



LC-BAT-14: HINDERING DENDRITE GROWTH IN LITHIUM METAL BATTERIES

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D3.1: SHE layer and its temperature control system

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5. Publishable Summary

Thermotropic liquid crystals are anisotropic liquids that in a given temperature range present properties of both liquid and solid materials. At high temperature, when the liquid crystal is in isotropic (or disordered) form, it is fully liquid, therefore it can be manipulated as an ink in printing or coating processes without additional solvents. However, if the required temperature is above 130 °C it may hinder the use of liquid crystals as such in said processes. In HIDDEN, we determined that by diluting the liquid crystal into a solvent, the processing temperature can be decreased by half, making it more suitable for roll to roll processes. Moreover, the addition of a solvent enhances the penetration of the liquid crystal electrolyte into the electrode's pores, a critical requirement to avoid residual voids, and thus to obtain an efficient charge transfer from the electrode to the electrolyte and vice versa. This can be monitored with cross sectional images taken from the electrode after electrolyte coating, see Figure 1.

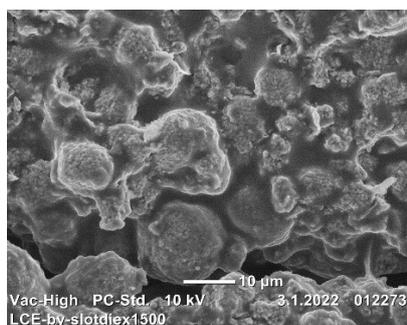


Figure 1 cross sectional image of electrode with liquid crystal electrolyte

One of the aims of HIDDEN is to take advantage of the phase transition of thermotropic liquid crystal to mitigate dendrite formation and growth on the surface of lithium metal. The latter is a promising replacement for the graphite anode but suffers from unstable Li plating during charge, which leads to formation of needle like structures, called dendrites, during repeated cycling of the battery. Dendrites can penetrate up to the cathode, causing a short circuit and a potential thermal runaway. To heat the battery up to the transition temperature of the thermotropic liquid crystal, a heating system is required either on the battery surface or inside the battery.