Enhanced discharge capacity of thermorechargeable battery composed of Cd-PBA and potential-matched PBA

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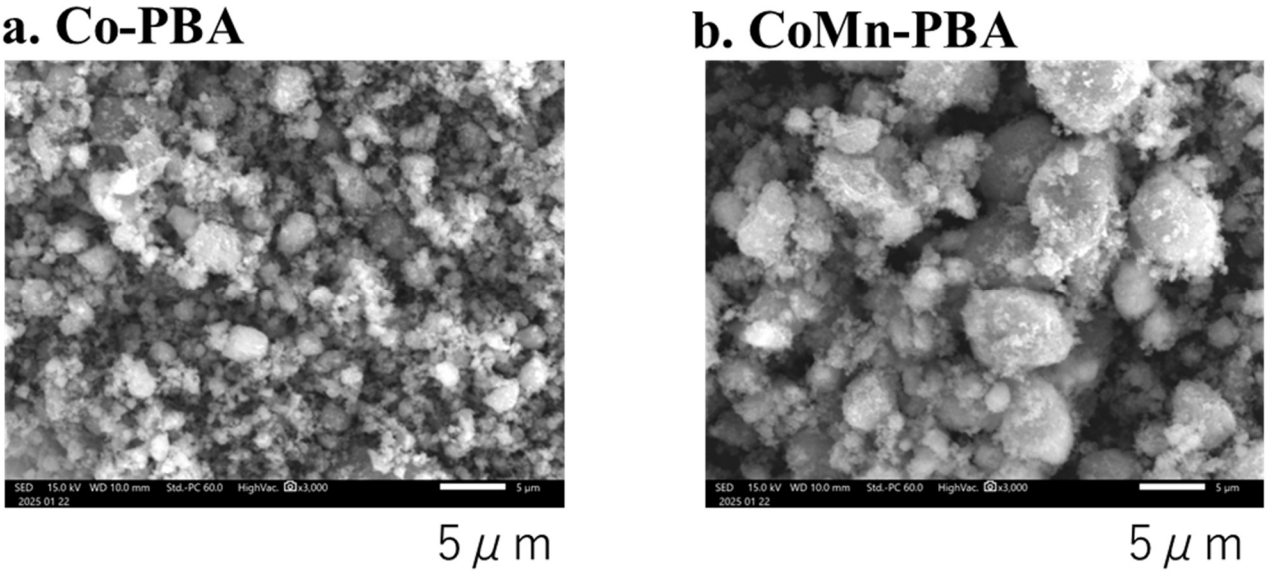

Fig. S1 SEM image of (a) CoMn-PBA and (b) Co-PBA

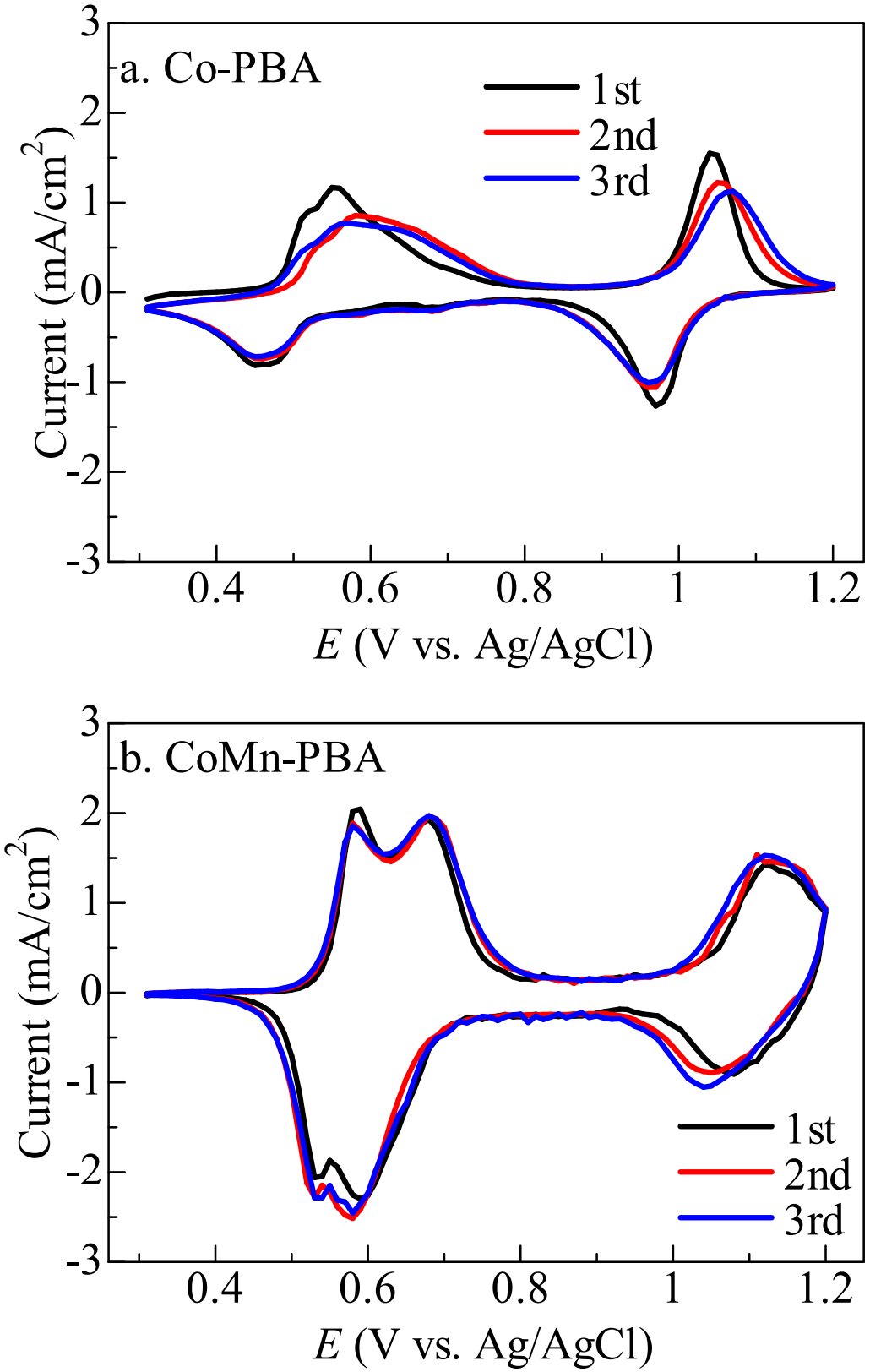

Fig. S2 Cyclic Voltammetry (CV) curve of (a) Co-PBA and (b) CoMn-PBA electrodes. The electrode area was 1.0 cm^2. The sweep rate of potential E was 1.0 mV/s.

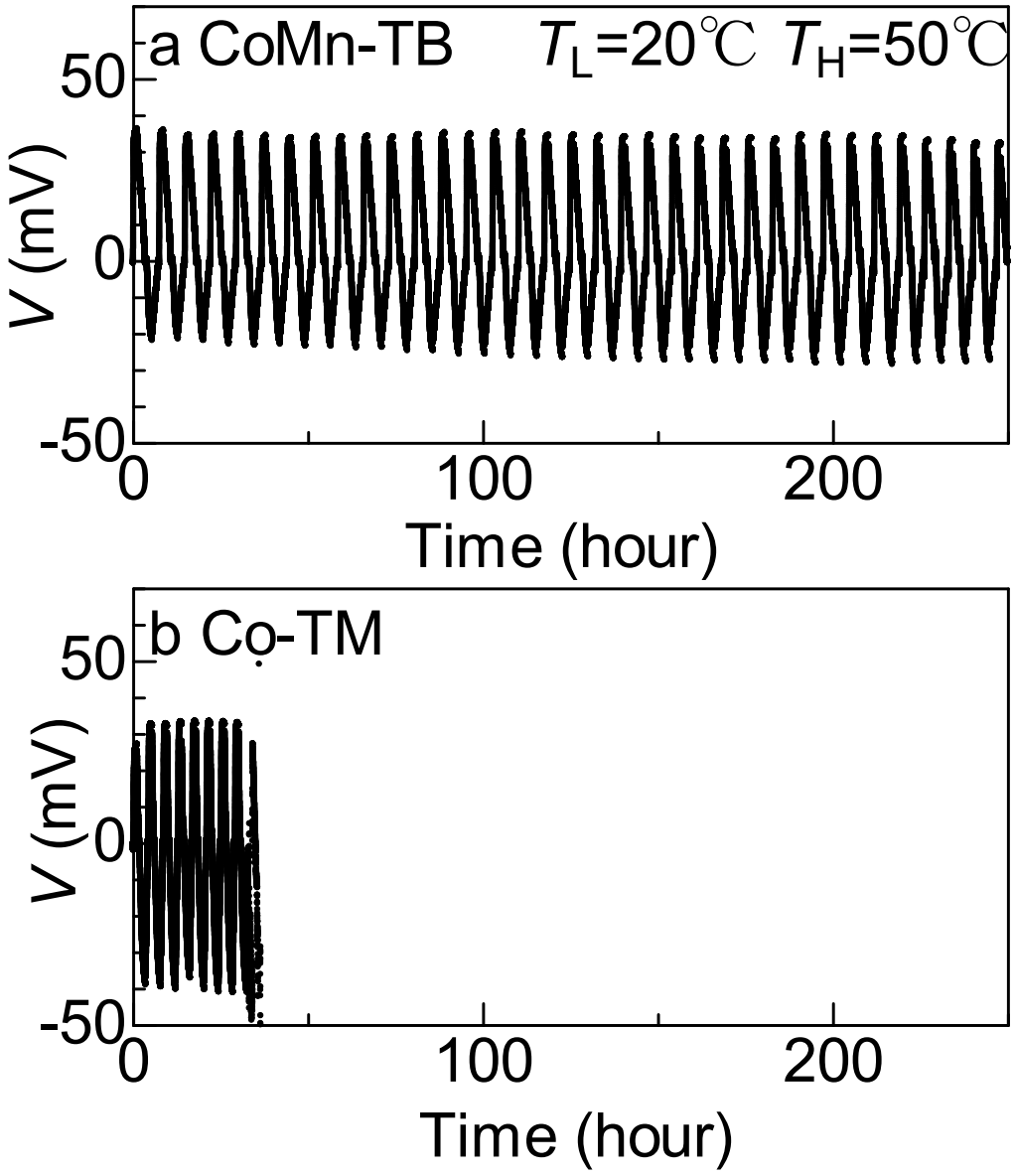

Fig. S3 Electromotive force V against time during the thermal cycle test between T_L (= 20 C°) and T_H (= 50 C°) in (a) CoMn-TB and (b) Co-TB. The thermal cycle test consists of four processes, i.e., heating from T_L to T_H, discharge at T_H, cooling from T_H to T_L, and discharge at T_L.

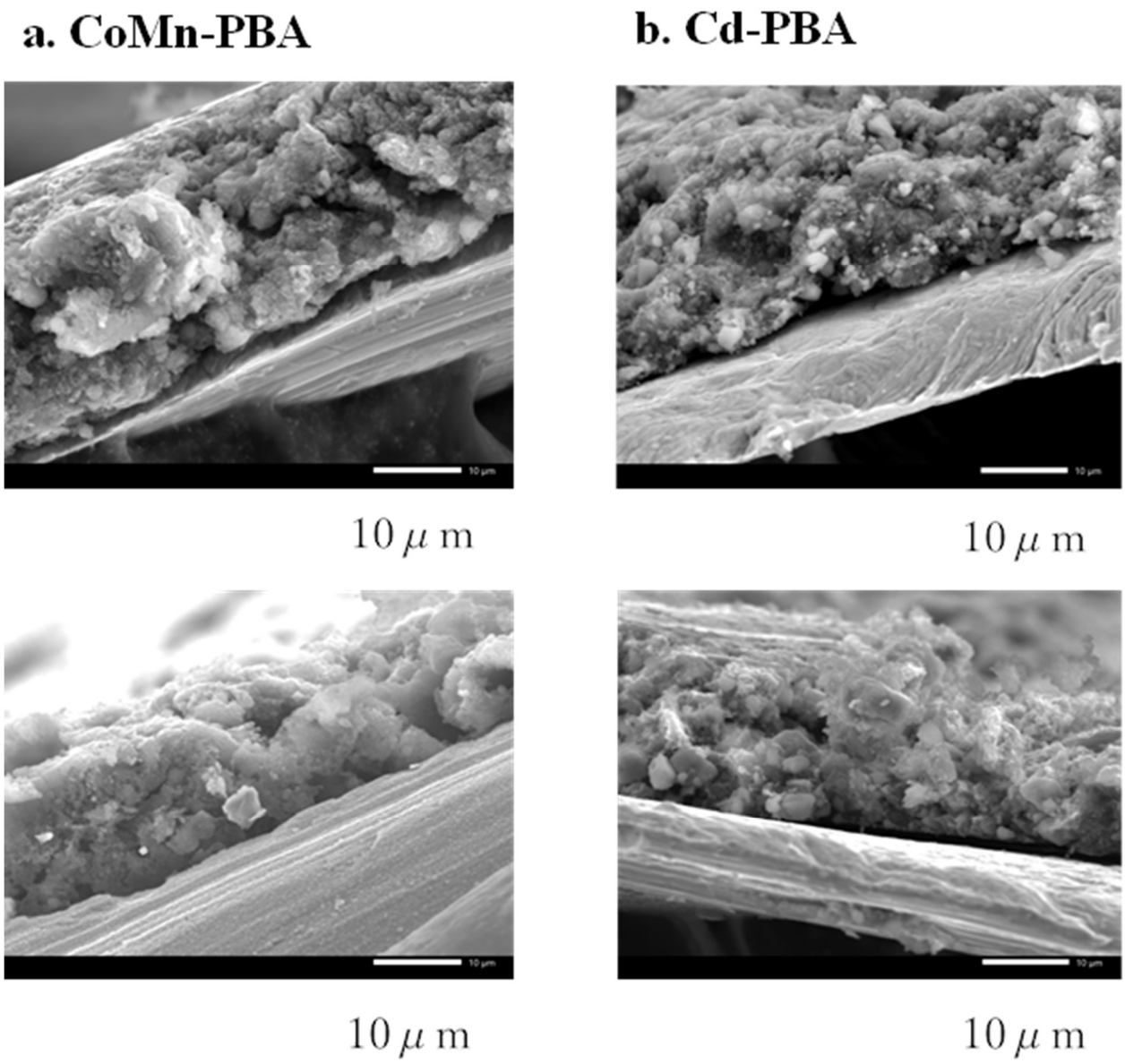

Fig. S4 cross sectional SEM images of (a) CoMn-PBA and (b) Cd-PBA electrodes. Upper and lower images are before and after a thermal cycle test, respectively.

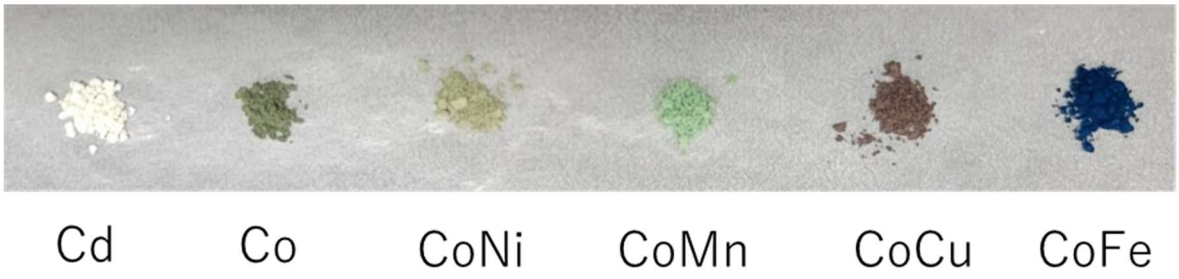

Fig. S5 Picture of the synthesized M-PBA (M = Cd, Co, CoNi, CoMn, CoCu, and CoFe).

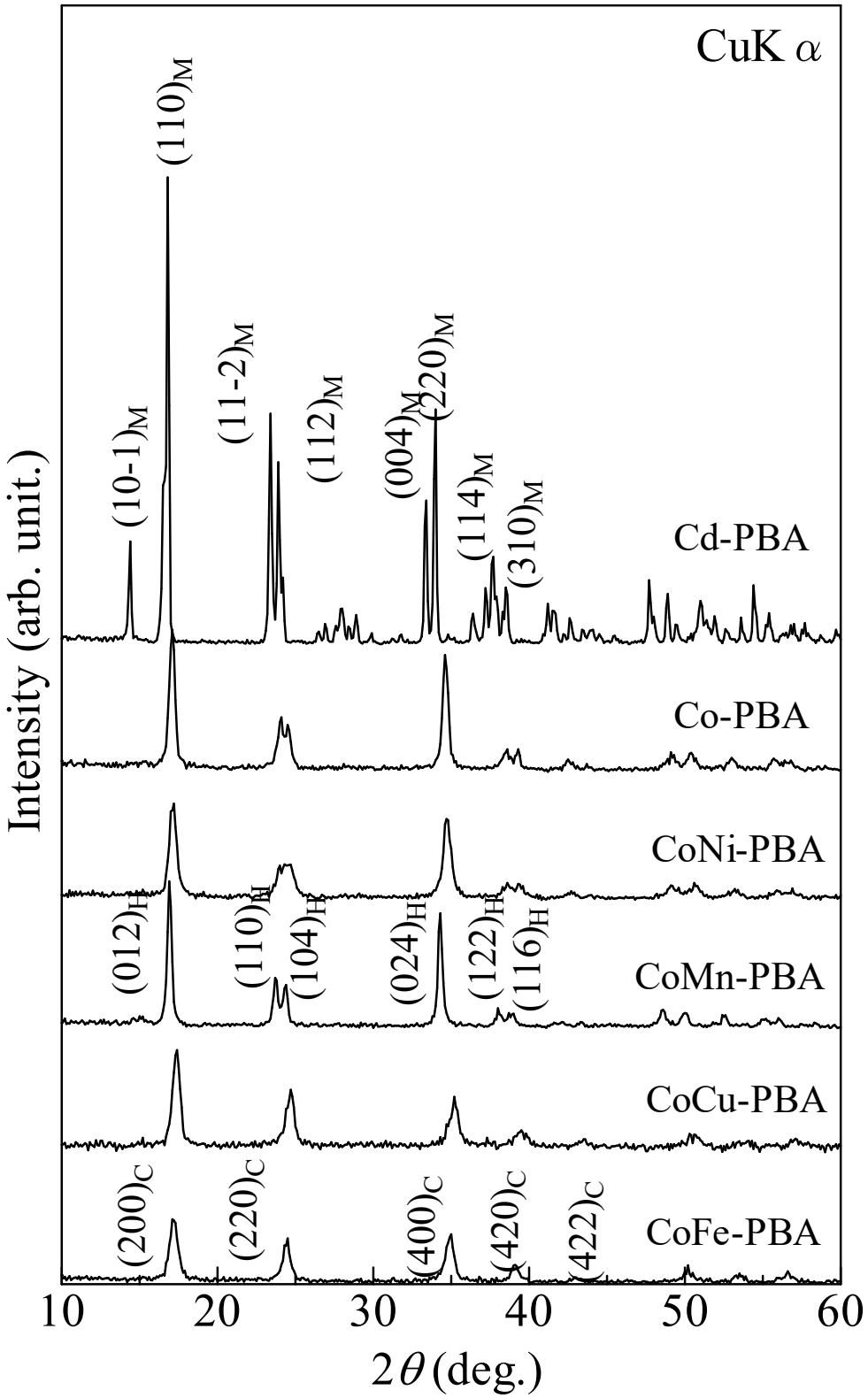

Fig. S6 X-ray diffraction pattern of M-PBA (M = Cd, Co, CoNi, CoMn, CoCu, and CoFe). The X-ray source was CuKα. The subscript M, C and H of the index stands for the monoclinic, face-centered cubic (fcc), and trigonal (hexagonal setting) cells, respectively

The data supporting this article

Potential difference ΔV against temperature difference ΔV at 0.64 V vs. Ag/AgCl in M-PBA.

#Cd-PBA (ref.44)
#ΔT (K), ΔV (mV)
5, -4.92
10, -10.6
15, -10.7
20, -24.3

#Co-PBA
#ΔT (K), ΔV (mV)
5, 3.1
10, 5.2
15, 6.5
20, 6.9

#CoNi-PBA
#ΔT (K), ΔV (mV)
5, -1.0
10, -2.8
15, -4.5
20, -6.4

#CoMn-PBA
#ΔT (K), ΔV (mV)
5, 3.0
10, 6.5
15, 10.0
20, 13.8

#CoCu-PBA
#ΔT (K), ΔV (mV)
5, -0.1
10, -1.1
15, -1.9
20, -2.9

#CoFe-PBA
#ΔT (K), ΔV (mV)
5, 1.7
10, 3.5
15, 5.3
20, 6.4

Thermal voltage V_{TB} and discharge capacity Q_{TB} per unit weight of total active material against cycle number in CoMn-B and Co-TB.

#CoMn-TB

#cycle number, V_{TB} (mV) at T_H, V_{TB} (mV) at T_L, Q_{TB} (mAh g^{-1}) at T_H, Q_{TB} (mAh g^{-1}) at T_L,

1, 36.1, 21.6, 5.09, 4.33
2, 35.7, 21.2, 5.01, 4.16
3, 34.5, 21.8, 4.81, 4.27
4, 34.6, 22.5, 4.83, 4.37
5, 34.6, 22.5, 4.87, 4.27
6, 34.9, 23.0, 4.77, 4.27
7, 34.2, 22.5, 4.71, 4.32
8, 33.9, 23.3, 4.70, 4.36
9, 34.1, 23.7, 4.71, 4.42
10, 34.2, 23.7, 4.72, 4.39
11, 34.0, 24.3, 4.71, 4.47
12, 34.7, 24.6, 4.79, 4.56
13, 34.8, 25.5, 4.77, 4.56
14, 34.8, 25.5, 4.78, 4.64
15, 35.2, 25.7, 4.81, 4.64
16, 35.3, 26.2, 4.79, 4.51
17, 34.4, 26.5, 4.65, 4.53
18, 34.5, 26.3, 4.65, 4.48
19, 34.1 ,26.8, 4.57, 4.50
20, 34.1 ,26.8, 4.55, 4.52
21, 34.5, 27.2, 4.60, 4.45
22, 34.0, 27.1, 4.49, 4.39
23, 33.6, 27.3, 4.46, 4.41
24, 33.6, 27.2, 4.44, 4.41
25, 33.7, 27.3, 4.47, 4.40
26, 33.4, 27.2, 4.43, 4.55
27, 34.5, 28.0, 4.58, 4.60
28, 34.5, 28.0, 4.58, 4.52
29, 34.2, 27.9, 4.50,4.50
30, 34.3, 27.9, 4.52, 4.48

#Co-TB

#cycle number, V_{TB} (mV) at T_H, V_{TB} (mV) at T_L, Q_{TB} (mAh g^{-1}) at T_H, Q_{TB} (mAh g^{-1}) at T_L,

1, 27.1, 38.8, 0.84, 1.05
2, 32.3, 39.5, 0.87, 1.01
3, 32.0, 40.1, 0.81, 0.96
4, 32.7, 37.0, 0.68, 0.81
5, 32.8, 40.2, 0.73, 0.86
6, 32.7, 40.9, 0.71, 0.83
7, 32.7, 41.1, 0.68, 0.80
8, 32.4, 40.9, 0.64, 0.67