Supplementary Information (SI) for EES Batteries.

A Direct Upcycling Method of Spent NMC Cathode Material for High Performance Lithium Ion Batteries

Table S1. Compositions of Up-NCM, P-NCM, and D-NCM

Sample	Composition
Up-NCM-2	$Li_{1.156}Ni_{0.641}Co_{0.211}Mn_{0.189}O_2 - (LiAlO_2)_{0.03}$
P-NCM	$Li_{1.146}Ni_{0.644}Co_{0.216}Mn_{0.189}O_2$
D-NCM	$Li_{0.986}Ni_{0.643}Co_{0.217}Mn_{0.182}O_2$

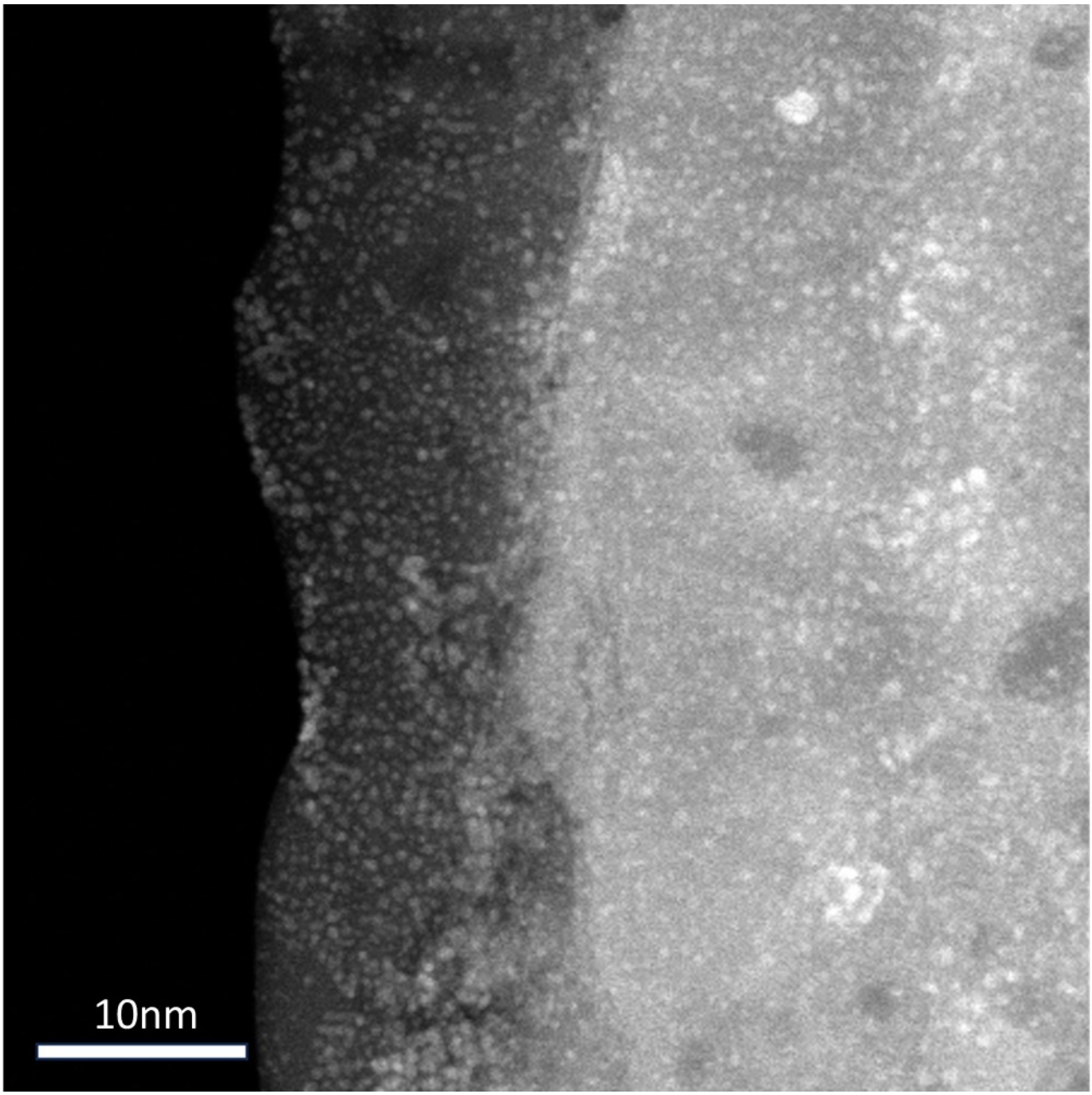

Figure S1. TEM image of Up-NCM-2

Table S2. Rietveld refinement data of Up-NCM

Peak	θ, °	d, Å	I
(003)	18.733	4.7330	2860
(101)	21.344	4.1600	64
(102)	31.786	2.8138	20
(200)	34.066	2.6297	16
(101)	36.729	2.4449	1139
(006)	37.979	2.3672	115
(102)	38.385	2.3432	341
(104)	44.483	2.0350	2477
(105)	48.667	1.8694	339
(107)	58.676	1.5722	452
(108)	64.430	1.4449	654
(110)	65.009	1.4334	573
(113)	68.292	1.3723	369

Table S3. Rietveld refinement data of D-NCM

Peak	θ, °	d, Å	I
(003)	18.624	4.7605	3091
(101)	36.898	2.4341	1122
(006)	37.727	2.3825	109
(102)	38.534	2.3445	300
(104)	44.541	2.0354	2304
(105)	48.673	1.8692	322
(107)	58.594	1.5742	467
(108)	64.261	1.4483	558
(110)	65.330	1.4272	612
(113)	68.579	1.3673	419

Table S4. Rietveld refinement data of P-NCM

Peak	θ, °	d, Å	I
(003)	18.708	4.7393	2964
(101)	36.698	2.4469	1157
(006)	37.949	2.3691	129
(102)	38.350	2.3452	352
(104)	44.460	2.0361	2547
(105)	48.638	1.8705	349
(107)	58.680	1.5721	463
(108)	64.419	1.4452	600
(110)	65.973	1.4342	685
(113)	68.246	1.3731	411

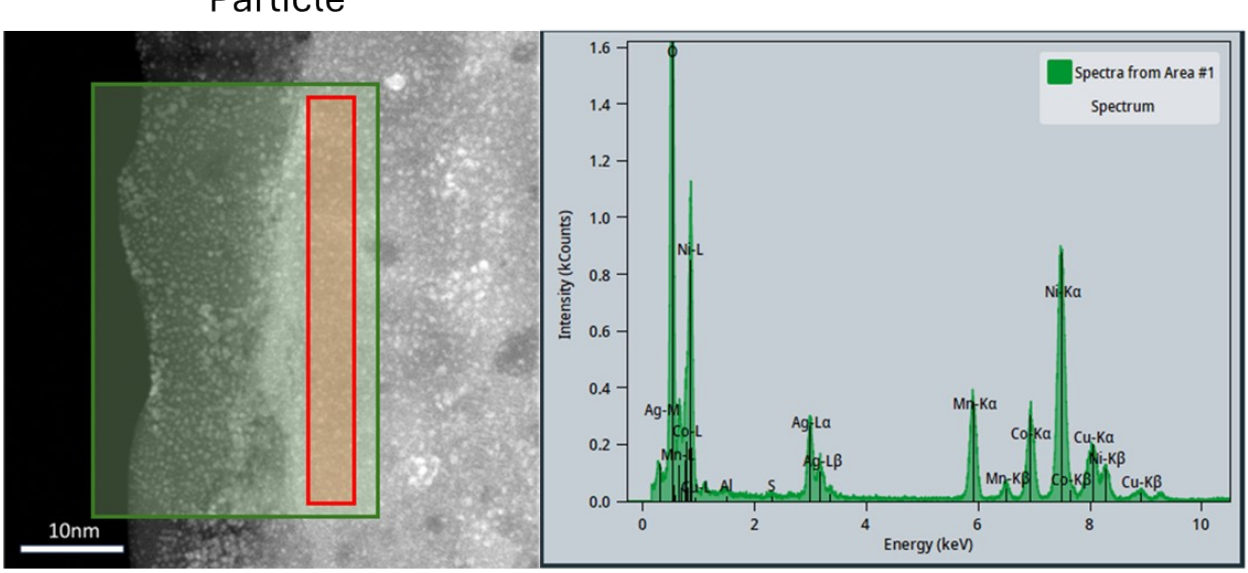

Figure S2. TEM image and elemental mapping results of inner NCM particle

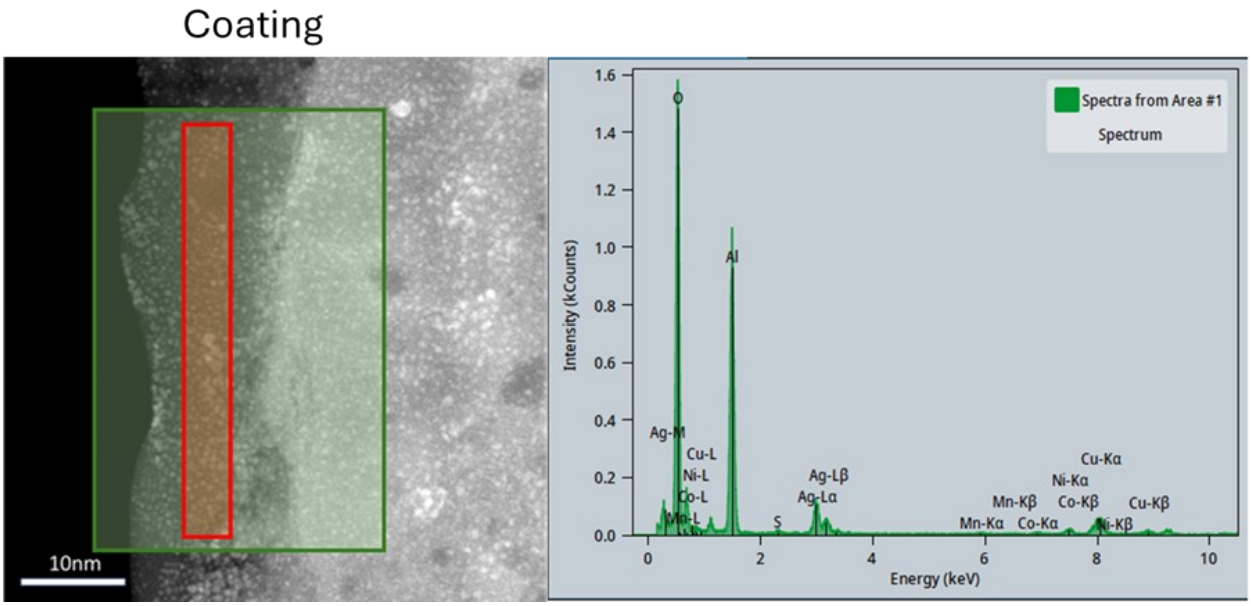

Figure S3. TEM image and elemental mapping results of outer LiAlO2 coating layer