Characterizing Anti-Perovskite Films for Solid-State Electrolytes in Batteries

Gabriel Adams, Electrical Engineering
Mentor: Nicholas Rolston, Assistant Professor
School of Electrical, Computer, and Energy Engineering

Background
- Goal: create thin-film solid-state batteries
- Advantages over lithium-ion batteries: higher energy density, faster charging, increased safety, flexibility and durability
- Anti-perovskites are a class of material being explored for use as solid-state electrolytes due to their high ion conductivities

Process & Methods
- Ideally rapid, low-cost manufacturing processing

Preliminary Results
- Conductivity values:
  - $1.15 \times 10^{-7}$ S/cm unsintered
  - $4.07 \times 10^{-6}$ S/cm sintered in $N_2$
  - $3.12 \times 10^{-6}$ S/cm sintered in $O_2$
- Visually dense thin films
- XRD and EIS align with theoretical results

Challenges Faced
- Instability in atmosphere, particularly $Li_3OCl$
- Lack of literature on $Li_3ONO_3$
- Film density (see microscopy)
- Blade coating speed/temperature settings
- Accurately curve fitting conductivity data

Conclusion
Visually dense, uniform films of $Li_3ONO_3$ were created that match theoretical results and have an ion conductivity on the order of $10^{-6}$ S/cm, showing that this material is a strong candidate for use as an SSE.

References:
4. Wei Xu, Yang Zhao, Feipeng Zhao, Keegan Adair, Ruo Zhao, Shuai Li, Ruqiang Zou, Yucheng Zhao, and Xueliang Sun. Chemical Reviews 2022 122 (3), 3763-3819, DOI: 10.1021/acs.chemrev.1c00594