Electronic Supplementary Information for

Polyaniline Nanofiber/Vanadium Pentoxide Sprayed Layer-by-Layer Electrodes for Energy Storage

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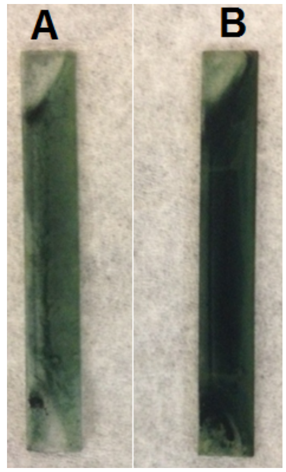

Figure S1. Sample A was prepared with a blow-drying time of 30 sec; Sample B was prepared with a blow-drying time of 1 min. Both samples have 50 layer pairs.

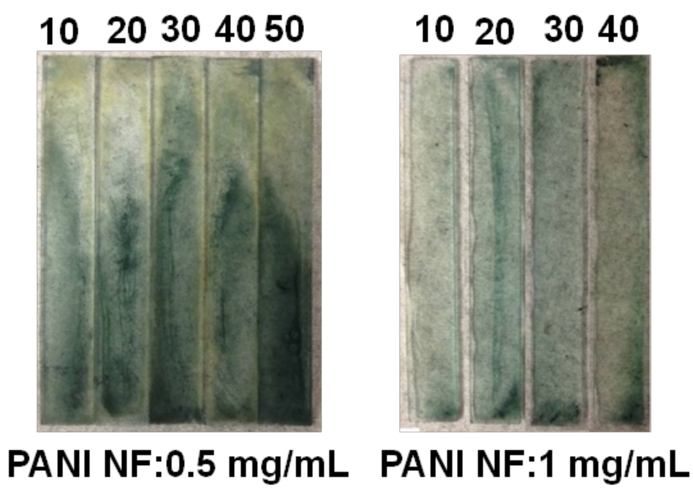

Figure S2. Images of PANI NF/V_2O_5 LbL electrodes prepared by spray process with different PANI NF concentrations. The numbers on top of the images are the number of layer pairs.

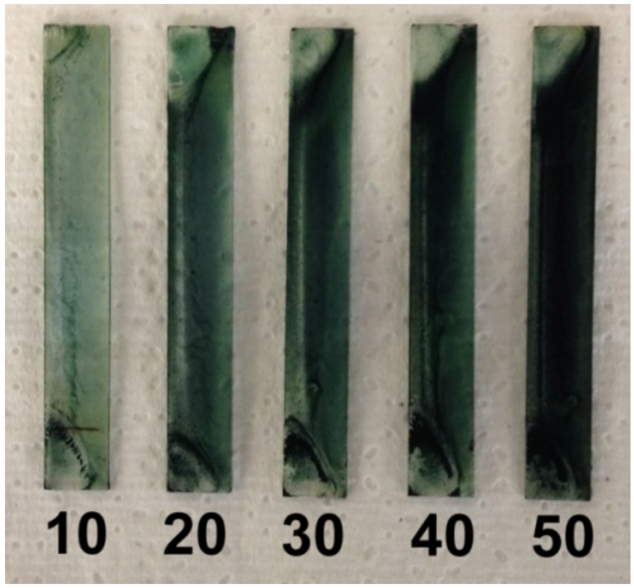

Figure S3. Image of PANI NF/V_2O_5 LbL electrodes after optimization of parameter settings.

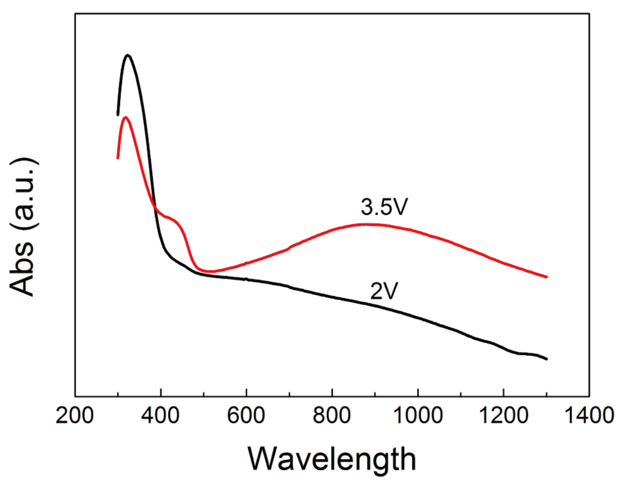

Figure S4. (a) UV-Vis spectra of (PANI NF/V_2O_5)$_{30}$ LbL films at 2.0 V (black curve) and at 3.5 V vs Li/Li^+ (red curve).

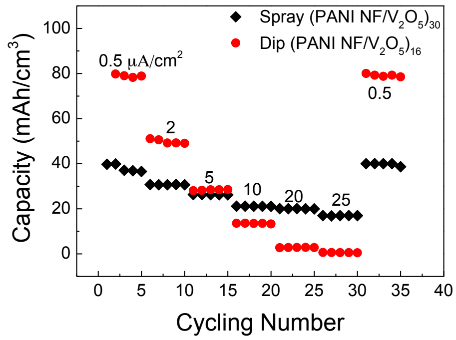

Figure S5. Galvanostatic cycling data based on volume.

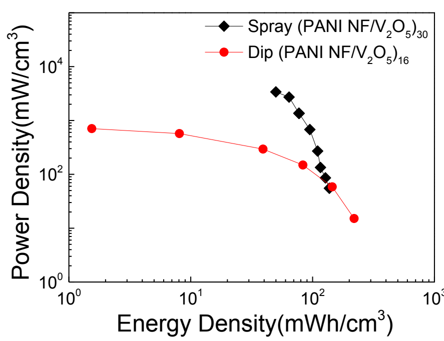

Figure S6. Ragone plot of $(PANI\ NF/V_2O_5)_{30}$ spray-assisted LbL electrodes and $(PANI\ NF/V_2O_5)_{16}$ dip-assisted LbL electrodes, which is based on volume.

Table S1. Parameters used for fitting of the equivalent-circuit model to the data

30 BL	3.5V	2.75V	2V
Y_{0CPE2}	8.57e-6	6.147e-6	3.383e-6
a_{CPE2}	0.8345	0.8497	0.84
R_2/Ω	228.2	285	350.3
Y_{0W}	134.1e-3	356.6e-6	200.0e-6
B_W	0.3841	0.9514	0.06651
Y_{0CPE1}	214.2e-12	222.3e-12	214.1e-12
a_{CPE1}	0.958	0.9566	0.9586
R_1/Ω	956.9	957.1	959.7
Y_{CPE3}	0.02343	0.02653	0.05103
a_{CPE3}	0.9335	0.9434	0.8979

The impedance of a CPE has the form:

$$Z = (1/Y_o)/(j\omega)^{\alpha}$$

When this equation describes a capacitor, the constant Y_0 = C (the capacitance) and the exponent a = 1. For a constant phase element, the exponent a is less than one.

The equation for the Warburg impedance can be written as:

$$Z = (1/Y_o)/\sqrt{j\omega}$$

where

$$Y_o = 1/(\sqrt{2} \cdot \sigma)$$

If the diffusion layer is bounded, the impedance at lower frequencies no longer obeys the equation above. Instead, we get the form:

$$Z = [(1/Y_o)/\sqrt{(j\omega)}]\tanh[B\sqrt{j\omega}]$$

with

$$B = \delta/D^{1/2}$$

d = Nernst diffusion layer thickness (cm)
D = an average value of the diffusion coefficients of the diffusing species (cm^2/s)