

Description of Additional Supplementary Files

Supplementary Data 1

Atomic coordinates for Figure 1 are provided as VASP POSCAR format.

Supplementary Video 1

To evaluate the safety of the quasi-all-solid-state Li-metal batteries, a nail penetration test was conducted using a single pouch cell of capacity 100 mAh (Supplementary Video 1). After the first formation cycle at 4.5 V (vs. Li^+/Li) at 0.05 C, the cell was charged to SOC 40% (3.92 V) and then placed in a test chamber. A metal nail with a diameter of 3 mm was used to penetrate the cell at a speed of 5 mm/s, and the changes in the cell voltage were recorded during the test. The cell did not experience thermal runaway, emit smoke, ignite, or explode. Although a temporary short circuit occurred during the penetration test, the cell voltage returned to its initial value (3.92 V) after completion of the test.