### Conclusions and Future Work

- The mechanical properties of sodium ion conductors can be tuned by controlling:
  - Extent of clay exfoliation
  - Pressure during pellet formation
  - Polymer content in clay composites
- Mechanical properties can be correlated with topographical features to further inform design decisions

### Future Considerations:
- Can MMT be used as an ion conductor in other battery chemistries?
- Can other polymers further improve mechanical properties in composites?
- Can MMT platelets be oriented preferentially in thru-plane direction?
- For details regarding conductivity see “Solid State Separator Development” poster by Erik Spoerke

### Acknowledgements
This work was done in collaboration with Sandia National Laboratories and was supported through the Energy Storage Program, managed by Dr. Imre Gyuk, within the U.S. Department of Energy’s Office of Electricity. Sandia National Laboratories is a multimission laboratory managed and operated by National Technology & Engineering Solutions of Sandia, LLC, a wholly owned subsidiary of Honeywell International Inc., for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA0003525. SAND No.: SAND2020-9554 C

### Mechanical properties of pellets can be controlled by:

- **Montmorillonite (MMT) structure** – water content, platelet orientation
- **Pellet preparation** – pressure, pellet thickness
- **Composition** – Polyethylene can be added to increase modulus/hardness

### Nanomechanical mapping

Small deformations made with an AFM cantilever can extract elastic modulus with sub-micron spatial resolution

Local mechanical properties can be correlated with surface features (pores, impurities, roughness)