



**Exponent<sup>®</sup>**  
Engineering & Scientific Consulting

**Greg Cardoen, Ph.D.**

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## Professional Profile

Dr. Cardoen is a polymer scientist with over 17 years of industrial experience in a wide variety of fields including drug delivery, coatings and adhesives, home and personal care and wire & cable. Dr. Cardoen partners closely with clients to support early-stage R&D research, intellectual property identification and prosecution, product development, scale-up, manufacturing, market introduction and product troubleshooting. Dr. Cardoen has extensive experience in acrylic, cellulosic, silicone and polyolefin chemistry, formulation and processing (extrusion and compounding) coupled with an in-depth knowledge of analytical and material characterization.

Dr. Cardoen has extensive expertise in polymer chemistry (including free and controlled radical polymerization, suspension and emulsion polymerization, anionic polymerization and olefin polymerization), material characterization (morphology, thermomechanical properties), processing (extrusion and compounding), formulation and application performance (aging, application-specific tests, root cause investigation). Through his years in industry, Dr. Cardoen has supported clients in various coatings spaces (architectural, industrial, wood, and elastomeric roof coatings), adhesives, home and personal care (rheology modification, surfactants for detergents, body wash, shampoos and conditioners, liquid laundry formulation, hair and skin care formulations) and wire and cable (polyolefin compounds for telecom and power cables). In addition, Dr. Cardoen has researched technical issues related to microplastics and developed biodegradable products as potential alternatives to existing materials. Dr. Cardoen's chemical expertise also allows him to advise clients about evaluating and specifying alternatives to substances such as halogenated flame retardants, PFAS, anti-oxidants, and other chemicals associated with evolving regulations.

Prior to joining Exponent, Dr. Cardoen spent over 15 years at Dow Inc, contributing in the Formulation Science group in Core R&D, and then leading the Personal Care R&D group and later the Wire & Cable R&D group. While at Dow, several of the products he and his team have developed have garnered many accolades, including four R&D 100 awards.

Dr. Cardoen's academic research was focus on self-assembly of hybrid organic inorganic block copolymer. In his early career, Dr. Cardoen focused on designing block copolymer for hydrophobic cancer drug and genetic material delivery at a biotechnology start-up.

## Academic Credentials & Professional Honors

Ph.D., Polymer Science and Engineering, University of Massachusetts, Amherst, 2006

M.S., Polymer Science and Engineering, University of Massachusetts, Amherst, 2002

M.S., Chemistry, Ecole Nationale Supérieure de Chimie de Mont., 2002



Santos Go Award, Polymer Science and Engineering Department, UMass, Amherst, MA, (2002), awarded to the best student of the year.

R&D 100 Awards - Vora Zzz™ 100 High Airflow (2017), MaizeCare™ Clarity (2022), ENDURANCE™ HFDD 4201 (2023), AXELERON™ DGDA 6321BK (2024)

## Academic Appointments

Post-Doctoral Associate, Soft Matter Sciences and Engineering Laboratory - UMR7615, ESPCI, Paris, France. 2006-2007

## Prior Experience

Associate R&D Director, Wire & Cable, Dow Inc., Collegeville, PA, 2022-2025

Senior R&D Leader, Personal Care, Dow Inc., Collegeville, PA, 2017-2022

R&D Manager, Formulation Science, The Dow Chemical Company, Collegeville, PA, 2015-2017

Senior Scientist, Formulation Science, The Dow Chemical Company, Spring House, PA, 2010-2015

Senior Scientist, Synthetic Chemistry, Intezyne, Tampa, FL, 2008-2010

## Professional Affiliations

Member of the Society of Plastics Engineers (SPE)

## Patents

**US Patent 12,077,655 B2: Terminal alkenyl functional silylated polysaccharides, November 2024 (with R. Baumgartner, S. Mangold, Z. Wenzlick, M.A. Courtemanche, and M. Ferritto).**

Related International Patent Publications include:

Korean Patent KR 102679283 B1, July 2024 (Granted)

European Patent EP 4314148 B1, November 2024 (Granted)

Japanese Patent JP 7481784 B2, May 2024

Chinese Patent Application CN 116940628 A, October 2023

World Patent Application (PCT) WO 2022/203799 A1, September 2022

**US Patent 10,669,444 B2: Coating formulation with an open time additive, June 2020 (with D. Brennan, J. DeRocher, A. Van Dyk and K. Yeung)**

Related International Patent Publications include:

European Patent EP 3426692 B1, February 2020 (Granted)

Mexican Patent MX 379609 B, March 2025 (Granted)

Brazilian Patent Application BR 112018068289 A2, January 2019



World Patent Application (PCT) WO/2017155845 A1, September 2017

Canadian Patent Application CA 3017122 A1, September 2017

Chinese Patent Application CN 109121415 A, January 2019

Australian Patent Application AU 2017229008 A1, October 2018

**US Patent 10,654,964 B2: Compositions comprising polyether-urethane-urea additives for block resistance and open time, May 2020 (with D. Brennan, J. DeRocher, J. Rabasco, A. Van Dyk and K. Yeung)**

Related International Patent Publications include:

European Patent EP 3481880 B1, July 2023 (Granted)

Chinese Patent CN 109415477 B, April 2022 (Granted)

Australian Patent AU 2017293355 B2, March 2021 (Granted)

Mexican Patent MX 405161 B, August 2023 (Granted)

World Patent Application (PCT) WO 2018/009370 A1, January 2018

Canadian Patent Application CA 3029824 A1, January 2018

Brazilian Patent Application BR 112018075197 B1, July 2022

**US Patent 10,604,590 B2: Di- or tristyrylphenol monoglycidyl ether adduct of maltodextrin, March 2020 (with D. Brennan, J. DeRocher, R. Hefner, A. Van Dyk and T. Zhang)**

Related International Patent Publications include:

Mexican Patent MX 377071 B, March 2025 (Granted)

European Patent EP 3181590 B1, January 2019 (Granted)

Chinese Patent CN 106892985 B, November 2020 (Granted)

Canadian Patent Application CA 2948965 A1, June 2017

Brazilian Patent Application BR 102016028437 A2, June 2017

**US Patent 9,969,817 B2: Phenyl glycidyl ether adduct of maltodextrin, May 2018 (with J. DeRocher, A. Van Kyk and T. Zhang)**

Related International Patent Publications include:

European Patent EP 3181589 B1, December 2018 (Granted)

Mexican Patent MX 376752 B, March 2025 (Granted)

Canadian Patent Application CA 2948956 A1, June 2017

Brazilian Patent Application BR 102016028428 A2, June 2017



Chinese Patent Application CN 106883302 A, June 2017

**US Patent 9,783,669 B2: Polyurea macromer and latexes thereof, October 2017 (with I. Drake, R. Even, A. Hughes, T. Zhang and T. Kalantar)**

Related International Patent Publications include:

Australian Patent AU 2014201932 B2, March 2018 (Granted)

Chinese Patent CN 104177967 B, June 2018 (Granted)

European Patent EP 2805980 B1, December 2016 (Granted)

Brazilian Patent Application BR 102014011023 A2, May 2016

Canadian Patent Application CA 2851118 A1, November 2014

Korean Patent Application KR 2014-0137299 A, December 2014

**US Patent 9,505,874 B2: Polyurea macromer and latexes thereof, November 2016 (with I. Drake, R. Even, A. Hughes, T. Zhang and T. Kalantar)**

Related International Patent Publications include:

China Patent CN 104177586 B, July 2019 (Granted)

Australian Patent AU 2014202496 C1, July 2018 (Granted)

European Patent EP 2805979 B1, April 2017 (Granted)

Brazilian Patent Application BR 102014011025 A2, November 2015

Canadian Patent Application CA 2851117 A1, November 2014

Korean Patent Application KR 2014-0137300 A, December 2014

**US Patent 9,321,871 B2: Water insoluble copolymer including pendant aryl epoxide groups, April 2016 (with A. Schultz, W. I. Harris, W. J. Harris, C. Marston and D. Moll)**

Related International Patent Publications include:

Chinese Patent CN 104704008 B, October 2016

Australian Patent AU 2013329561 B2, December 2016

Russian Patent Application RU 2015117608 A, December 2016

Canadian Patent Application CA 2887426 A1, April 2014

Philippine Patent Application PH 12015500804 A1, June 2015

World Patent Application (PCT) WO 2014/058756 A1, April 2014

**US Patent 9,217,081 B2: Polyurea macromer and latexes thereof, December 2015 (with I. Drake, R. Even, A. Hughes, T. Zhang and T. Kalantar)**



Related International Patent Publications include:

Australian Patent AU 2014201932 B2, March 2018 (Granted)

Chinese Patent CN 104177967 B, June 2018 (Granted)

European Patent EP 2805980 B1, December 2016 (Granted)

Brazilian Patent Application BR 102014011023 A2, May 2016

Canadian Patent Application CA 2851118 A1, November 2014

Korean Patent Application KR 2014-0137299 A, December 2014

**US Patent 8,747,904 B2: Polymeric micelles for polynucleotide encapsulation, June 2014 (with J. Mirosevich, K. Sill and H. Skaff)**

Related International Patent Publications include:

World Patent Application (PCT) WO 2010/127159 A2, April 2010

**US Patent 8,524,783 B2: Polymer micelles containing anthracyclines for the treatment of cancer, September 2013 (with K. Sill, H. Skaff and J. Rios-Doria)**

Related International Patent Publications include:

World Patent Application (PCT) WO 2010/127271 A1, November 2011

European Patent Application EP 2424359 A4, January 2014

**US Patent 8,287,910 B2: Polymeric micelles for polynucleotide encapsulation, October 2012 (with J. Mirosevich, K. Sill and H. Skaff)**

Related International Patent Publications include:

World Patent Application (PCT) WO 2010/127159 A3, February 2011

**US Patent Application 2024/0117089 A1: Composition comprising an alkali-swelling copolymer, April 2024 (with R. Butterick, M. Creamer, R. Even, K. Magni, Y. O'Connor and E. Wasserman)**

Related International Patent Publications include:

Chinese Patent CN 114402005 B, December 2024 (Granted)

Japanese Patent JP 7668268 B2, April 2025 (Granted)

European Patent EP 4045548 B1, October 2024 (Granted)

World Patent Application (PCT) WO 2021/076537 A1, April 2021

**US Patent Application 2024/0110014 A1: Silicone elastomer from silylated polysaccharides, April 2024 (with R. Baumgartner, S. Mangold, Z. Wenzlick, M.A. Courtemanche, R. Haller, and M. Ferritto)**

Related International Patent Publications include:



European Patent Application EP 4314119 A1, February 2024

Korean Patent Application KR 2023-0159497 A, November 2023

Chinese Patent Application CN 116917381 A, October 2023

Japanese Patent Application JP 2024-513727 A, March 2024

World Patent Application (PCT) WO 2022/203801 A1, September 2022

**US Patent Application 2024/0043644 A1: Viscoelastic polyurethane foam with coating, February 2024 (with K. Aou, Y. Gu, R. Duggal, Y. Srivastava, J. Jacobs, Q. Meng, R. Even and M. Springs)**

Related International Patent Publications include:

Australian Patent AU 2017273837 B2, May 2021 (Granted)

European Patent EP 3464403 B1, December 2020 (Granted)

Spanish Patent ES 2855735 T3, September 2021 (Granted)

Chinese Patent CN 109219625 B, July 2022 (Granted)

Japanese Patent JP 6968828 B2, November 2021 (Granted)

Japanese Patent JP 7228018B2, February 2023 (Granted)

Brazilian Patent Application BR 112018073988 B1, April 2023

World Patent Application (PCT) WO 2017/210439 A1, December 2017

Mexican Patent Application MX 2018014886 A, May 2019

**US Patent Application 2023/0285268 A1: Aqueous emulsion based antiperspirant formulation, September 2023 (with T. Lan, F. Zeng, X. Lu, I. Shulman, I. Van Reeth, F. Bizeray, M. Pacholski, P. Yang, H. Dihang, M. Eeman, T. Ratani, J. Fisk, and T.C. Kuo)**

Related International Patent Publications include:

World Patent Application (PCT) WO 2022/051441 A1, March 2022

**US Patent Application 2017/0107189 A1: Tristyrylphenol monogycidyl ether, April 2017 (with D. Brennan, R. Hefner and A. Van Dyk)**

Related International Patent Publications include:

Canadian Patent Application CA 2942354 A1, April 2017

Australian Patent Application AU 2016234971 A1, May 2017

Mexican Patent Application MX 2016012876 A, April 2017

European Patent Application EP 3156401 A1, April 2017

Brazilian Patent Application BR 102016023127 A2, May 2017



Chinese Patent Application CN 106588822 A, April 2017

**US Patent Application 2013/0344117 A1: Pegylated polyplexes for polynucleotide delivery, December 2013 (with J. Mirosevich and K. Sill)**

Related International Patent Publications include:

World Patent Application (PCT) WO 2011/068916A1, June 2011

**US Patent Application 2012/0148631 A1: Pegylated polyplexes for polynucleotide delivery, June 2012 (with J. Mirosevich and K. Sill)**

**US Patent Application 2010/0292432 A1: Polymers for polynucleotide encapsulation, November 2010 (with K. Sill, J. Mirosevich, and H. Skaff)**

Related International Patent Publications include:

World Patent Application (PCT) WO 2010/127154 A1, November 2010

**US Patent Application 2010/0278932 A1, Polymer micelles containing sn-38 for the treatment of cancer, September 2014 (with K. Sill, H. Skaff, A. Carie, J. Rios-Doria and R. Slama)**

Related International Patent Publications include:

Mexican Patent Application MX 2011011730 A, December 2011

Korean Patent Application KR 20120094546 A, August 2012

World Patent Application (PCT) WO2010/129581 A1, November 2010

Canadian Patent Application CA 2760771 A1, November 2010

European Patent Application EP 2427176 A4, March 2014

Australian Patent Application AU 2010246019 A1, November 2011

Japan Patent Application JP 2012526049 A, October 2012

Israel Patent Application IL 216122 A0, January 2012

**US Patent Application 2009/ 0286938 A1: Synthesis of hybrid block copolymers from difluoroacetate ammonium salts, November 2009 (with K. Sill and K. Breitenkamp)**

Related International Patent Publications include:

World Patent Application (PCT) WO 2009/134984 A1, November 2009

Canadian Patent Application CA 2722767 A1, November 2009

European Patent Application EP 2283063 A1, February 2011

**World Patent Application (PCT) WO 2022/051440 A1: Aqueous antiperspirant formulation, March 2022 (with T. Lan, F. Zeng, X. Lu, I. Shulman, I. Van Reeth, F. Bizeray, M. Pacholski, P. Yang, H. Dihang, M. Eeman, T. Ratani, J. Fisk, and T.C. Kuo)**



**World Patent Application (PCT) WO 2022/051439 A1: Antiperspirant composition, March 2022 (with T. Lan, F. Zeng, X. Lu, I. Shulman, I. Van Reeth, F. Bizeray, M. Pacholski, P. Yang, H. Dihang, M. Eeman)**

**World Patent Application (PCT) WO 2019/182714 A1: Compositions containing latex particles and ir actives, September 2019 (with J. Bohling, X. Chen, J. Gu, Y. O'Connor, C. Schwartz and F. Zeng)**

**World Patent Application (PCT) WO 2019/173154 A1, (Meth)acrylate copolymer compositions and use thereof as pour point depressants for crude oil, September 2019 (with M. Petr, L. Bai, R. Even, W. Gao, A. Hughes, J. Manna, S. Potisek, L. Reyes)**

**World Patent Application (PCT) WO 2011/112969A1, Poly(ethylene glycol) derivatives for metal-free click chemistry, September 2011 (with K. Sill)W**

## Publications

Drake I, Cardoen G, Hughes A, Nakatani AI, Landes B, Reffner J, Even R. Polyurea-acrylic hybrid emulsions: characterization and film properties. *Polymer* **2019**; 181:121761.

Drake I, Cardoen G, Hughes A, Beshah K, Kearns KL, Zhang T, Reffner J, Wolf C, Even R. Self-assembled polyurea macromer nanodispersion and resulting hybrid polyurea-acrylic emulsions and films. *Journal of Polymer Science Part A: Polymer Chemistry* **2019**; 57(13):1373–1388.

Mirosevich J, Cardoen G, Burke B, Costich T, Sill K. Nonviral gene delivery using poly-d/l aspartate-diethylenetriamine cationic polymers and polyethylene glycol: a two-step approach. *Journal of Polymer Science Part A: Polymer Chemistry* **2012**; 50(5):836–850.

Cardoen G, Burke B, Sill K, Mirosevich J. Synthesis of heterobifunctional polyethylene glycols with azide functionality suitable for “click” chemistry. *Journal of Polymer Research* **2012**; 19(4):9856.

Gadodia G, Cardoen G, Simon Y, Abe H, Coughlin EB. Inorganic-organic hybrid copolymers derived from silsesquioxanes or carborane building blocks. *MRS Online Proceedings Library (OPL)* **2011**; 1312:mrsf10-1312–jj1301–1303.

Zheng L, Hong S, Cardoen G, Burgaz E, Gido SP, Coughlin EB. Polymer nanocomposites through controlled self-assembly of cubic silsesquioxane scaffolds. *Macromolecules* **2004**; 37(23):8606–8611.

Cardoen G, Coughlin EB. Hemi-telechelic polystyrene-POSS copolymers as model systems for the study of well-defined inorganic/organic hybrid materials. *Macromolecules* **2004**; 37(13):5123–5126.

McKiernan RL, Cardoen G, Boutevin B, Améduri B, Gido SP, Penelle J. Macromolecular crystal engineering based on segmented polymers: influence of heteroatoms on the thermal properties and crystallization of m, n-polyurethanes derived from long-chain, heteroatom-containing, monodisperse  $\alpha$ ,  $\omega$ -diols. *Macromolecular Chemistry and Physics* **2003**; 204(7):961–969.

## Presentations

Sill K, Rios-Doria J, Carie A, Cardoen G, Slama R, Skaff H. SN38 encapsulated in polymer micelles Induce tumor regression in multiple colorectal cancer models. AACR Meeting, San Diego, CA, 2009.

Cardoen G, Mays JW, Gido SP, Russell TP, Hu X, Baskaran D, Coughlin EB. POSS containing multiblock copolymers as model of well-defined organic-inorganic hybrid materials. Abstracts of Papers, 230th ACS National Meeting, Washington, DC, 2005; 46(2):783–784.

Coughlin EB. Silsesquioxane-based inorganic organic hybrid copolymers. Seventh Middle Atlantic Regional Meeting of the American Chemical Society, New Brunswick, NJ, 2005.



Cardoen G, Mays JW, Gido SP, Russell TP, Hu X, Baskaran D, Coughlin EB. POSS containing multiblock copolymers as model of well-defined organic-inorganic hybrid materials. Gordon Conference, Polymer West, Ventura, CA, 2005.

Cardoen G, Coughlin EB. Hemi-telechelic and diblock copolymers of polystyrene and POSS as model systems for the study of well defined inorganic/organic hybrid materials. World Polymer Congress, IUPAC Meeting, Paris, France, 2004.

Cardoen G, Burgaz E, Gido SP, Coughlin EB. Self-assembly of organic-inorganic hybrid copolymers. Abstracts of Papers, 226th ACS National Meeting, New York, NY, 2003; 44(2):252–253.

### Additional Education & Training

Foundational GenAI badge (Coursera, 2024)

Fundamental of Economic Evaluation (Dow Inc., 2024)

Leading Strategic Growth (Exec Online, Columbia Business School, Credential ID 1-176662-465778-1717380946, 2024)

Aligning Work with Strategy (Korn Ferry, 2023)

USPTO Patent Agent Training via PLI (on-going)

Fundamentals of Finance for the Technical Executive (MIT, 2020)

Bates Executive Presence Assessment (ExPI™) (2019)

Six Sigma Black Belt Certification (Dow Inc., 2013)