William Ridgely Fullerton

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Professional Summary

- Experimental polymer scientist with 6 years of laboratory experience in polymer synthesis, processing and characterization
- 3 years of experience collaborating with a cross-university team (Stanford, UPenn, Brown and UMass Amherst) to devise innovative engineering strategies for the processing and assembly of 3D solid-state sodium metal batteries
- Proven leadership as a laboratory manager for 3 years, promoting a culture of safety by providing thorough training, organizing regular lab cleanups, and ensuring consistent adherence to safety protocols

Research and Work Experience

Graduate Research Assistant **September 2020 – Present**
Li Research Group Drexel University, Philadelphia, PA

- Developed synthesis conditions and optimized processing parameters for a thin-film solid polymer electrolyte (SPE) platform, gaining working knowledge of the effects of solvent properties (e.g. volatility & χ) on network structure formation during curing
- Established methodology for processing solid-state battery cathode slurries with uniform active particle dispersion to reduce ionic transport tortuosity and enhance battery performance
- Illustrated relationship between SPE network structure and mechanical properties on performance in lithium metal batteries using techniques such as tensile testing, XPS, symmetric cell testing, Coulombic Efficiency measurements and galvanostatic full cell testing
- Systematically correlated mechanical resilience with electrochemical performance in sodium-ion network SPEs by combining tensile, creep and fatigue testing with symmetric and full cell electrochemical methods
- Fabricated the first-ever SPE with precisely controlled micron-scale surface patterning using soft lithography, establishing a platform to investigate how confined alkali metal electrodepositon affects anode stability and performance
- Generated comprehensive protocol for characterizing alkali metal nucleation and growth in polymer-based solid-state batteries utilizing *ex situ* SEM

Undergraduate Research Assistant **September 2018 – May 2020**
Hickey Research Group The Pennsylvania State University, University Park, PA

- Synthesized a series of single-ion conducting copolymer electrolytes with well-regulated composition and molecular weight dispersity through controlled radical polymerization
- Determined the influence of ion content on polymeric relaxations and its subsequent effect on ionic transport mechanisms using dielectric relaxation spectroscopy
- Revealed the impact of ion content on ion aggregation behavior utilizing differential scanning calorimetry

Intern **May 2018 – August 2018**
MATRIX Industries, Menlo Park, CA

- Designed ambient thermal resonators to better harness day-to-night temperature fluctuations to maximize temperature gradients across thermoelectric devices
- Demonstrated how the thermodynamic and thermal transport properties of thermal sink materials governed temperature gradient formation across ambient thermal resonator devices

Education

PhD in Materials Science and Engineering **Expected Graduation: September 2025**
Drexel University, Philadelphia, PA
GPA: 3.97/4.0

Bachelor of Science in Materials Science and Engineering **May 2020**
The Pennsylvania State University, University Park, PA
GPA: 3.56/4.0

Skills

Electrochemical Characterization: Electrochemical impedance spectroscopy (EIS), cyclic voltammetry (CV), linear sweep voltammetry (LSV), staircase voltammetry (SV) and galvanostatic intermittent titration technique (GITT)

Materials Characterization: Scanning electron microscopy (SEM), energy-dispersive x-ray spectroscopy (EDS), differential scanning calorimetry (DSC), dielectric relaxation spectroscopy (DRS), x-ray photoelectron spectroscopy (XPS), Fourier transform infrared spectroscopy (FTIR), nuclear magnetic resonance spectroscopy (NMR) and size exclusion chromatography (SEC)

Materials Development: Slurry processing, polymer thin film processing, nanolithography, soft imprint lithography, photopolymerization and controlled radical polymerization

Software: OriginLab, LayoutEditor and Microsoft Office

Publications

1. **Fullerton, W. R.**; Li, C. Y. Compliant Solid Polymer Electrolytes (SPEs) for Enhanced Anode-Electrolyte Interfacial Stability in All-Solid-State Lithium–Metal Batteries (LMBs) *ACS Appl. Polym. Mater.* **2024**
2. Jagad, H. D.; Fu, J.; **Fullerton W.R.**; Li, C. Y.; Detsi, E.; Qi, Y.; A Physics-based Model Assisted by Machine-Learning for Sodium-ion Batteries with both Liquid and Solid Electrolytes. *J. Electrochem. Soc.* **2024**
3. Zheng, Y.; Li, X.; **Fullerton, W. R.**; Qian, Q.; Shang, M.; Niu, J.; Li, C. Y. Interpenetrating Network-Based Hybrid Solid and Gel Electrolytes for High Voltage Lithium Metal Batteries. *ACS Appl. Energy Mater.* **2021**, *4* (6), 5639–5648.
4. Li, X.; Zheng, Y.; **Fullerton, W. R.**; Li, C. Y. Multilayered Solid Polymer Electrolytes with Sacrificial Coating for Suppressing Lithium Dendrite Growth. *ACS Appl. Mater. Interfaces* **2021**.

5. Zheng, Y.; Li, X.; **Fullerton, W. R.**; Li, C. Y. Decoupling the Modulus and Toughness Effects of Solid Polymer Electrolytes in All-Solid-State Lithium Batteries. *ACS Appl. Energy Mater.* **2021**.

Conference Presentations

Materials Research Society (MRS) – Boston **December 2023**
Oral presentation: Shreyas Pathreeker[1], Shahryar Mooraj[2], Selina Liu[1], **William R. Fullerton**[3], Hyeongjun Koh[1], Wen Chen[2], Russell Composto[1], Eric Stach[1], Christopher Li[3], Eric Detsi[1], *Towards a 3D Solid–State Na–Ion Battery using a Direct Ink Writing–Infiltration Approach*, **2023**, SF01.11.10 (2023).

Materials Research Society (MRS) – San Francisco **April 2023**
Oral presentation: William R. Fullerton: Christopher Y. Li* Team, *Discerning the Effects of Solid Polymer Electrolyte Properties on Lithium Electrodissolution and Electrodeposition*, **2023**, EN09.05.06 (2023).

American Physical Society Conference (APS) – Chicago **March 2022**
Poster presentation: William R. Fullerton: Christopher Y. Li* Team, *Molecular Engineering of Network Solid Polymer Electrolytes for Enhanced Mechanical, Electrochemical and Ionic Transport Properties*, **2022**, T00.379 (2022).

American Physical Society Conference (APS) – Virtual **March 2021**
Poster presentation: William R. Fullerton, Y. Zheng, X. Li, and C. Li, *Tuning Ionic Conductivity and Mechanical Properties of Network SPEs*, **2021**, M71.048 (2021).