Automated, High Throughput Screening of Increased Ionic Conductivity Polymer Electrolytes

Dr. Johanna J. Schwartz*, Michell Marufu, Dr. Yiran Xiao, Dr. Junhyug Noh, Brian Au, Robert Cerda

Advancement of increased ionic conductivity polymer electrolyte materials for Li-ion battery applications has traditionally required formulations to be hand-mixed by researchers, limiting progress and adding potential batch-to-batch variability. Through our Studying-Polymers-On a-Chip (SPOC) platform, we seek to solve the challenge of developing safe, stable, and cost effective batteries. We do so by accelerating screening of polymer electrolyte materials through integration of additive manufacturing, impedance characterization, and machine learning experimental planning systems. Various monomers, salts, and nanoparticle fillers were screened to modify the amorphous character in semicrystalline polyethylene glycol-based polymer electrolytes. Ultimately, long-term cycling, aging, and stability measurements need to be made for identified polymer electrolytes to be useful for battery applications. The end of the talk will discuss some of our ongoing SPOC platform developments to create and couple high-throughput aging and degradation assessments into our screening platform.

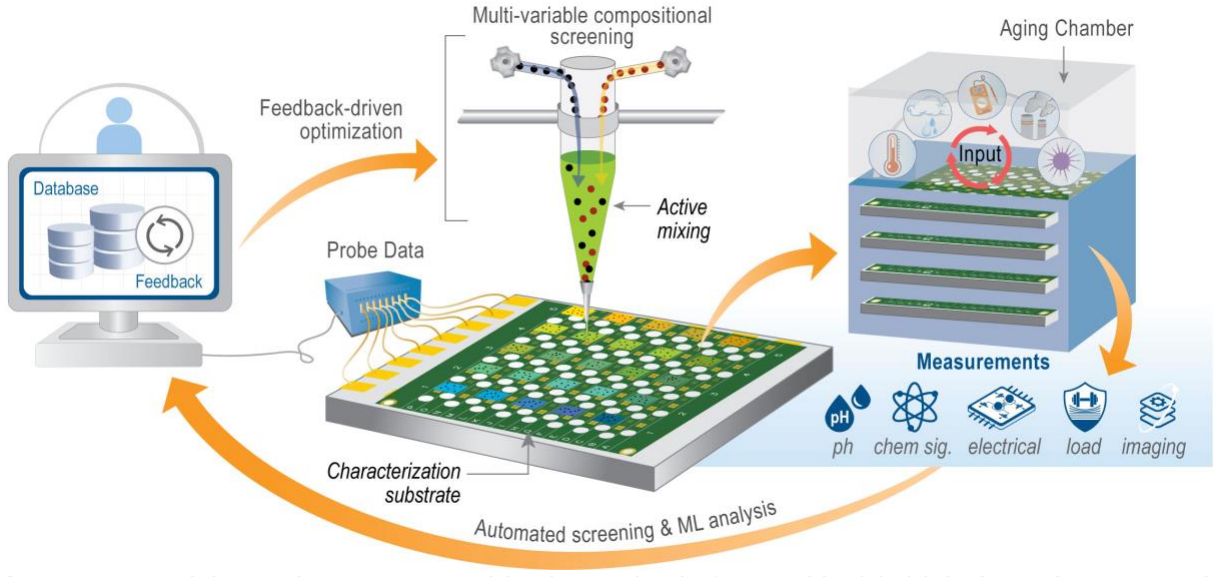

Figure 1. Studying-Polymers-On-a-Chip (SPOC) platform with (1) high-throughput material production via active mixing direct-ink-write, (2) an automated lifetime and aging assessment chamber—with in-situ characterization technologies and tunable temperature, humidity, voltage, gas, and light control—and (3) a living database and ML-driven feedback systems. SPOC will generate new knowledge about polymer membrane degradation to improve materials' performance and lifetimes.

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