Supporting Information

A closed-loop regeneration of $LiNi_{0.6}Co_{0.2}Mn_{0.2}O_2$ and graphite from spent battery via efficient lithium supplement and structural remodelling

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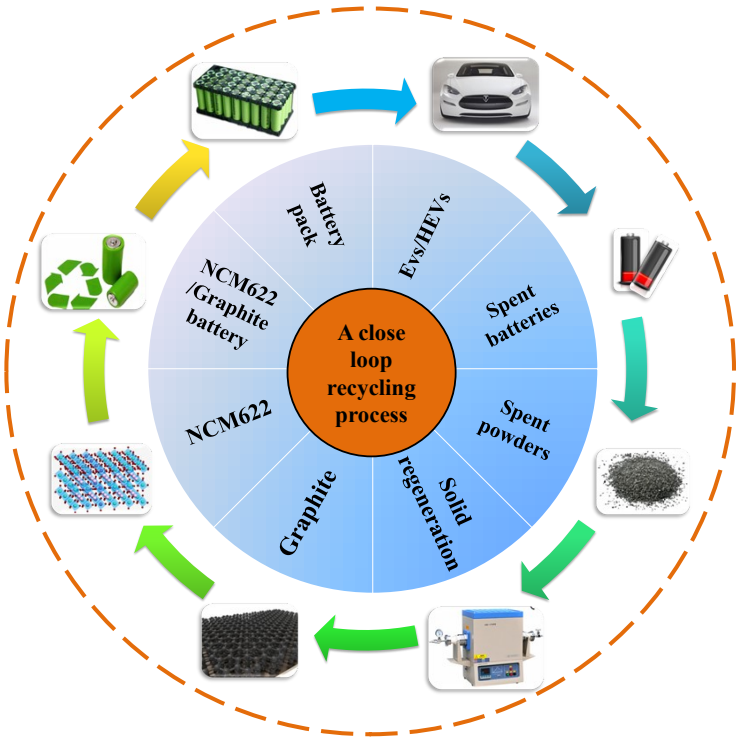

Fig. S1. The whole recycling and regeneration processes of NCM622 and graphite in this research.

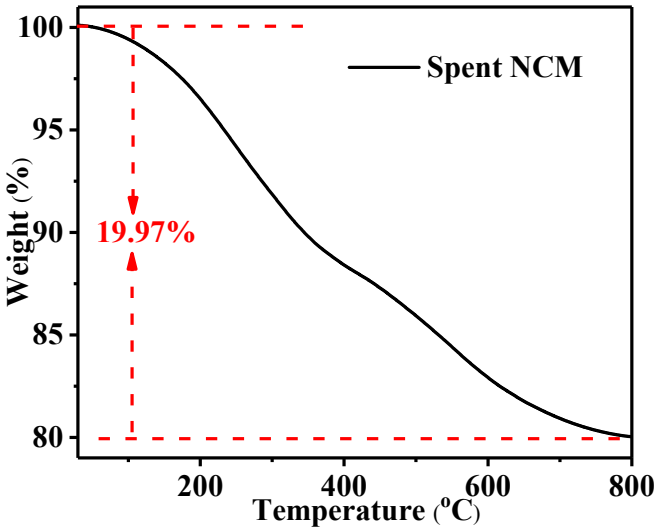

Fig. S2. TG curves of spent NCM622 sample in this experiment.

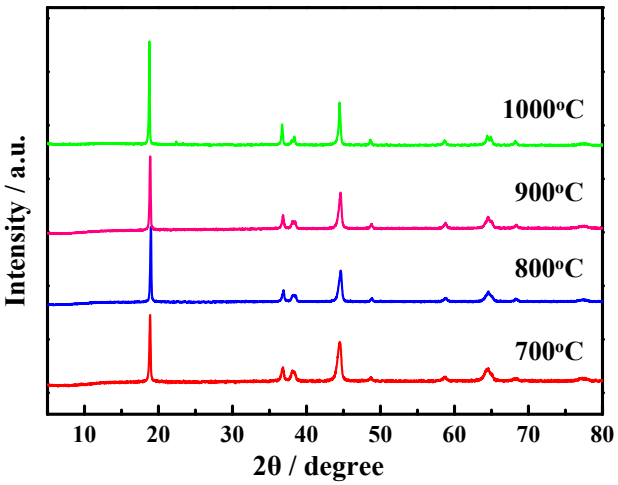

Fig. S3. XRD patterns of regenerated NCM samples at different temperatures.

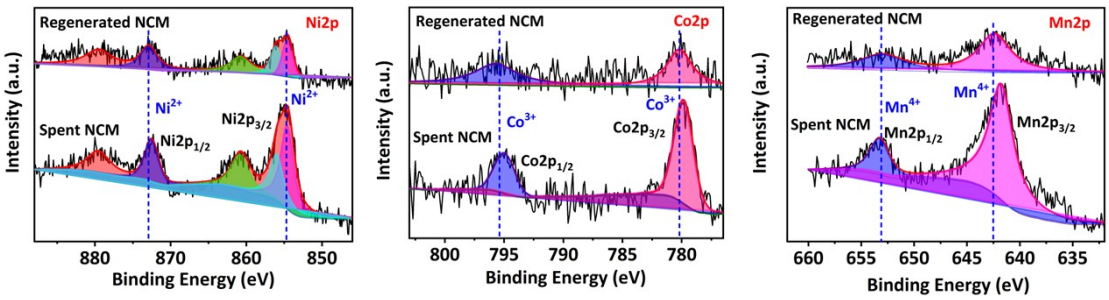

Fig. S4. XPS spectra of Ni2p, Co2p and Mn2p in the spent and regenerated NCM622 samples.

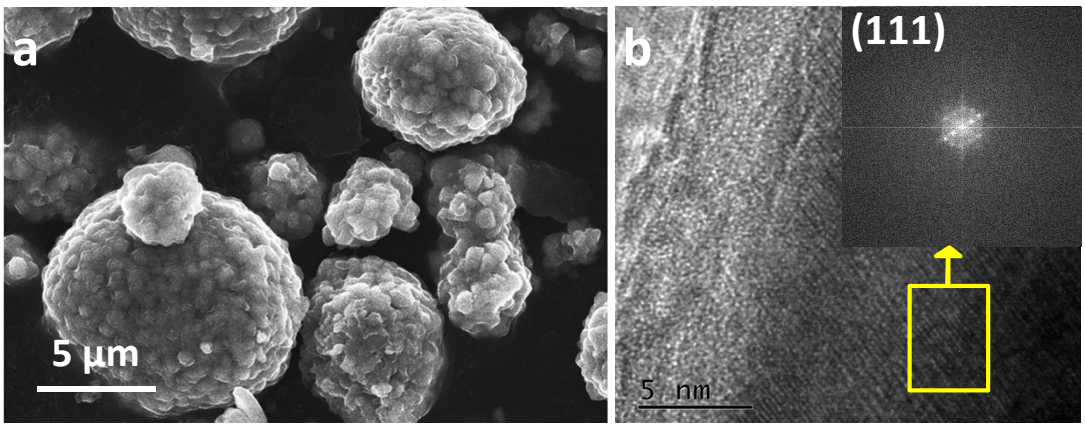

Fig. S5. (a) SEM and (b) HRTEM images of spent NCM622 sample.

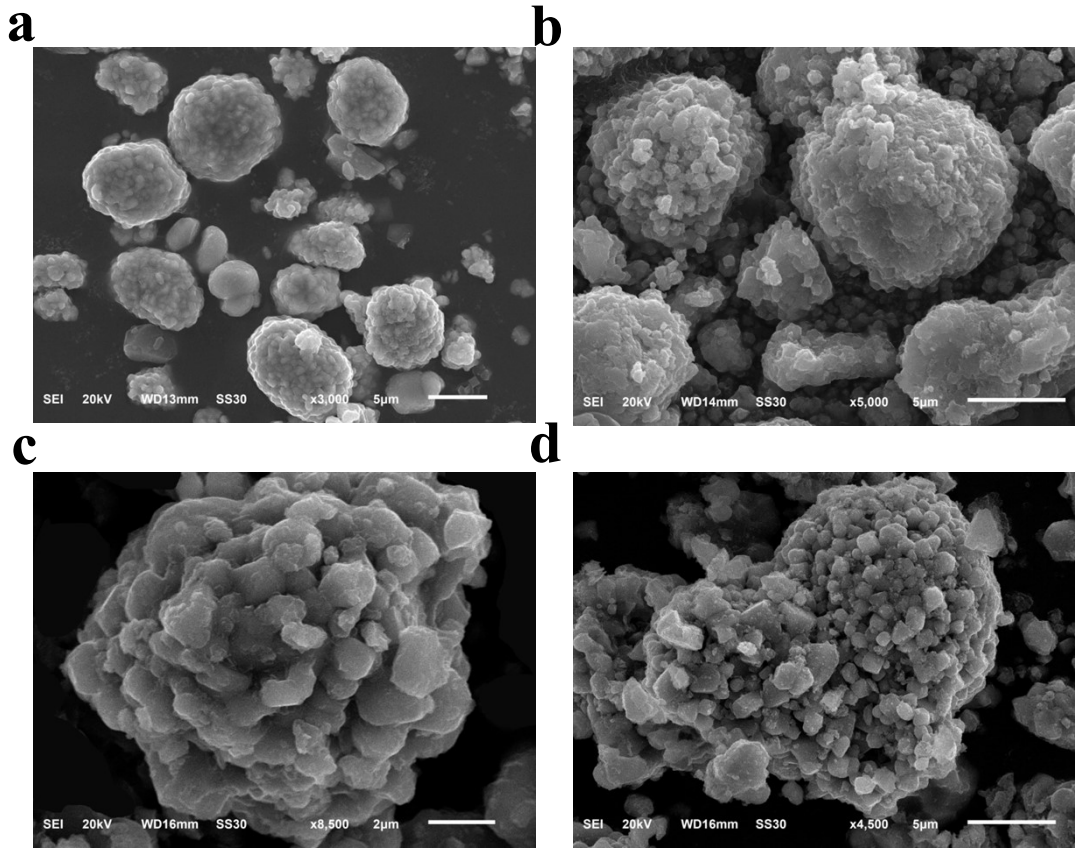

Fig. S6. SEM images of RN regenerated at (a) 700, (b) 800, (c) 900 and (d) 1000 ^{o}C.

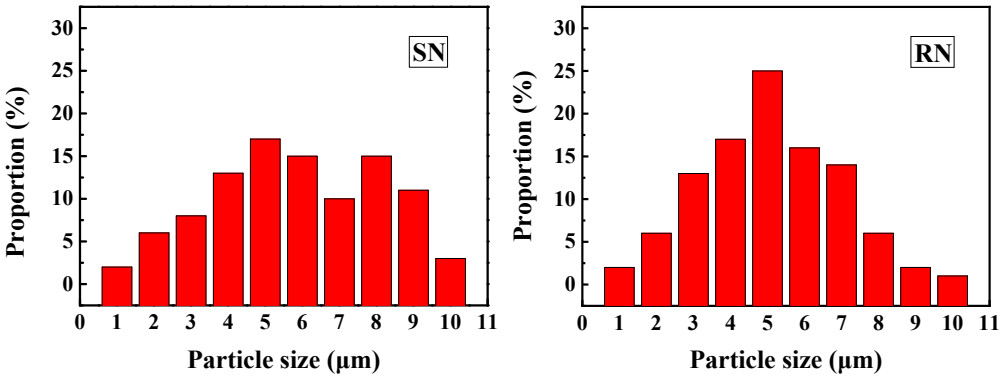

Fig. S7. Particle distributions of spent NCM622 and regenerated NCM622 samples (regenerated at optimal temperature).

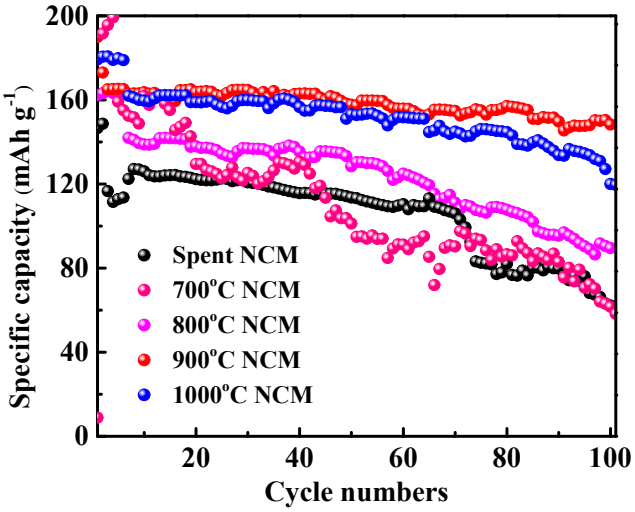

Fig. S8. Cycling performances of NCM materials regenerated at different temperatures.

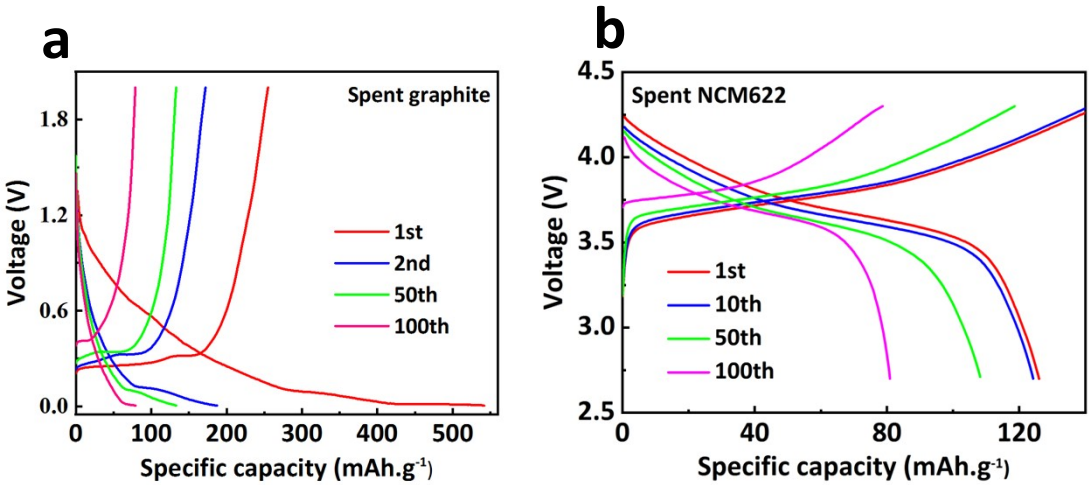

Fig. S9. Charge-discharge profiles of (a) spent graphite and (b) spent NCM622 half batteries at 0.2C in 1st, 10th, 50th and 100th cycle.

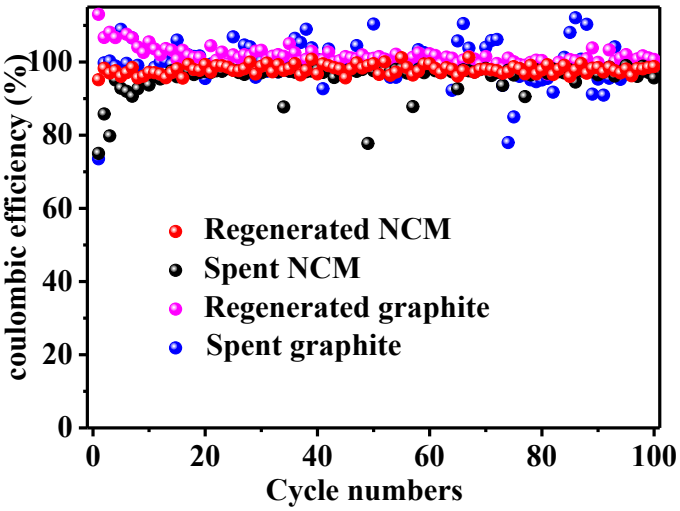

Fig. S10. Coulombic efficiency of RN, SN, RG and SG electrodes at 0.2C.

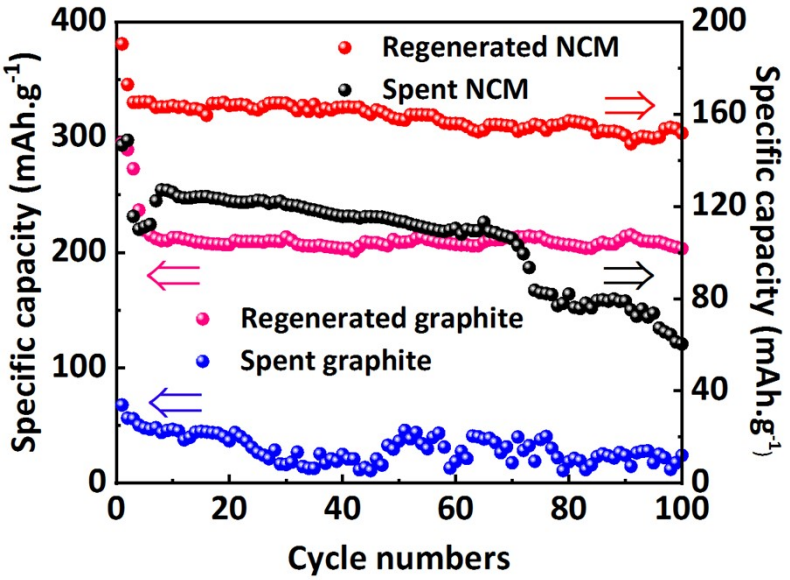

Fig. S11. Cycling performances of regenerated NCM622 and regenerated graphite half batteries at 1C.

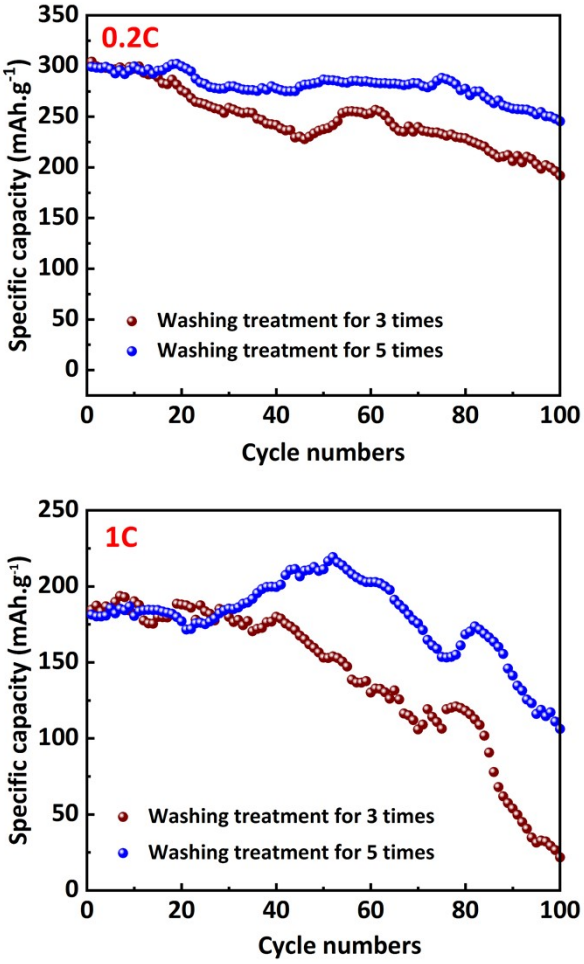

Fig. S12. Cycling performance of spent graphite electrodes after washing for 3 or 5 times.

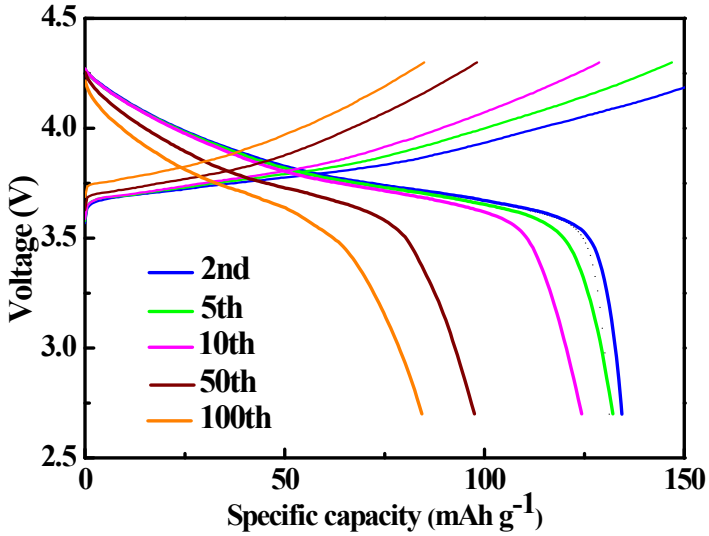

Fig. S13. Charge-discharge profiles of SN/SG full battery in the potential range of 2.7-4.3 V at 0.2C in 2nd, 5th, 10th, 50th and 100th cycle.

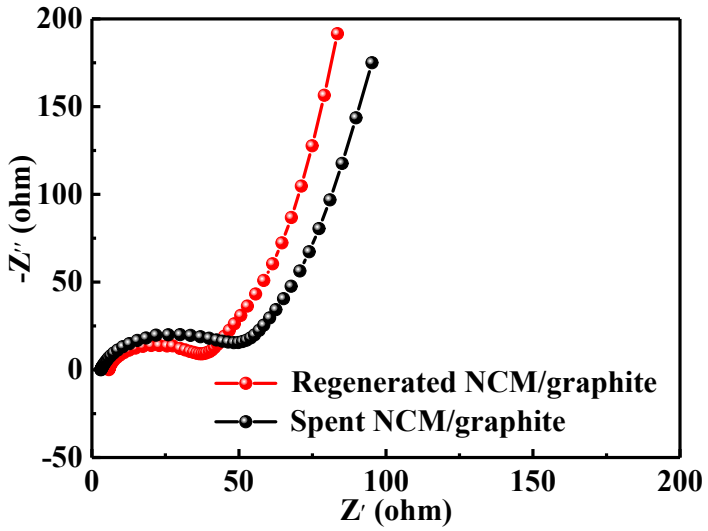

Fig. S14. Electrochemical impedance spectra of RN/RG and SN/SG full cells with an amplitude of 5.0 mV over the frequency range of 100 kHz-0.01Hz after the first cycle.

Table S1. Metal contents including Li, Ni, Co and Mn calculated based on ICP results of spent and regenerated NCM622.

Sample	Li	Ni	Co	Mn
Spent NCM	0.635	0.614	0.215	0.192
RN (T-700)	0.971	0.659	0.208	0.201
RN (T-800)	0.995	0.610	0.210	0.203
RN (T-900)	1.000	0.611	0.212	0.205
RN (T-1000)	1.000	0.610	0.211	0.204

Table S2. $I_{(006)}/I_{(012)}$ and $I_{(018)}/I_{(110)}$ values of XRD patterns from spent and regenerated NCM622 at different temperatures.

Sample	T-700	T-800	T-900	T-1000	Un-treated
$I_{(006)}/I_{(012)}$	1.89	1.88	2.12	2.03	1.65
$I_{(018)}/I_{(110)}$	1.06	1.07	1.13	1.10	0.89