Electropolymerization of copolymers for Use as Electrolytes in Lithium Ion Batteries
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Abstract

- Goal:
  - Deposition of polymethyl methacrylate – poly(ethyleneoxide) on a copper surface to demonstrate proof of concept to be applied on a 3 dimensional structure
  - Tested on both copper foils and sputtered copper samples
- Advantages in Lithium Ion Batteries
  - Higher energy density
  - Safer systems
  - Cost

Methods

- Cyclic Voltammetry
  - Voltage range: -1.0V to -1.8V
  - Scan rate: 25mV/s
  - Cycles: 150
- Surfaces Tested:
  - Copper foils
  - Sputtered Copper

Mechanism

Electropolymerization on Copper Foils

Fig 2. Left depicts copper foil that is unpolymerized while the right shows a sample after 150 cycles (-0.9V to -1.8V 10mV/s) the specks you see on the right sample may be the polymer deposition.

Electropolymerization on Sputtered Copper

Fig 3. Depicts the deposition on sputtered copper. Chunks are believed to be products of oxidization. Our decreasing current depicted in the CV graph shows that there is an insulating presence that formed as a result of increasing cycles that could be attributed to the oxidation.

Conclusions

- Despite the promising results on our CV graphs, we were unable to confirm the formation of polymer on our surface through our SEM images. The monomer was clearly polymerized as the solution turned yellow after numerous experiments were run. Some possible reasons why the polymer was unable to bind to the substrate include an oxidative coating forming on the surface of the substrate, the hydrogen evolution reaction happening too fast, and the interaction of the active environment with the radicalization reaction.

Further Work

- Running voltammetry experiments in an inert atmosphere
- Opting to fill pores rather than form a film