Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.

Supporting information

Etched current collector-guided creation of wrinkles in steel mesh supported V_6O_{13} cathode for lithium-ion batteries

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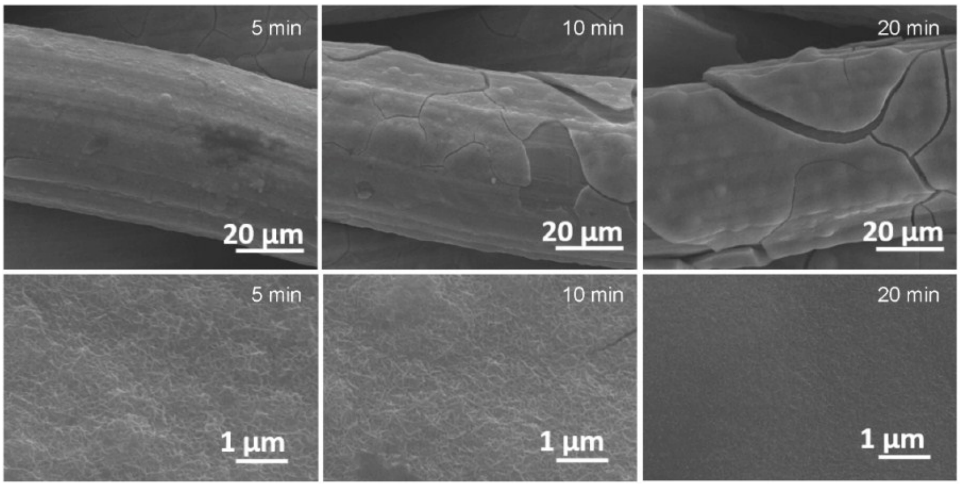

Figure S1. SEM images of as-deposited MnO_2 on 3D stainless mesh. From left to right: samples with 5, 10 and 20 min deposition.

Table S1. Summary of V_6O_{13} electrochemical performance (electrode area 1 cm^2, 500 mA g^{-1})

Electrode	Mass / mg	Rate capacity/mAh g^{-1}	Total capacity / mAh	Energy density / Wh kg^{-1}	Power density / W kg^{-1}
VO-5	0.62	164	0.10	517	1576
VO-10	1.28	94	0.12	302	1606
VO-20	2.49	84	0.21	280	1666
eVO-10	1.23	192	0.24	477	1242

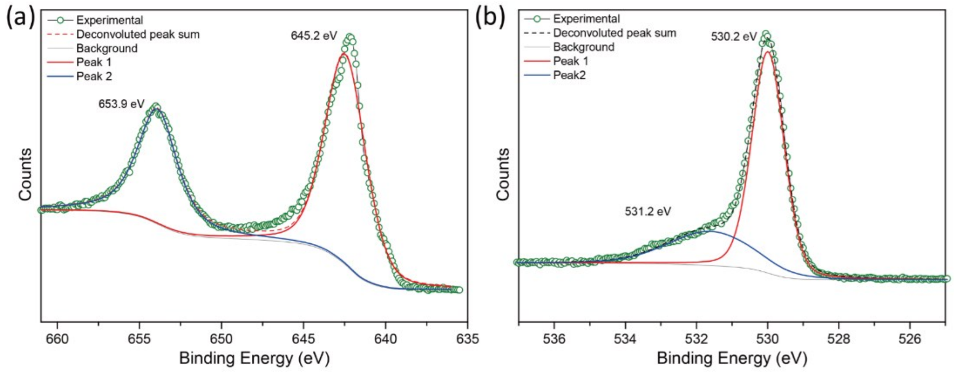

Figure S2. XPS for as-deposited MnO_2. (a) Mn 2p spectrum. (b) O 1s spectrum.

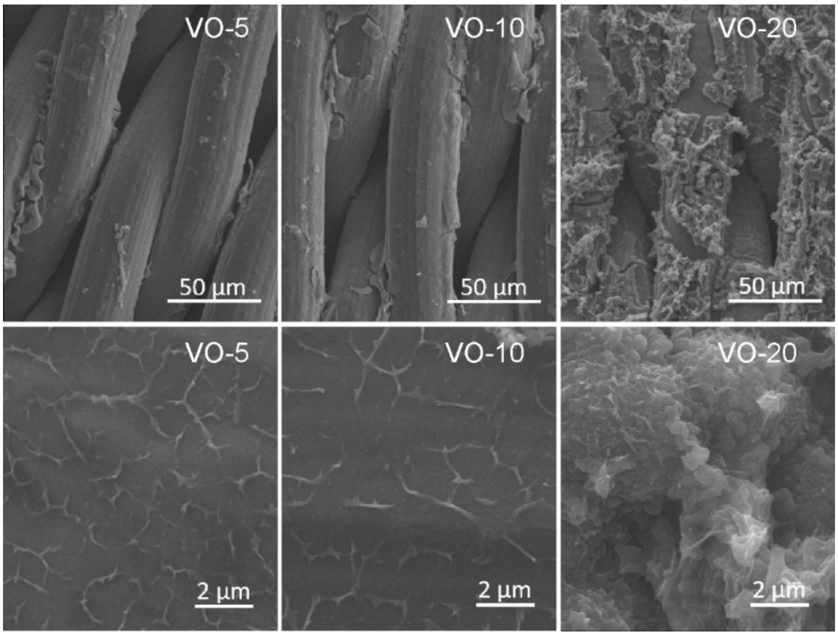

Figure S3. SEM images of VO-5, VO-10 and VO-20, which were converted from MnO_2 precursors.

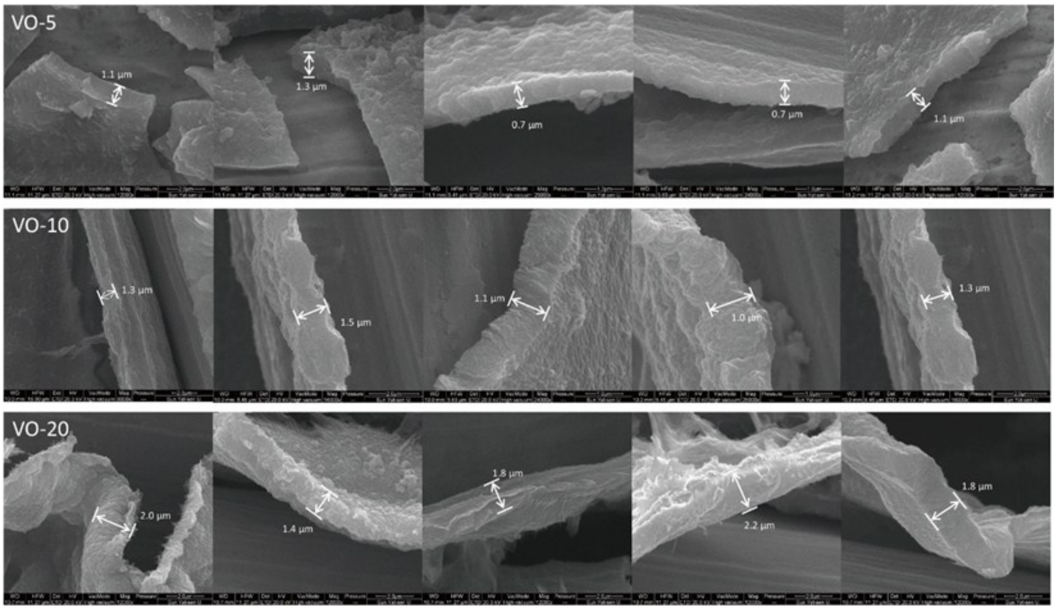

Figure S4. The thickness measurement of VO-5, VO-10 and VO-20, for each sample 5 representative images are shown.

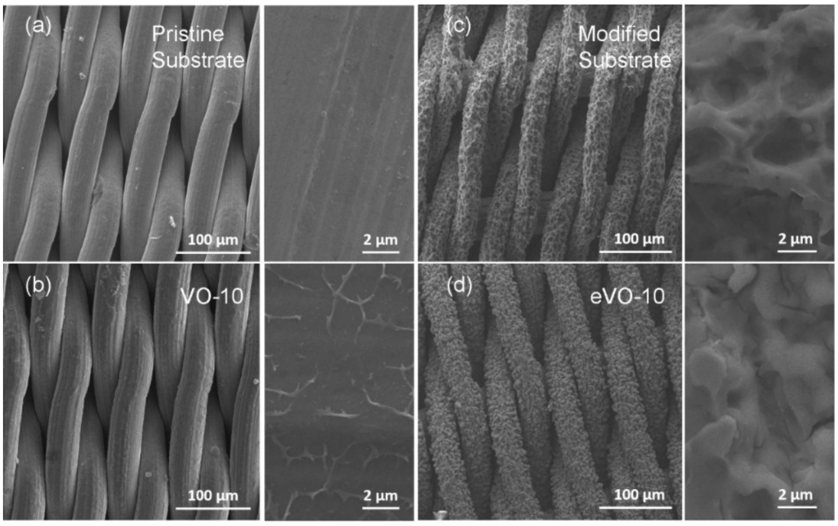

Figure S5. Low-magnification SEM images of (a) unmodified substrate, (b) VO-10, (c) modified substrate and (d) eVO-10.

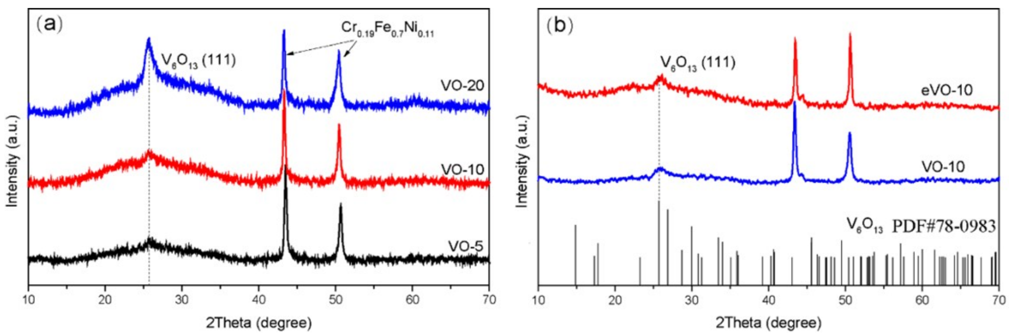

Figure S6. (a) XRD patterns for VO-5, VO-10 and VO-20. (b) XRD pattern for eVO-10, VO-10 pattern is shown for comparison. Peaks for stainless steel are marked out.

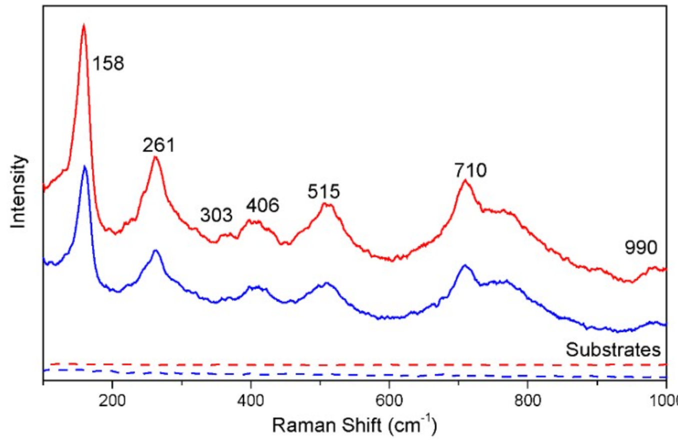

Figure S7. Raman spectra of VO-10 (blue), eVO-10 (red), pristine substrate (blue dashed) and modified substrate (red dashed).

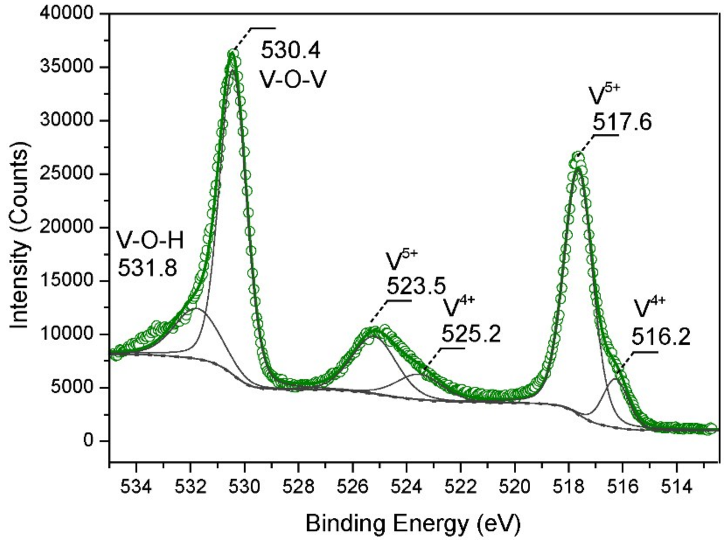

Figure S8. O 1s and V 2p spectra, deconvoluted to six components as indicated in figure.

Table S2. Fitting results of XPS spectra of eVO-10

Peak	**Position (eV)**	**Area**
1 (O 1s)	531.8	11041.0
2 (O 1s)	530.4	39680.8
3 (V 2p, V^{5+})	525.2	12206.8
4 (V 2p, V^{4+})	523.5	5576.7
5 (V 2p, V^{5+})	517.6	33474.7
6 (V 2p, V^{4+})	516.3	5916.6

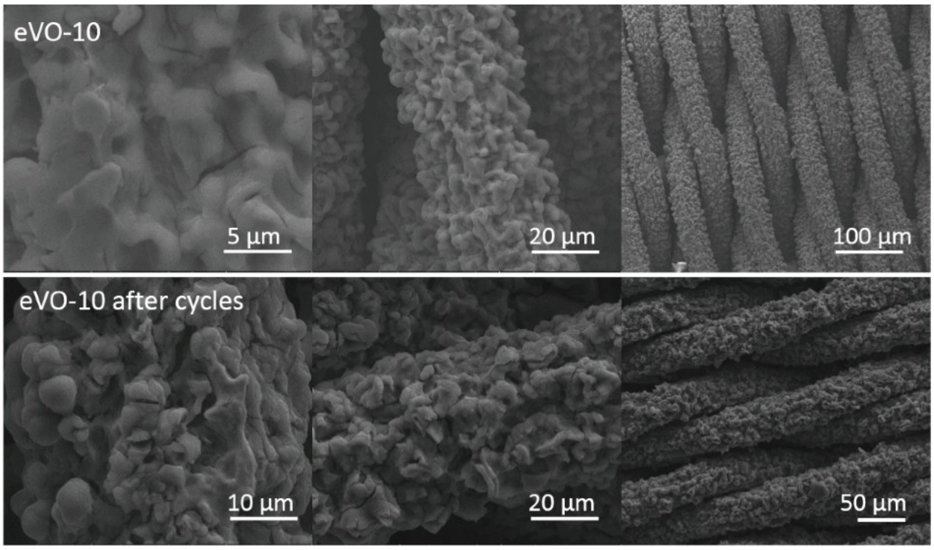

Figure S9. SEM images of eVO-10 before (upper) and after cycling (lower).

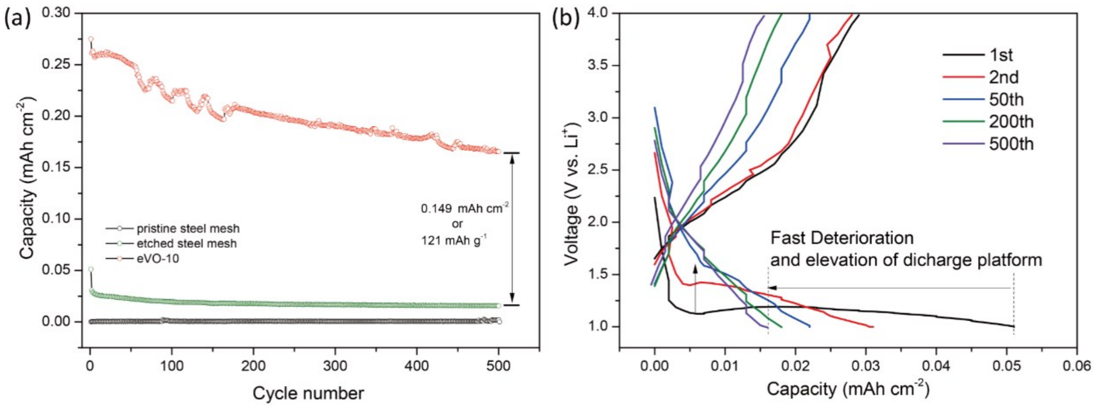

Figure S10. (a) Comparison among pristine steel mesh, etched steel mesh and eVO-10, showing small contribution from substrate. (b) Charge and discharge profile of etched substrates with fast deterioration rate.

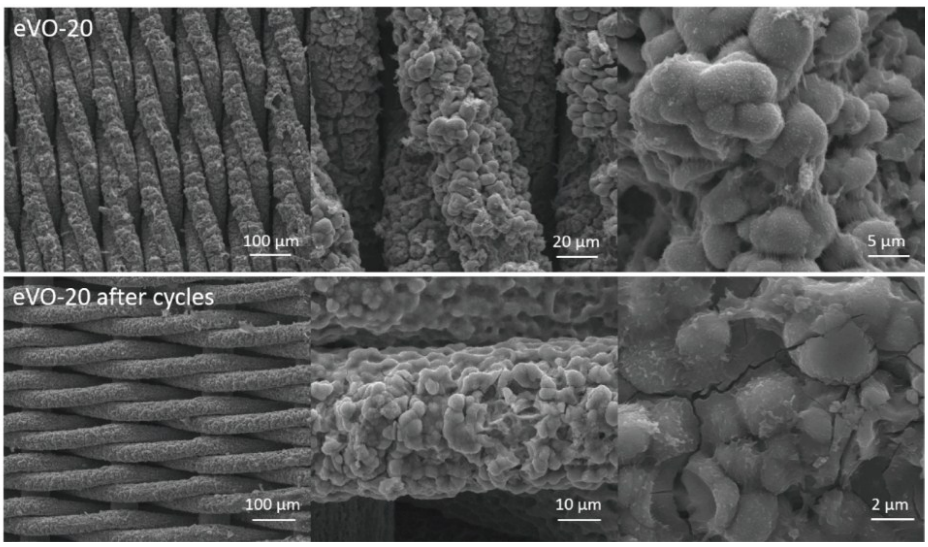

Figure S11. SEM images of eVO-20 on etched substrate before and after cycles.

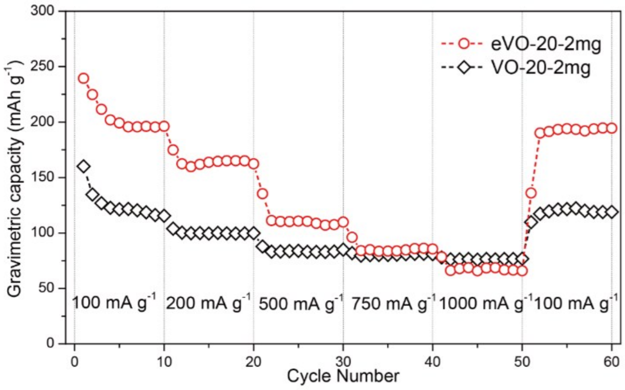

Figure S12. Rate performance of eVO-20 (1.98 mg cm^{-2}) in comparison with VO-20-2mg, a control sample with 2.12 mg cm^{-2} loading.

Calculation of energy density

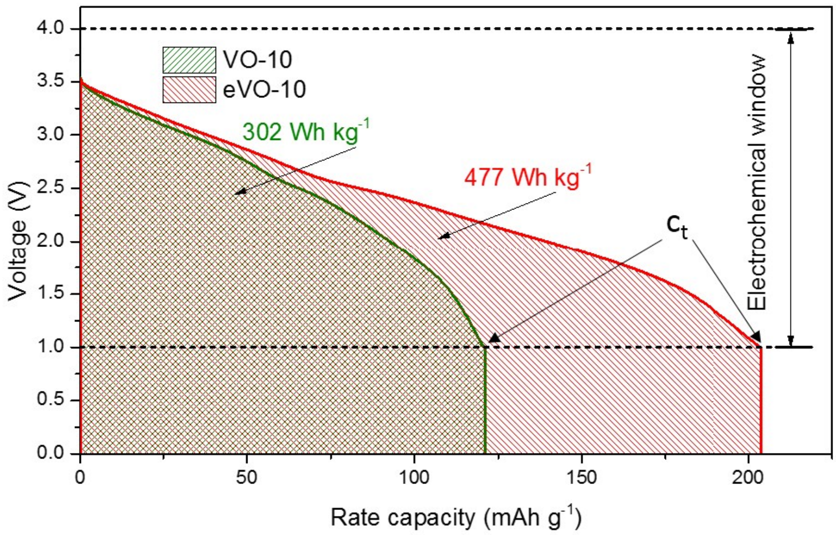

Figure S13. Illustration for energy density calculation, the shaded area equals to energy density.

The energy density provided in the table was calculated from discharge curve using following equation:

$$\text{Energy Density (E)} = \int_{0}^{ct} V dc$$

Where V stands for cell voltage recorded in real time (V) and c represents rate capacity. C_t is the rate capacity measured at the terminal point in the discharging process (mAh g^{-1}), as illustrated in Figure SX1. On the other hand, power density is accordingly calculated by dividing energy density with discharge time (rate capacity divided by current density).