

Supporting Information for

Standardizing Critical Current Density Measurements in Lithium Garnets

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Supplementary Methods

240 mg of commercial $\text{Li}_{6.25}\text{Al}_{0.25}\text{La}_3\text{Zr}_2\text{O}_{12}$ powder (Ampcera, 500 nm nanopowder) was pressed into pellets with a diameter of 10 mm using a uniaxial press at 10 kN force. The surface was cleaned with SiC sand paper and the pellets were dried at 200 °C for 30 min to remove any moisture. Afterwards, they were introduced into an argon filled glovebox (Inert Corp., $\text{O}_2 < 0.1$ ppm, $\text{H}_2\text{O} < 0.1$ ppm) and heat-treated at 900 °C for 10 minutes to remove any Li_2CO_3 impurities. The pellets were sintered in a home-built ultra-fast sintering setup with a pre-heating step at 1000 °C for 20 seconds and the sinter step at 1200 °C for 120 seconds. Afterwards, the pellets were treated at 600 °C for two hours in oxygen atmosphere, to remove any carbonaceous impurities on the surface. Finally, the pellets were treated in Argon atmosphere at 900 °C for 10 minutes, again. A fresh piece of lithium from a rod (Sigma Aldrich, 99.9%) was cut and rolled into a foil with a thickness of about 200 μm and punched into electrodes with a diameter of 6 mm. The electrodes were attached with the help of an isostatic press at 1000 kN for three minutes.

The cells were tested inside the argon-filled glovebox with a BioLogic VMP-2 multichannel workstation. To record the critical current density, a current density of 0.02 mA cm^{-2} was applied and increased in steps of 0.02 mA cm^{-2} . Each step was limited to the chosen areal capacity limitation (ACL). The experimental data is shown in Figure S1. Instead of using the time on the x-axis, we chose to use the cumulative areal capacity. As a result, the data is easier to understand, as the width each cycle is the same.

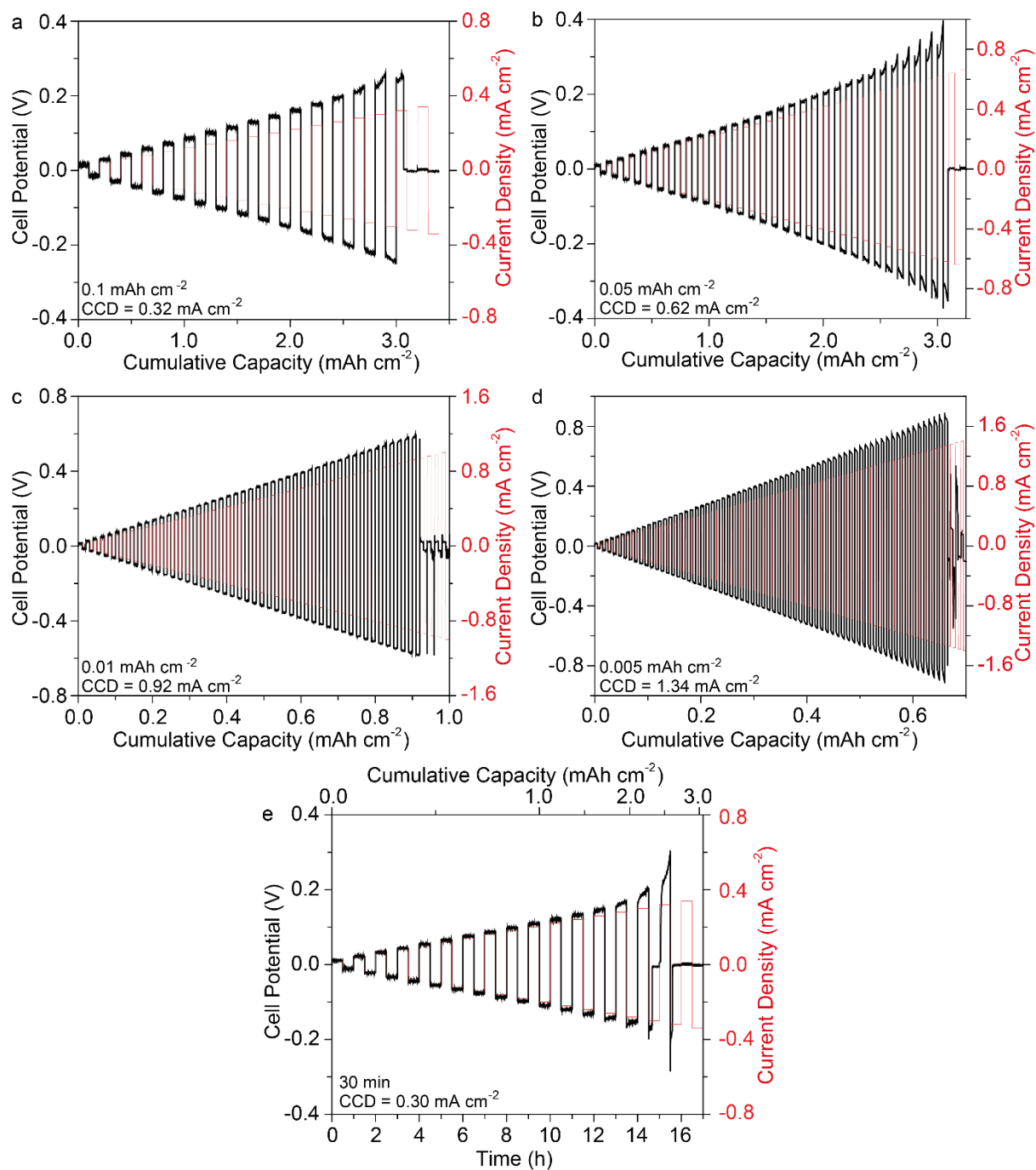


Figure S1. CCD voltage profiles of Li/LLZO/Li symmetrical cells measured with a different capacity/time limitation steps of 0.1 mAh cm⁻² (a), 0.05 mAh cm⁻² (b), 0.01 mAh cm⁻² (c), 0.005 mAh cm⁻² (d) and 30 min (e) per half-cycle.