

Exponent®
Engineering & Scientific Consulting


## Zach Seibers, Ph.D.

Senior Associate | Polymers & Chemistry
Atlanta
+1-678-412-4825 | zseibers@exponent.com


## Professional Profile

Dr. Seibers is a materials scientist specializing in polymer composites used in a variety of applications ranging from photovoltaics to aerospace materials for space exploration. He also routinely consults on projects centered on evaluating the end-use performance and durability of polymeric materials used in piping systems, liquid storage systems, flexible hoses, and medical devices.

Dr. Seibers has a strong understanding of many areas related to composite manufacturing including additive chemistry, composite formulation, solution and melt processing, and performance characterization. He has considerable experience in the synthetic modification of polymers, surfaces, and nanoparticles to tune performance and processing characteristics. He is also familiar with the effects of material exposure to harsh conditions found in the environment or within decontamination processes used in healthcare applications.

Prior to joining Exponent, Dr. Seibers was a research scientist at the Georgia Institute of Technology where he worked on a NASA funded effort to develop electrically conductive polymer composites for space applications. He received his Ph.D. from the Bredesen Center, a joint program between the University of Tennessee Knoxville and Oak Ridge National Laboratory, where his work focused on enhancing the performance of solar cells through synthetic modification, blend formulation, and process optimization.

Dr. Seibers has used chemical characterization techniques to probe aspects of polymer chemistry ranging from monomer or solvent purity to polymer molecular weight or end-group composition. Some of the techniques used in these efforts include gas chromatography mass spectroscopy (GC-MS), Nuclear magnetic resonance (NMR), size exclusion chromatography (SEC), and matrix-assisted laser desorption ionization - time of flight MS (MALDI-ToF MS), thermogravimetric analysis (TGA), Fourier Transform Infrared Resonance (FTIR), Raman spectroscopy, and X-Ray Photoelectron Spectroscopy.

In his efforts to understand how chemistry, processing, or field exposure affect morphology and performance, Dr. Seibers has used techniques utilized atomic force microscopy (AFM), contact angle analysis, dynamic mechanical analysis (DMA), electrical properties assessment, ellipsometry, neutron reflectometry, transmission & scanning electron microscopy (TEM, SEM), X-ray diffraction (XRD), small and wide-angle X-ray scattering (SAXS & WAXS).

## Academic Credentials & Professional Honors

Ph.D., Energy Science and Engineering, University of Tennessee, Knoxville, 2016

B.S., Chemical Engineering, Tennessee Tech University, 2011

Bredesen Center for Interdisciplinary Graduate Research & Education Fellowship; August 2012.

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Tennessee Solar Conversion and Storage using Outreach, Research, and Education Research Fellowship; September 2012.

## Prior Experience

Research Scientist II, Georgia Institute of Technology, 2019-2021

Postdoctoral Research Fellow, Georgia Institute of Technology, 2017-2019

Oak Ridge Institute for Science & Education, 2017

## Professional Affiliations

Society of Plastics Engineers - member

## Patents

US Patent Application No. PCT/US2021/055189. Chemically Functionalized Graphene Oxide Nanoparticle Composites, Coatings and Methods of Use Thereof. Applied Oct. 2021 (Seibers ZD, Reynolds JR, Orlando TM)

## Publications

Ryan, Emily; Seibers, Zach; Reynolds, JR; Shofner, ML. Surface-Localized Chemically Modified Reduced Graphene Oxide Nanocomposites as Flexible Conductive Surfaces for Space Applications. ACS Applied Polymer Materials, 2023.

Seibers, Zach; Orr, Matthew; Collier, Graham S; Henriquez, Adriana; Gabel, Matthew; Shofner, Meisha L; La Saponara, Valeria; Reynolds, John. Chemically Functionalized Reduced Graphene Oxide as Additives in Polyethylene Composites for Space Applications. Polymer Engineering & Science 2020; 60: 86-94.

Seibers, Zach D; Collier, Graham S; Hopkins, Benjamin W; Boone, Evan S; Le, Thinh P; Gomez, Enrique D; Kilbey, S Michael. Tuning Fullerene Miscibility with Porphyrin-Terminated P3HTs in Bulk Heterojunction Blends. Soft Matter 2020; 16: 9769-9779.

Seibers, Zach D; Brim, Elliot; Lee Pittelli, Sandra; Beltran, Esther; Shofner, Meisha L; Reynolds, John R. Readily Dispersible Chemically Functionalized Reduced Graphene Oxide Nanosheets for Solution-Processable Electrodes and Conductive Coatings. ACS Applied Nano Materials 2020; 3: 11455-11464.

Scott, Philip J; Spiering, Glenn A; Wang, Yangyang; Seibers, Zach D; Moore, Robert B; Kumar, Rajeev; Lokitz, Bradley S; Long, Timothy E. Phosphonium-Based Polyzwitterions: Influence of Ionic Structure and Association on Mechanical Properties. Macromolecules 2020; 53: 11009-11018.

Aplan, Melissa P; Grieco, Christopher; Lee, Youngmin; Munro, Jason M; Lee, Wonho; Gray, Jennifer L; Seibers, Zach D; Kuei, Brooke; Litofsky, Joshua H; Kilbey, S Michael. Conjugated Block Copolymers as Model Systems to Examine Mechanisms of Charge Generation in Donor–Acceptor Materials. Advanced Functional Materials 2019; 29: 1804858.

Seibers, Zach D; Le, Thinh P; Lee, Youngmin; Gomez, Enrique D; Kilbey, S Michael. Impact of Low Molecular Weight Poly (3-hexylthiophene)s as Additives in Organic Photovoltaic Devices. ACS Applied Materials & Interfaces 2018; 10: 2752-2761.

Lee, Youngmin; Aplan, Melissa P; Seibers, Zach D; Xie, Renxuan; Culp, Tyler E; Wang, Cheng;

Hexemer, Alexander; Kilbey, S Michael; Wang, Qing; Gomez, Enrique D. Random Copolymers Allow Control of Crystallization and Microphase Separation in Fully Conjugated Block Copolymers. Macromolecules 2018; 51: 8844-8852.

Lee, Youngmin; Aplan, Melissa P; Seibers, Zach D; Kilbey, S Michael; Wang, Qing; Gomez, Enrique D. Tuning the Synthesis of Fully Conjugated Block Copolymers to Minimize Architectural Heterogeneity. Journal of Materials Chemistry A 2017; 5: 20412-20421.

Carrillo, Jan-Michael Y; Seibers, Zach; Kumar, Rajeev; Matheson, Michael A; Ankner, John F; Goswami, Monojoy; Bhaskaran-Nair, Kiran; Shelton, William A; Sumpter, Bobby G; Kilbey, S Michael. Petascale Simulations of the Morphology and the Molecular Interface of Bulk Heterojunctions. ACS Nano 2016; 10: 7008-7022.

**Presentations**

REVEALS Activities in Exploration, Graphene-based Antistatic Coatings Real-time & Design and Performance Considerations of Graphene-Laminated Thermoplastics for Electrically Conductive Applications in Space. NASA Lunar Surface Science Workshop; 2021 Aug. 19; Virtual.

Design and Performance Considerations of Graphene-Laminated Thermoplastics for Electrically Conductive Applications in Space. NASA Exploration & Science Forum and European Lunar Symposium; 2021 Jul. 22; Virtual.

Tailoring Polymer Composites for Space: Realizing Electrically Conductive Polymer Composites Through Reinforcement with Chemically-Modied Reduced Graphene Oxide. NASA Exploration & Science Forum. 2020 Jul. 9; Virtual.

REVEALS Activities in Exploration, Graphene-based Antistatic Coatings Real-time & 2D Meta-material Radiation Detectors. IEEE International Conference on Wireless for Space and Extreme Environments; 2019 Oct. 18; Ottawa, ON, Canada.

Multi-Functional Composites for Space Travel: Design Considerations and Early Concepts Using Reduced Graphene Oxide as Additives in Polymers. Explorations and Origins Colloquium; 2019 Mar. 28; Atlanta, GA.

Multi-Functional Composites of Chemically Functionalized Reduced Graphene Oxide and HDPE for Aerospace Applications. Symposium on Space Innovations; 2018 Nov 13-14; Atlanta, GA.

Chemically Functionalized Reduced Graphene Oxide as Additives in Polyethylene Composites for Radiation Shielding Applications. NASA Exploration Science Forum; 2018 Jun 26-28; NASA Ames Research Center, CA.

Role of Oligomeric Additives on P3HT/PCBM Domain Interface & Photovoltaic Performance. National Graduate Research in Polymers Conference; 2016 Jun 19-22; Akron, OH.

Role of Oligomeric Additives on P3HT/PCBM Domain Interface & Photovoltaic Performance. 251st ACS National Meeting; 2016 Mar 17-21; San Diego, CA.

## Additional Education & Training

NASA Breakthrough Materials Workshop, Huntsville, AB; April 24, 2019.

Surface Science Techniques - XPS and ToF-SIMS of Surfaces; Georgia Inst. Of Tech., Atlanta, GA; December 14-15, 2018.

NSF Becoming the Messenger, Knoxville, TN; November 7, 2012.

## Research Grants

Materials development for additive manufacture of radiation sensors and shielding. NASA Marshall Space Flight Center Cooperative Agreement No. 80MSFC21M0001; July 2, 2021 (Co-Investigator).

Hybrid Dust Mitigation Brush Utilizing EDS and UV Technologies. NASA Big IDEAS Challenge, Jan 2021 (Technical Advisor).

Current and Next Generation Mask Elastomer Straps: Mechanical Integrity with Sterilization and Reuse. National Science Foundation - COVID 19 RAPID. Award Number: 2031545, June 2020 (Co-Investigator).

Electrode Fabrication for Neutron Reflectivity Studies of Redox-Active Electrochromic Polymer Films. Center for Nanophase Material Science, Oak Ridge National Laboratory. Proposal ID: CNMS2019-R-063, Sep. 2019 (Principle Investigator).

In-Situ Ion Diffusion in Electrochromic Polymer Films. Spallation Neutron Source, Oak Ridge National Laboratory. Proposal ID: IPTS-22018.1, Nov. 2018 (Principle Investigator).

Controlling Morphology of Bulk Heterojunction Active Layers Using Porphyrin-Functionalized Poly(3-Hexylthiophene)s as Additives. Spallation Neutron Source, Oak Ridge National Laboratory. Proposal ID: IPTS-16638.1, Nov. 2016 (Co-Investigator).