

Supplementary Information

LiGaO₂-mediated grain boundary engineering in Ta-doped Li₇La₃Zr₂O₁₂ solid electrolyte

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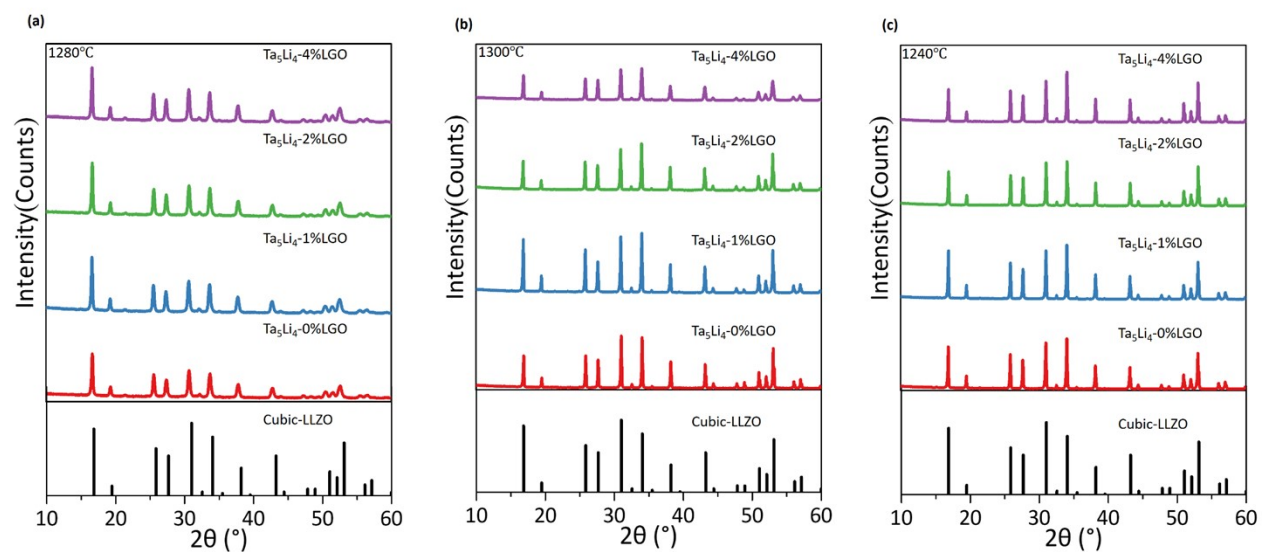


Fig. S1 X-ray diffraction (XRD) patterns of ceramics sintered at different temperatures.

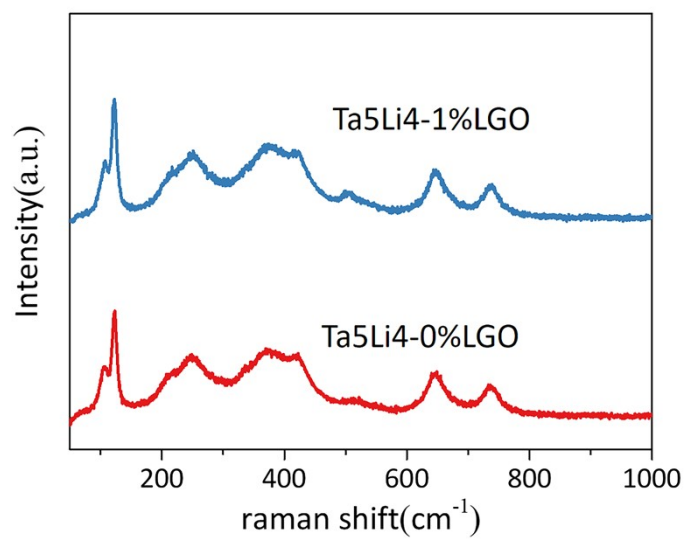


Fig. S2 Raman spectra of Ta₅Li₄-1%LGO and Ta₅Li₄ ceramics sintered at 1260 °C.

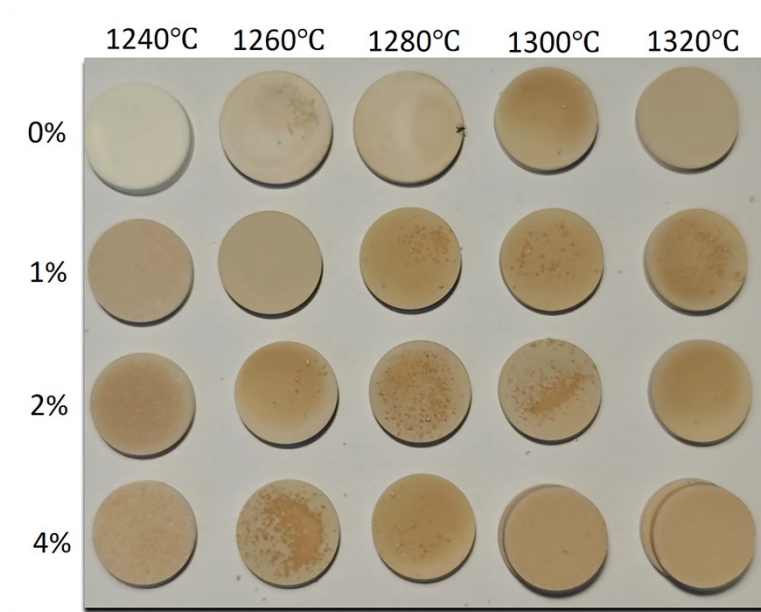


Fig. S3 Optical micrographs of $\text{TasLi}_4\text{-x\%LGO}$ ($x=0,1,2,4$) ceramics sintered at temperatures ranging from 1240 °C to 1320 °C.

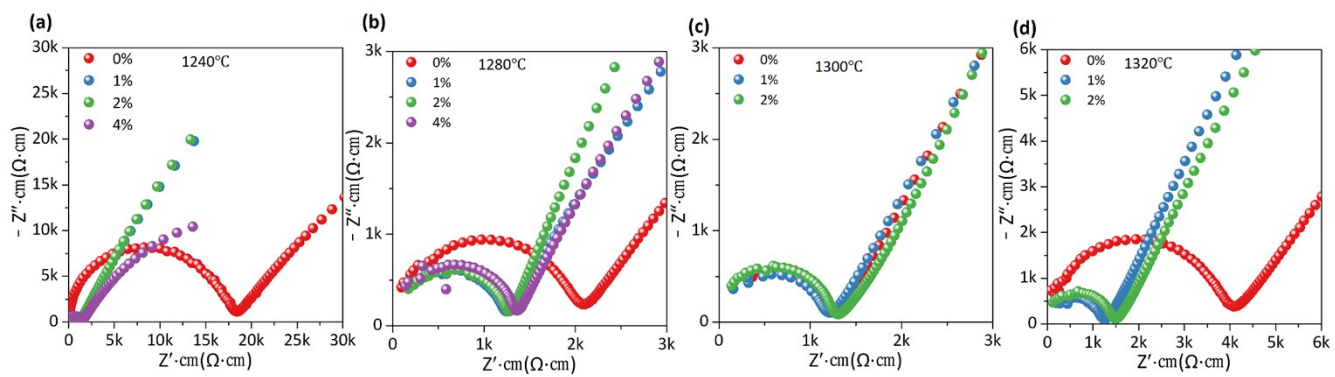


Fig. S4 EIS data at varying temperatures.

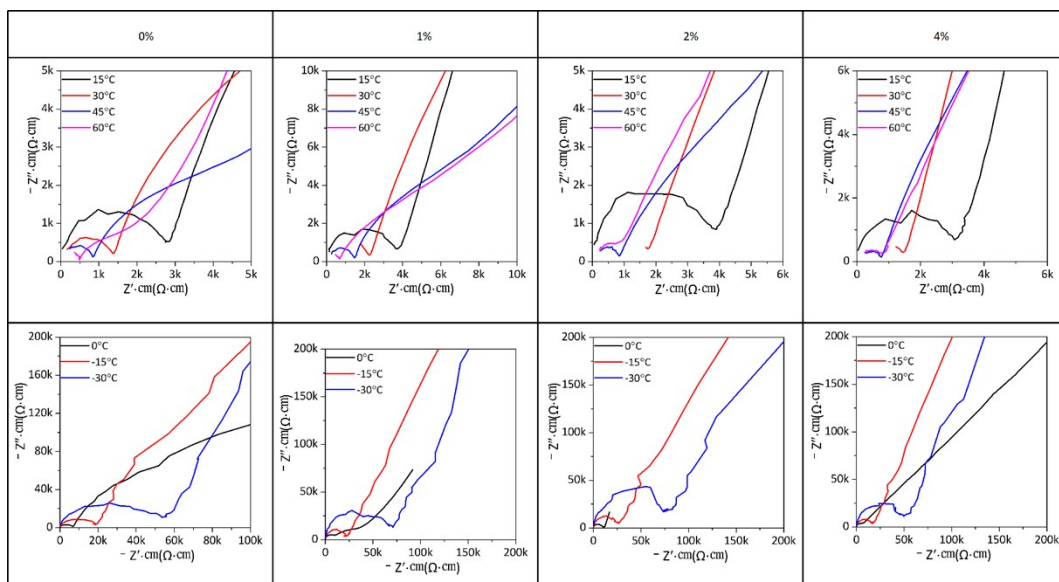


Fig. S5 Activation energy (E_a) from EIS of various TasLi_{4-x}%LGO.

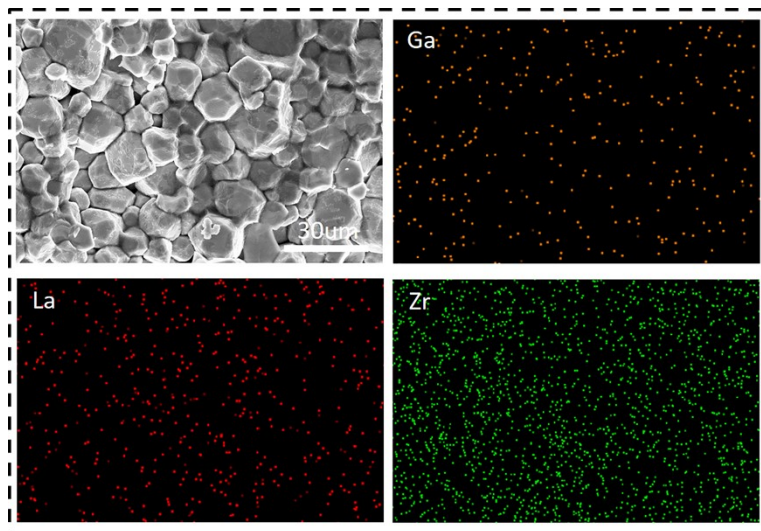


Fig. S6 Backscattered electron (SEM) image of TasLi₄-1 % LGO ceramic with overlaid EDS elemental maps: Ga L α (yellow), La L α (red), Zr K α (green).

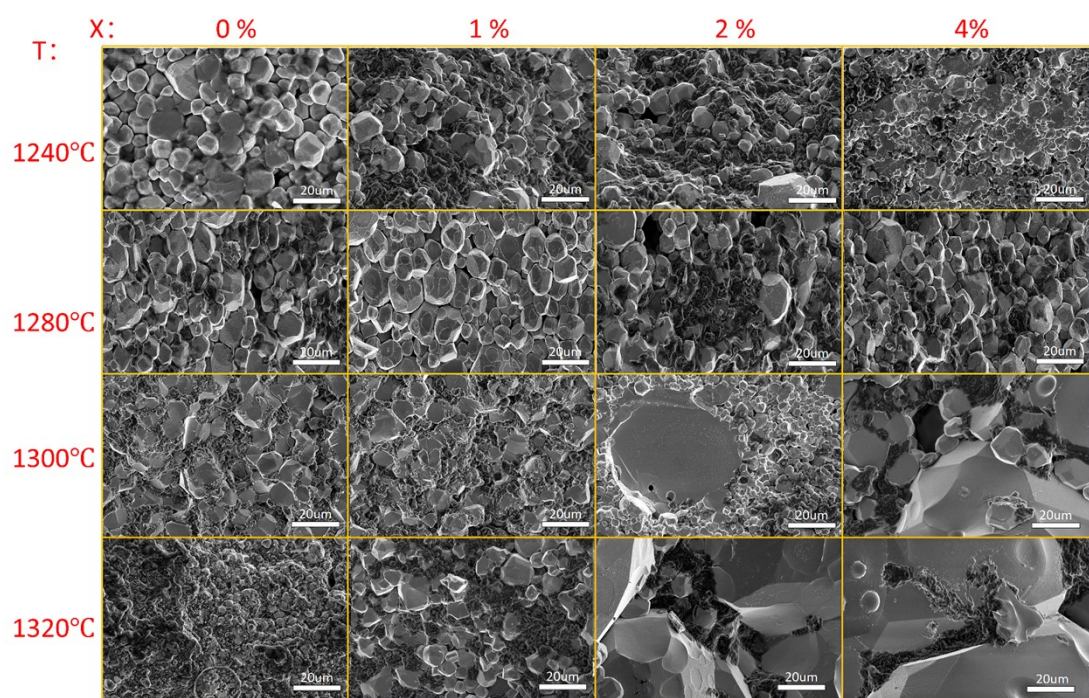


Fig. S7 SEM surface morphologies of $\text{Ta}_5\text{Li}_{4-x}\text{LGO}$ ($x = 0, 1, 2, 4$) ceramics sintered at 1240 °C, 1280 °C, 1300 °C, and 1320 °C.

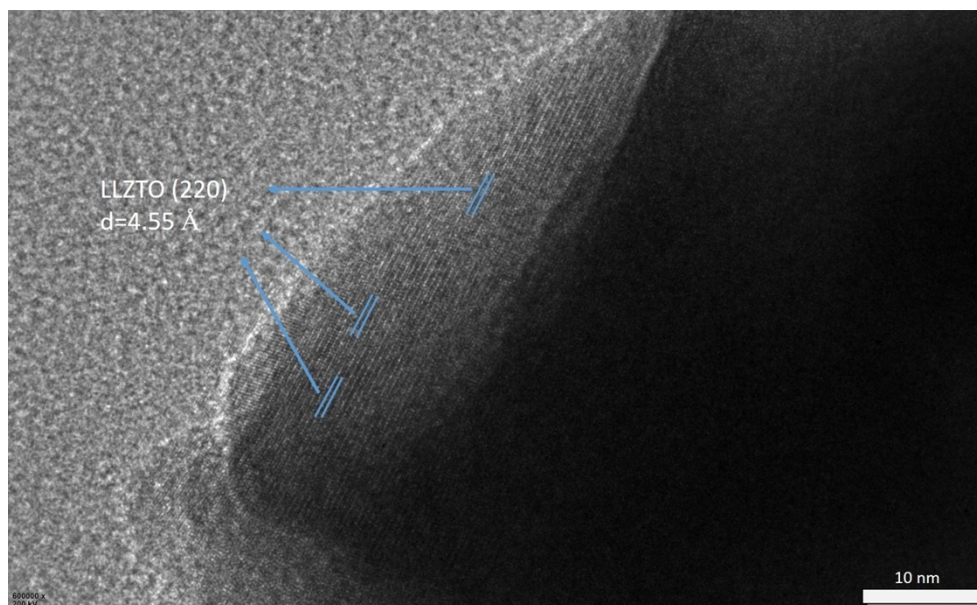


Fig. S8 The TEM image of Ta₅Li₄.

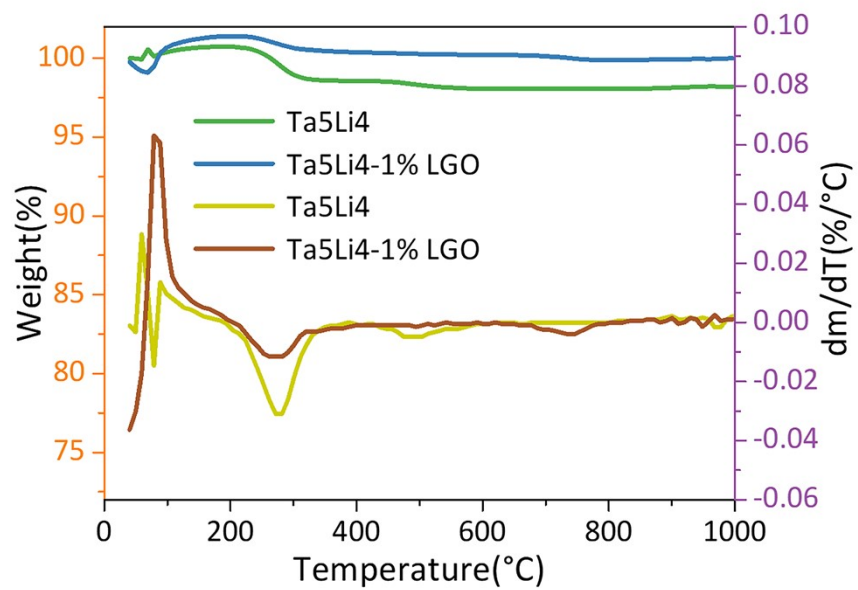


Fig. S9 Thermogravimetric analysis of the ceramic sample.

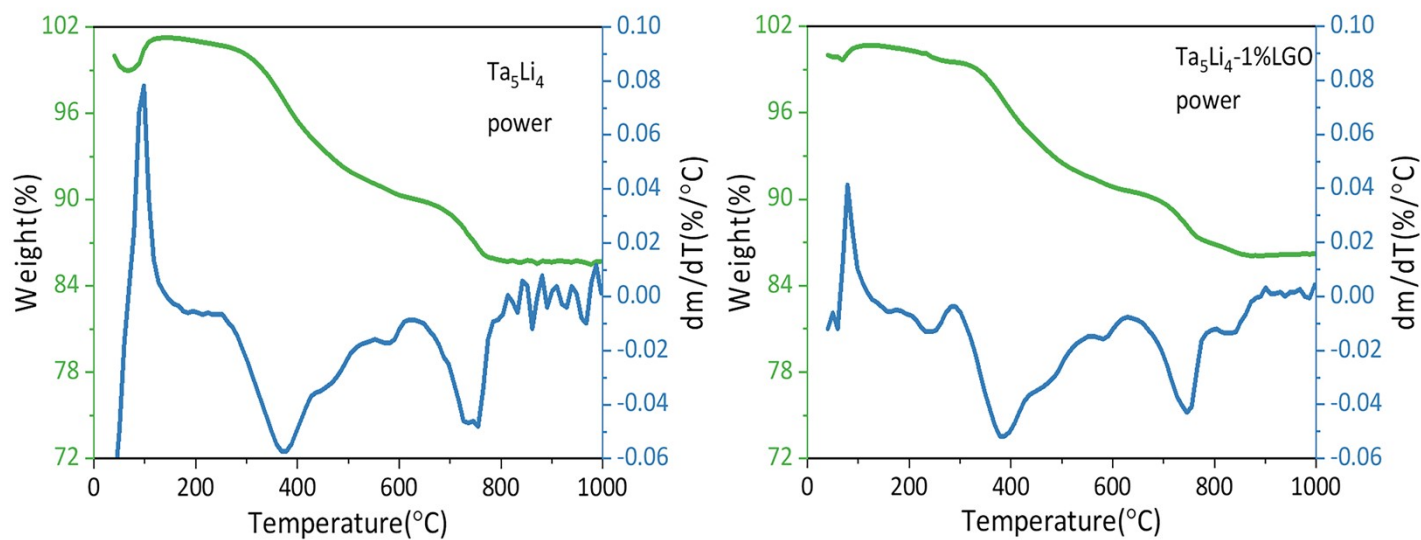


Fig. S10 The thermogravimetry of Ta₅Li₄ and Ta₅Li₄-1LGO powder.

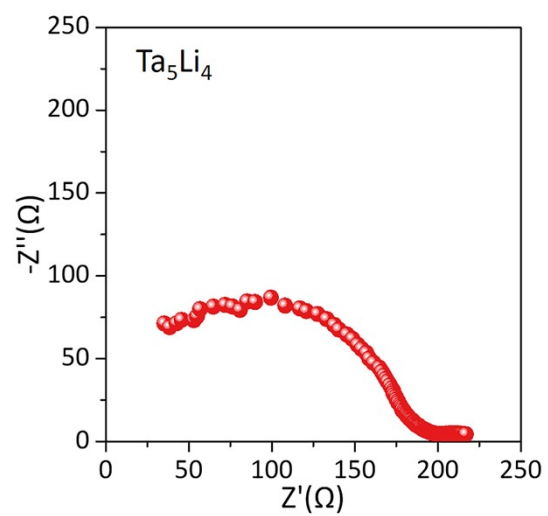


Fig. S11 EIS of Li| Ta_5Li_4 |Li Battery.

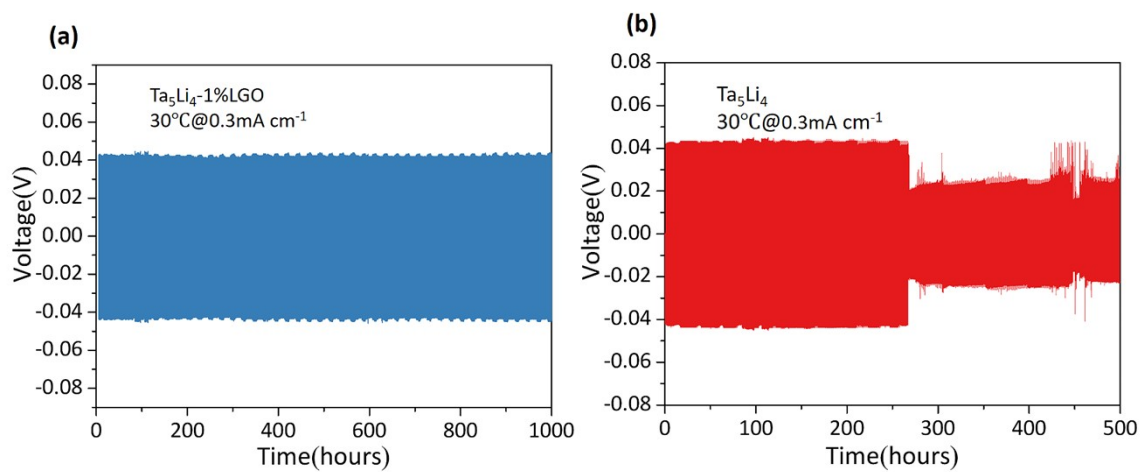


Fig. S12 Voltage profiles during lithium cycling at 0.3 mA cm^{-2} for (a) $\text{Ta}_5\text{Li}_4\text{-1\%LGO}$ and (b) Ta_5Li_4 ceramic.

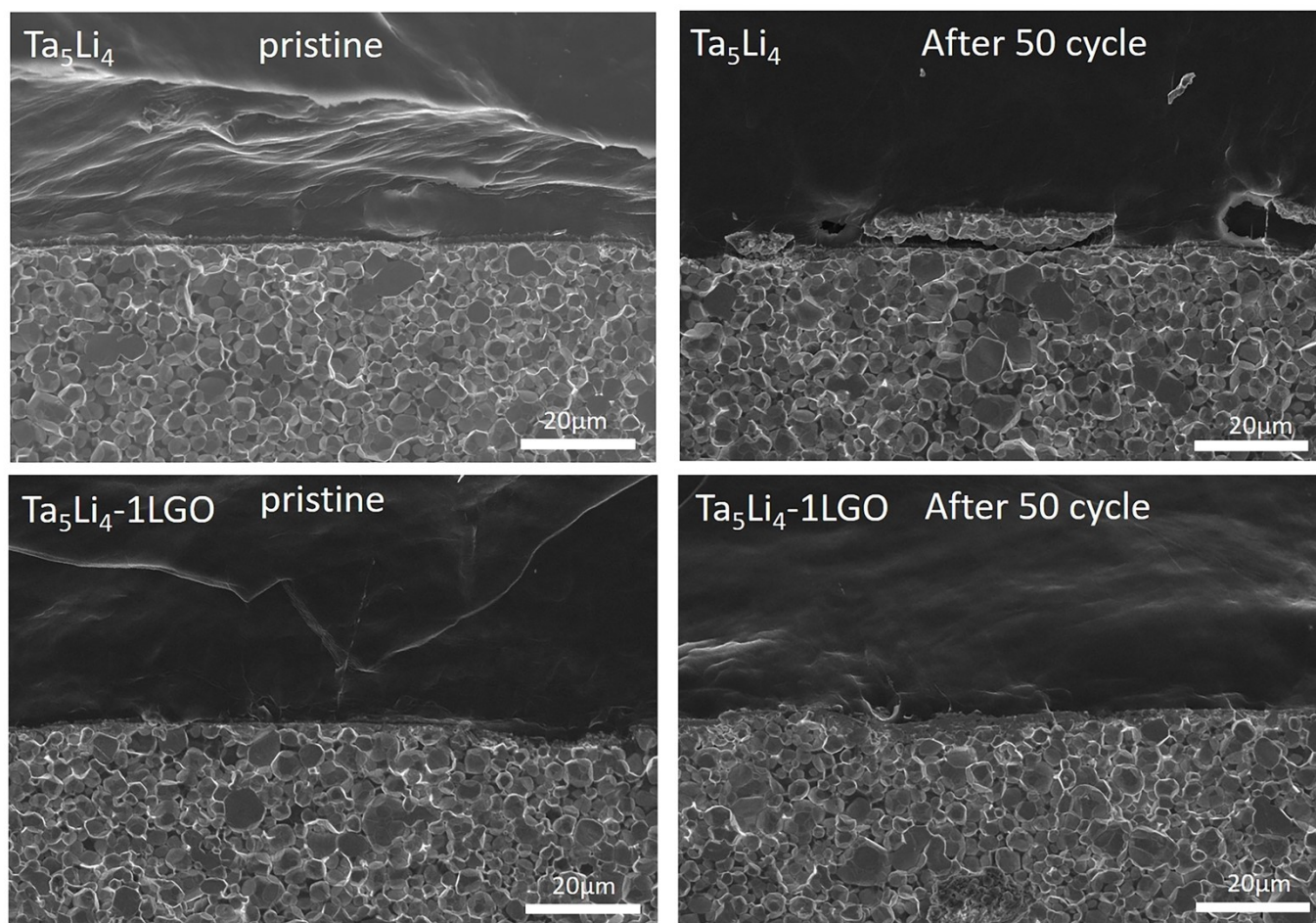


Fig. S13 SEM of the Li/Ta₅Li₄ interface before and after lithium cycling.

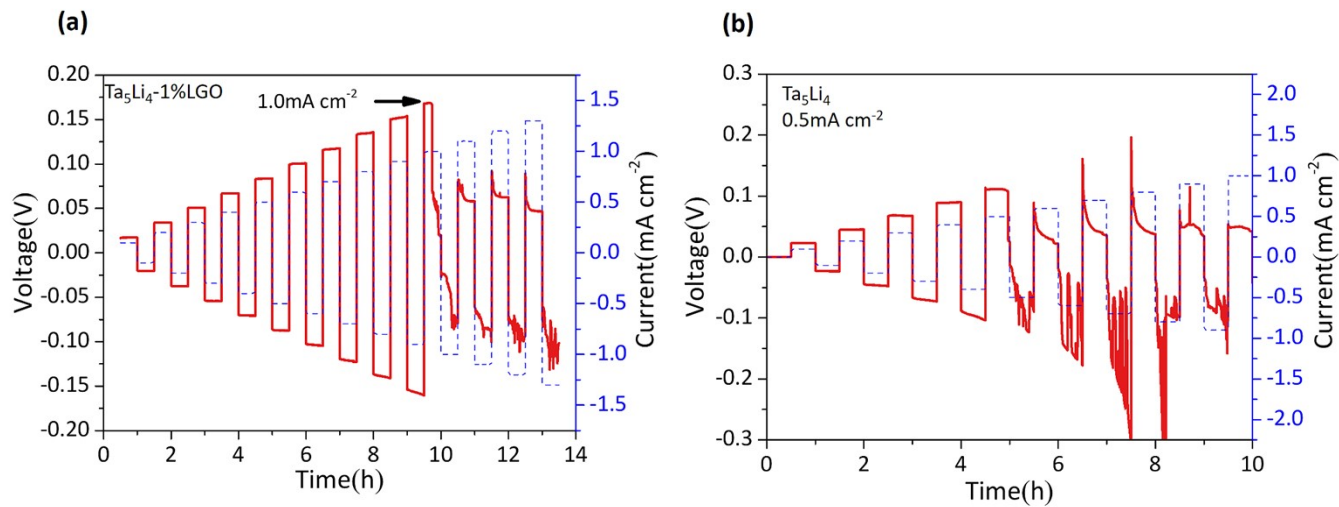


Fig. S14 Constant-current cycling (CCD) of Li symmetric cells: Li| Ta_5Li_4 -1%LGO|Li and Li| Ta_5Li_4 |Li.

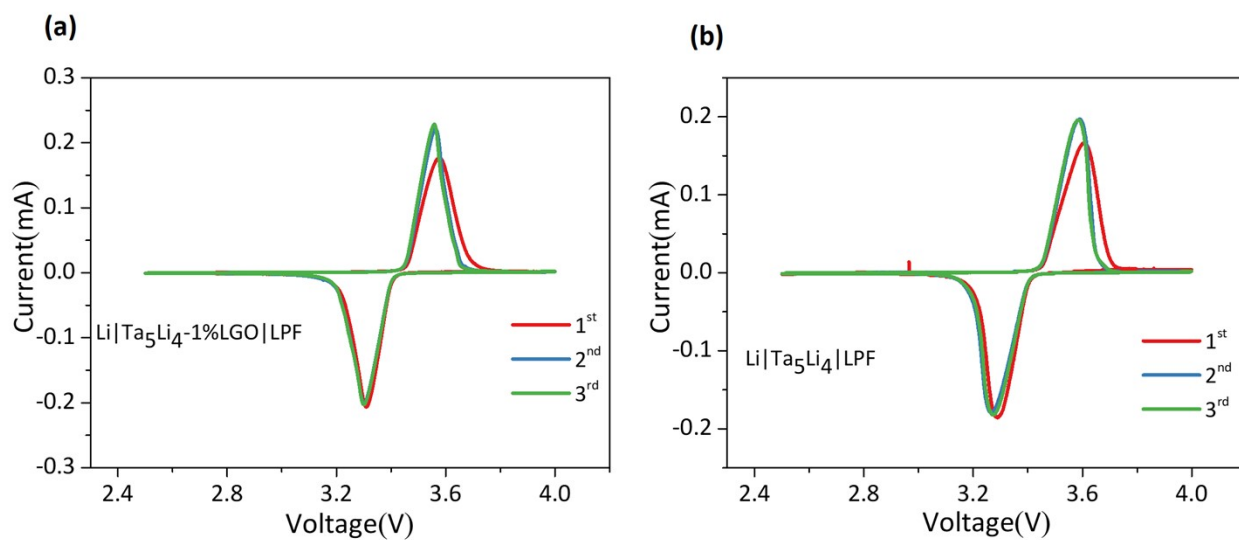


Fig. S15 Cyclic voltammetry (CV) testing for full cells with Li|Ta₅Li₄-1%LGO|LFP and Li|Ta₅Li₄|LFP.

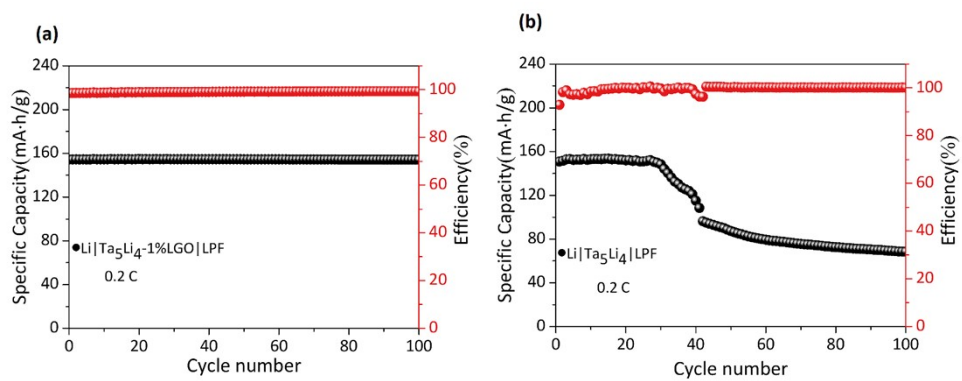


Fig. S16 Specific capacity and coulombic efficiency of $\text{Li}|\text{Ta}_5\text{Li}_4\text{-1\%LGO}|\text{LFP}$ and $\text{Li}|\text{Ta}_5\text{Li}_4|\text{LFP}$ full cells at 0.2 C.