ. Semicrystalline polymer nanocomposites using chemically designed compatibilizers and supercritical CO2-assisted polymer processing. ACS Fall 2004 National Meeting, Philadelphia, PA, August 22-25, 2004.

Garcia-Leiner M, Lesser AJ. Polymer-clay nanocomposites prepared in supercritical carbon dioxide. 2004 SPE Annual Technical Conference ANTEC, Paper #330, Chicago, IL, May 16-20, 2004.

Garcia-Leiner M, Lesser AJ. Polymer nanocomposites prepared by supercritical carbon dioxide-assisted polymer processing. Spring 2004 National Meeting, Anaheim, CA, March 28-April 1, 2004.

Garcia-Leiner M, Lesser AJ. Intercalated polymer nanocomposites prepared in supercritical carbon dioxide. 2003 MRS Fall Meeting, Boston, MA, December 1-5, 2003.

Garcia-Leiner M, Lesser AJ. Melt intercalation in polymer-clay nanocomposites promoted by supercritical carbon dioxide. ACS Fall 2003 National Meeting, New York, NY, September 7-11, 2003.

Garcia-Leiner M, Lesser AJ. Processing of intractable polymers using high-pressure carbon dioxide. 2003 SPE Annual Technical Conference ANTEC, W5 Paper #439, Nashville, TN, May 4-8, 2003.

Garcia-Leiner M, Lesser AJ. Polymer-clay nanocomposites prepared in supercritical carbon dioxide. ACS Spring 2003 National Meeting, New Orleans, LA, March 23-27, 2003.

Garcia-Leiner M, Lesser AJ. A study of the foaming process of polyethylene with high-pressure CO2 in a modified extrusion system. 2002 SPE Annual Technical Conference ANTEC, T25 Paper #764, San Francisco, CA, May 5-9, 2002.

Garcia-Leiner M, Lesser AJ. Drawing of UHMWPE fibers in the presence of supercritical CO2. 2002 SPE Annual Technical Conference ANTEC, T32 Paper #768, San Francisco, CA, May 5-9, 2002.

Garcia-Leiner M, Manero O, Herrera R. Functionalized Polybutadienes: Synthesis, Characterization and Rheological Modeling. 7th Pacific Polymer Conference, Oaxaca, Mexico, December 3-7, 2001.