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Engineering & Scientific Consulting

Brian Shen, Ph.D.

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Professional Profile

Dr. Shen specializes in electrochemistry, materials characterization, battery science and technologies, and failure analysis. He has evaluated next generation energy storage technologies for safety, reliability, quality, and performance, such as lithium sulfur, silicon anodes, solid-state, impact-safe electrolytes, and zero-volt technologies.

Dr. Shen has designed custom experiments to probe battery performance and reliability, such as establishing space readiness of batteries from a variety of manufacturers. He also has experience with a variety of material and electrochemical characterization methods to identify properties such as material composition and morphology, coating structure-property relationships, and battery degradation mechanisms. His scientific expertise includes x-ray photoelectron spectroscopy (XPS), Fourier transform infrared spectroscopy (FTIR), scanning electron microscopy (SEM), thermogravimetric analysis (TGA), rheology, and electrochemical impedance spectroscopy (EIS).

Prior to joining Exponent, Dr. Shen worked as a battery scientist at The Aerospace Corporation where he used his expertise to evaluate energy storage technologies for national security space applications. His work included on-orbit satellite operations (battery) support, elucidating failure modes in space batteries, performing flight-like battery testing to monitor and predict battery state of health prior to launch, and vetting next-generation energy-storage candidates for future space programs.

Dr. Shen completed his Ph.D. in Chemical Engineering at the University of Rochester. During his graduate work, he developed polymer coatings for a variety of battery and energy storage applications, including improving the cycling stability of silicon-based anodes, enhancing the ionic conductivity of solid-polymer composite electrolytes, and sterically stabilizing shear-thickening, impact-safe electrolytes. In addition, Dr. Shen worked closely with several staff scientists at the Oak Ridge National Laboratory in the Energy Storage and Membrane Materials group under a DOE office of science graduate student research award (SCGSR) to further develop and characterize advanced battery technologies.

Academic Credentials & Professional Honors

Ph.D., Chemical Engineering, University of Rochester, 2018

M.S., Technical Entrepreneurship and Management, University of Rochester, 2016

B.E., Chemical and Biomolecular Engineering, Vanderbilt University, 2013

Office of Science Graduate Student Research Award (SCGSR), Department of Energy, 2015

Integrated Graduate Education and Research Traineeship (IGERT), National Science Foundation, 2014

Prior Experience

Battery Scientist, The Aerospace Corporation, 2018 – 2020

Graduate Researcher, Oak Ridge National Laboratory, 2015 – 2016

Professional Affiliations

The Materials Research Society

Patents

US Patent 10,347,934 B2: Shear Activated Impact Resistant Electrolyte, July 2009 (Veith GM, Armstrong BL, Shen BH, Tenhaeff WE, Kalnaus S, Wang H).

11289757: Radioisotope thermoelectric battery (RTB) system March 2022 (Eric Joseph Nemanick, Henry Helvajian, Brian Shen)

US20210184247A1: 6Li BATTERY (Eric Joseph Nemanick, Brian Shen) (Pending)

Publications

Shen BH, Wang S, Tenhaeff WE. Ultrathin Conformal Polycyclosiloxane Films to Improve Silicon Cycling Stability. Science Advances 2019; 5:eaaw4856.

Shen BH, Veith GM, Tenhaeff WE. Silicon Surface Tethered Polymer as Artificial Solid Electrolyte Interface. Scientific Reports 2018; 8:11549.

Shen BH, Armstrong BL, Doucet M, Heroux L, Browning JF, Agamalian M, Tenhaeff WE, Veith GM. Shear Thickening Electrolyte Built from Sterically Stabilized Colloidal Particles. ACS Applied Materials & Interfaces 2018; 10, 11, 9424 - 9434.

Shen BH, Veith GM, Armstrong BL, Tenhaeff WE, Sacci RL. Predictive Design of Shear-Thickening Electrolytes for Safety Considerations. Journal of the Electrochemical Society 2017; 164 (12) A2547 - A2551.

Presentations

Shen BH, Tenhaeff WE. Exploring Alternative Polymer Compositions for Highly Conductive Solid Polymer Composite Electrolytes. Podium Presentation, 233rd ECS Meeting, Seattle, WA, 2018.

Shen BH, Tenhaeff WE. Surface-Tethered Polymer Brushes for Safe Lithium Battery Electrolytes. Podium Presentation, 2017 MRS Fall Meeting, Boston, MA, 2017.

Shen BH, Veith GM, Tenhaeff WE. Shear Thickening Electrolyte Built from Sterically Stabilized Colloidal Particles. Poster Presentation, NY-BEST Fall Energy Storage Technology and Innovation Conference, Rochester NY, 2017.

Shen BH, Veith GM, Tenhaeff WE. Designing Polymer Brush Films as Artificial Solid Electrolyte Interfaces for Silicon Based Anodes. Poster Presentation, 2016 MRS Fall Meeting, Boston, MA, 2016.