# Supporting Information

## A Lattice-matched Interface between In-situ/Artificial SEIs Inhibiting SEI Decomposition for Enhanced Lithium Storage

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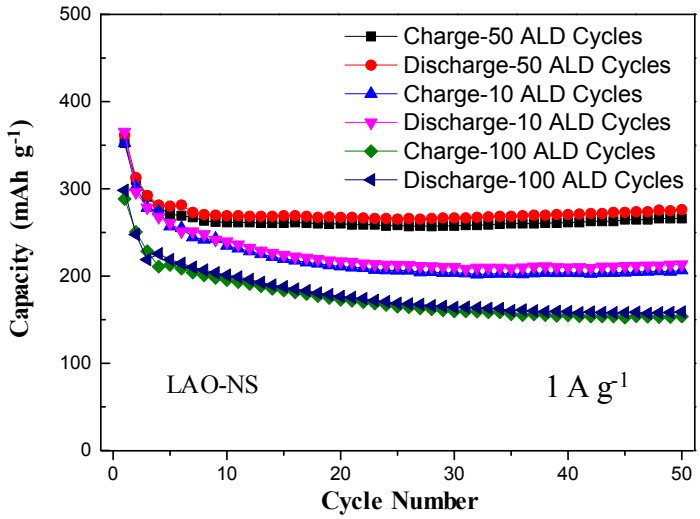


**Figure S1** Cycling performance at 1 A $g^{-1}$ of LAO-NS for 10, 50, 100 ALD cycles, respectively.

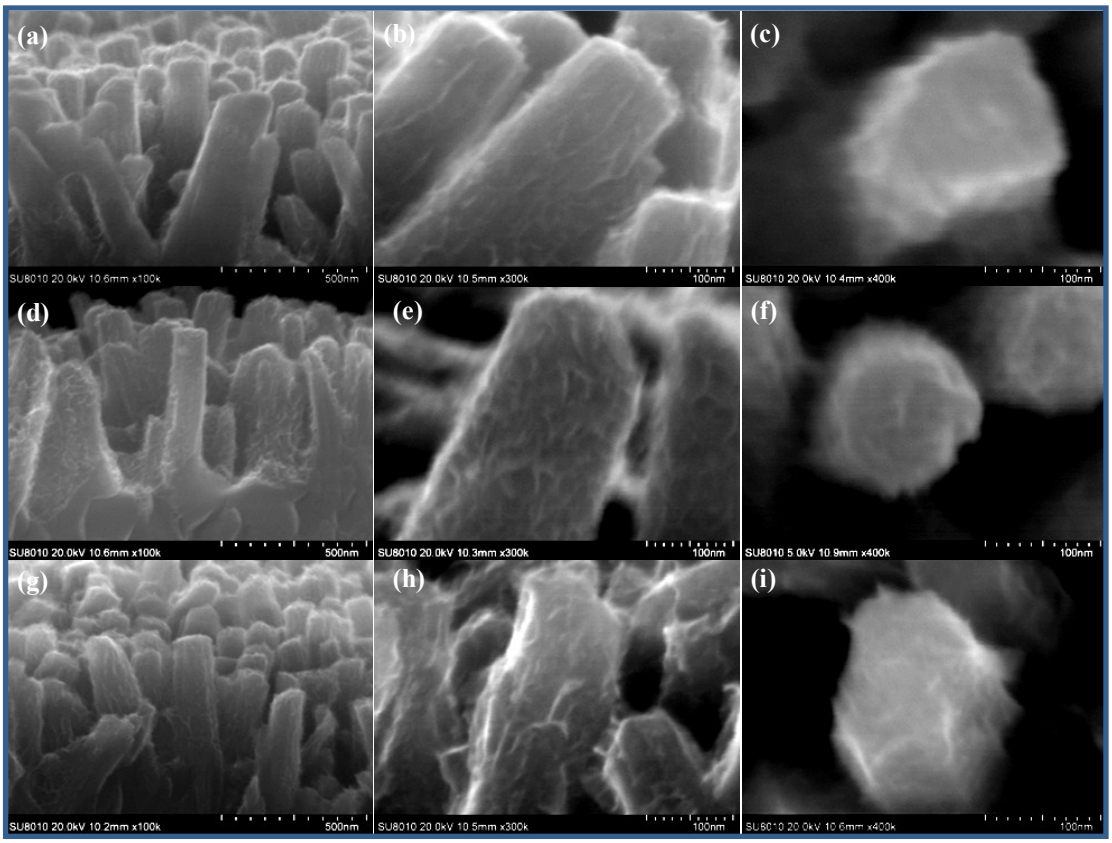


**Figure S2** Morphologies of (a, b, and c) NS, (d, e, and f) AO-NS, (g, h, and i) LAO-NS. (a, d, and g): side view, (b, e, and h): magnified side view, and (c, f, and i): top view of (NS, AO-NS, and LAO-NS), respectively.

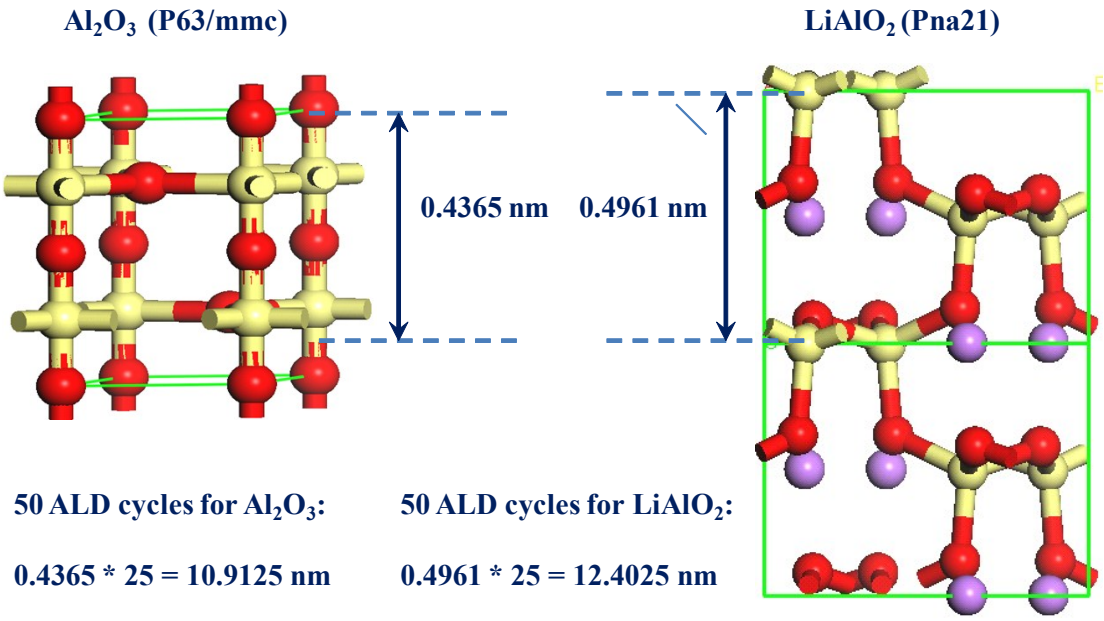


**Figure S3** Theoretical thickness calculation of $Al_2O_3$ with P63/mmc and $LiAlO_2$ with Pna21 for 50 ALD cycles.

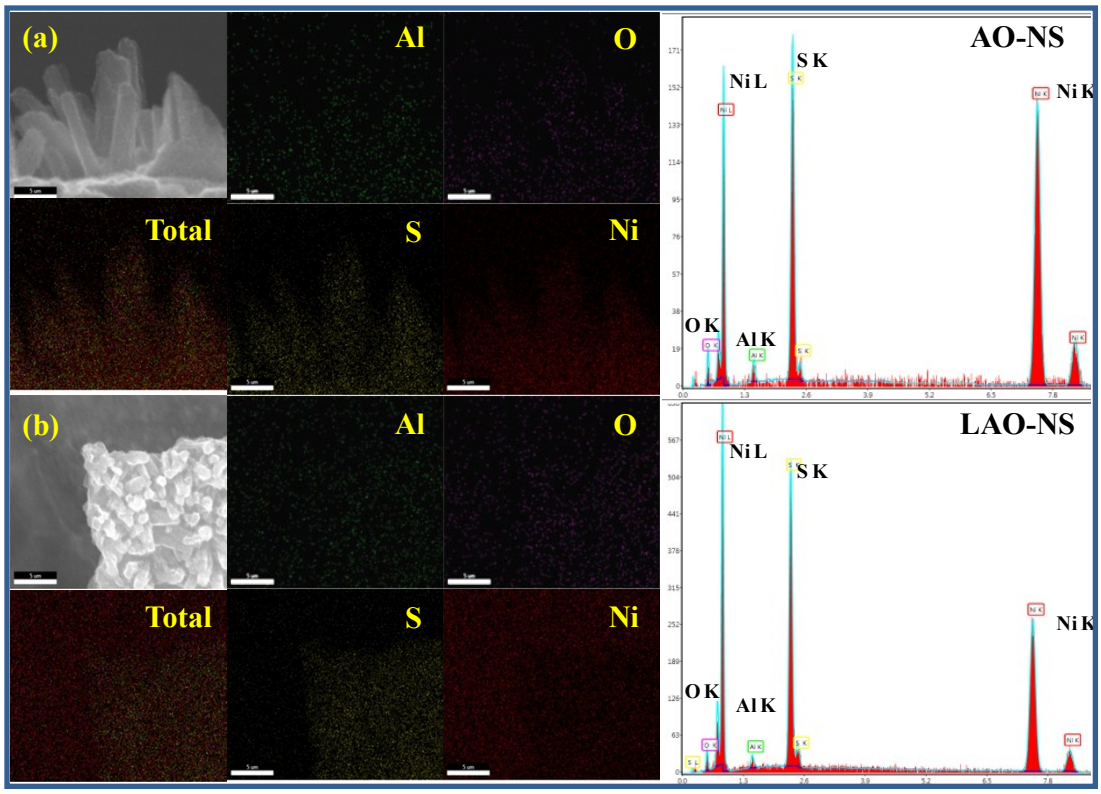


**Figure S4** EDS analysis of (a) AO-NS and (b) LAO-NS.

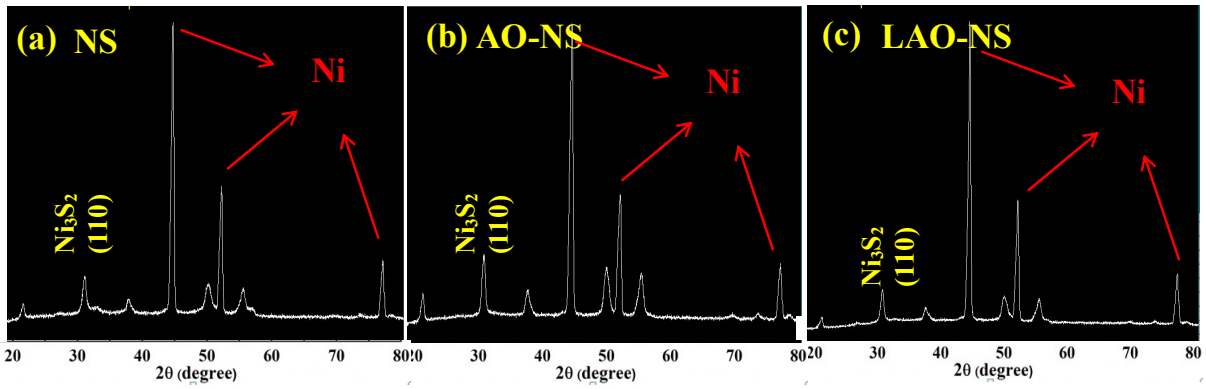


**Figure S5** XRD patterns of (a) NS, (b) AO-NS, and (c) LAO-NS, referring to heazlewoodite $Ni_3S_2$.

**Table S1.** Comparison of the capacity retention (refer to the capacity of the 2nd cycle) of ours LAO-NS to other reported nickel sulfide based electrodes for LIBs.

| **Capacity retention /%** | **Ours LAO-NS** | **Ref. 28** | **Ref. 30a** | **Ref. 30b** | **Ref. 30c** | **Ref. 30d** | **Ref. 30e** | **Ref. 30f** |
|---|---|---|---|---|---|---|---|---|
| **Current density (mA $g^{-1}$)** | 50 | 100 | 890 | 45 | 50 | 170 | 50 | 500 |
| **After 20 cycles** | 98.4 | | 80.8 | | | | 82.7 | |
| **After 60 cycles** | 98.5 | 89.0 | | | 90.3 | | | |
| **After 100 cycles** | 98.8 | | | 74.4 | | 95.3 | | 96.0 |

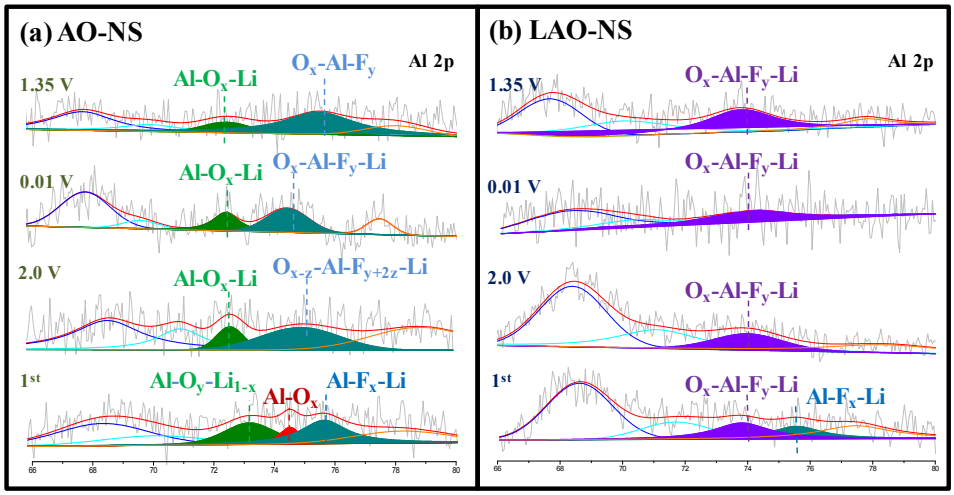


**Figure S6** Al 2*p* High-resolution XPS spectra of (a) AO-NS and (b) LAO-NS after discharging to 1.35 V, 0.01 V, and recharging to 2.0 V and 3.0 V, respectively.

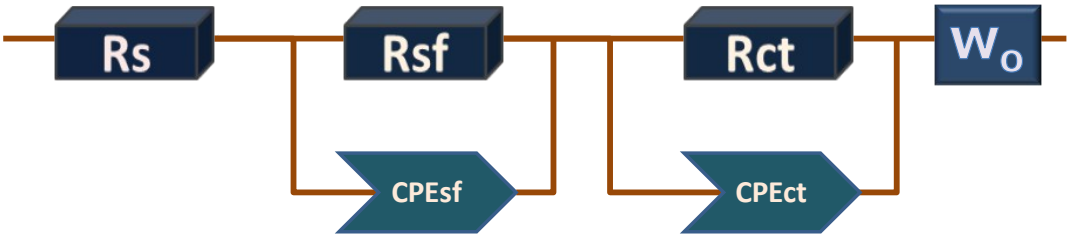


**Figure S7** Equivalent circuit used to simulate resultant Nyquist plots.

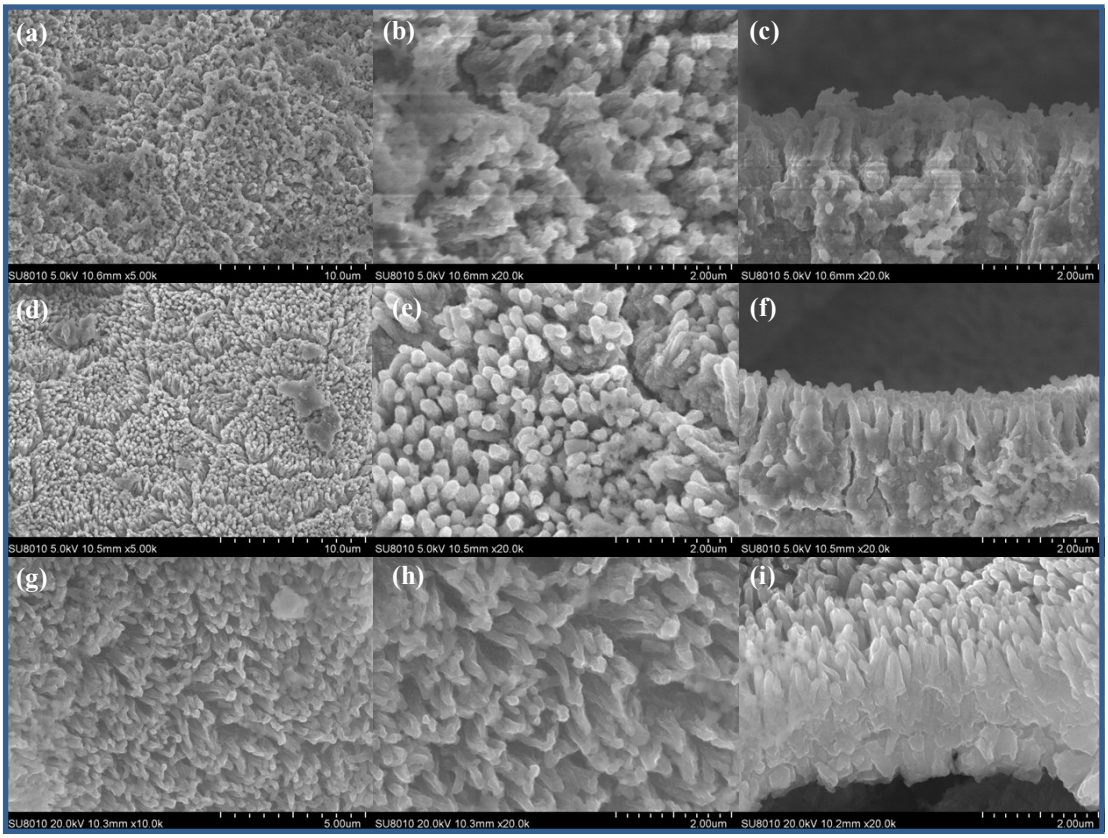


**Figure S8** Morphologies of (a, b, and c) NS, (d, e, and f) AO-NS, (g, h, and i) LAO-NS after 100 cycles. (a, d, and g): top view, (b, e, and h): magnified top view, and (c, f, and i): side view of (NS, AO-NS, and LAO-NS), respectively.