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PAPER TYPE

Coaxial $CoMoO_4$ Nanowire Arrays with Chemically Integrated Conductive Coating for High-Performance Flexible All-Solid-State Asymmetric Supercapacitors

(Electronic Supplementary Information)

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I. Cyclic Voltammograms of Different Electrode Materials

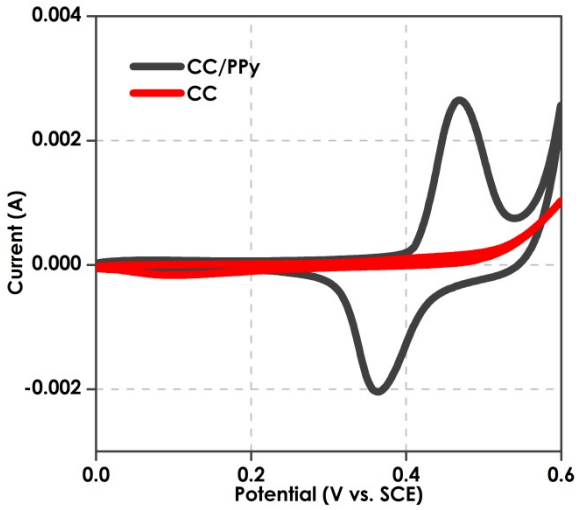

Fig. S1 Cyclic voltammograms for PPy/CC and pristine CC at the scan rate of 50 mV s^{-1}.

From the CV curves, we could dem 啊 onstrate that the pristine collector CC has no significant peak current and very little contribution to the total specific capacitance of the hybrid electrode supercapacitors. In addition, the peak currents of the PPy/CC nanocomposite electrode are more diminutive than those of bare $CoMoO_4$/CC and $CoMoO_4$/PPy/CC electrode, indicating that the conductive PPy wrapping just

enhance electrons/ions transportation, thus considerably improving the specific capacitance.

II. Morphological of After Cycling

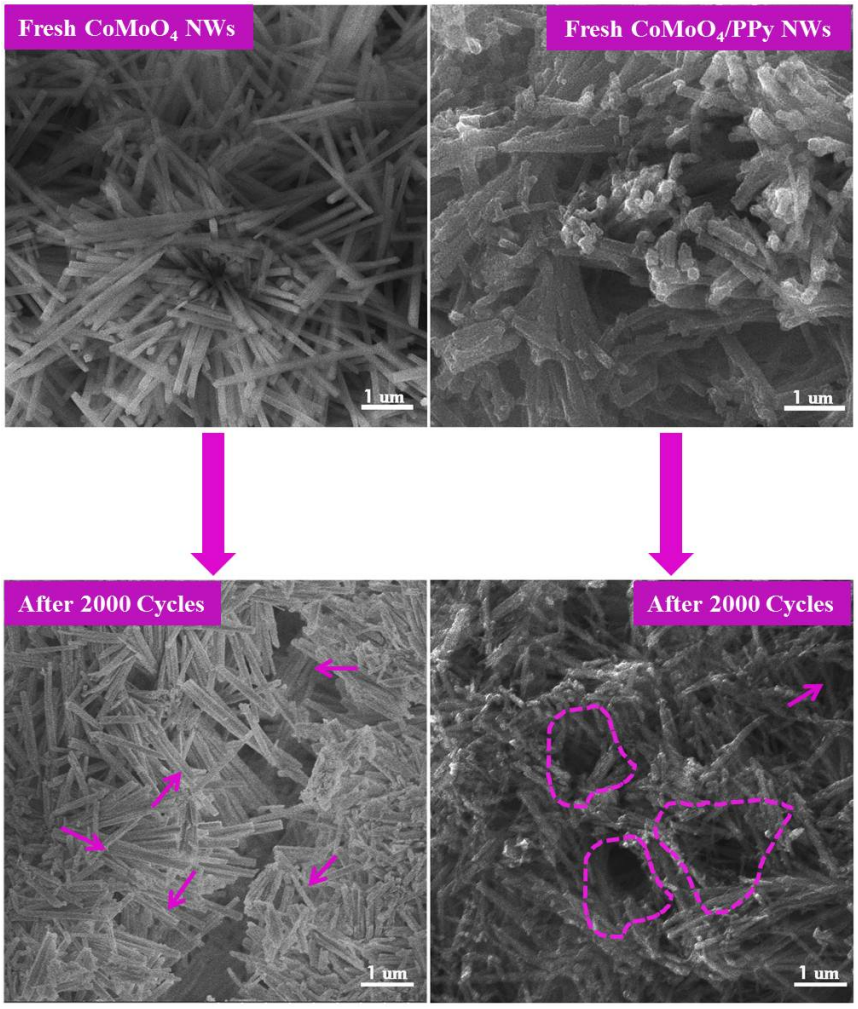

Fig. S2 SEM images of $CoMoO_4$ NWs and $CoMoO_4$/PPy hybrid NWs after 2000 cycles, respectively.

The morphology of the pure $CoMoO_4$ NWs after 2000 cycles is damaging badly compared with fresh $CoMoO_4$ NWs. Meanwhile, the extent of pure $CoMoO_4$ NWs destroyed is more serious than the $CoMoO_4$/PPy core–shell NWs after 2000 cycles, indicating that $CoMoO_4$ NWs encapsulated PPy after 2000 cycles has excellent stable structure and large porous pathways leading to efficient electrons and ions transportation between the electrode and electrolyte during charge-discharge processes. As expected, PPy wrapping on the surface of $CoMoO_4$ NWs is contribution to the cycling-dependent-electrode stable architecture.

III. EIS Plots of $CoMoO_4$/CC and $CoMoO_4$/PPy/CC Electrode After Cycling

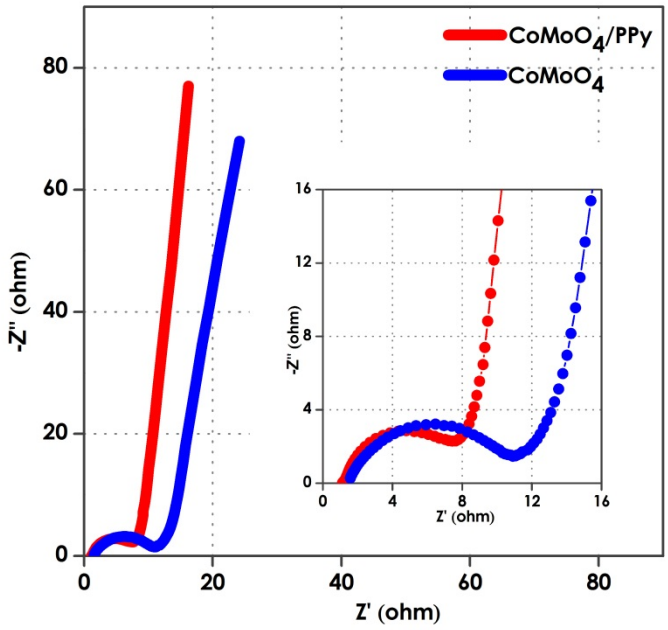

Fig. S3 EIS plots of $CoMoO_4$ NWs and $CoMoO_4$/PPy hybrid NWs after 2000 cycles, respectively.

IV. Data of Diffusion Coefficients and Warburg Impedance of $CoMoO_4$/CC and $CoMoO_4$/PPy/CC Electrode

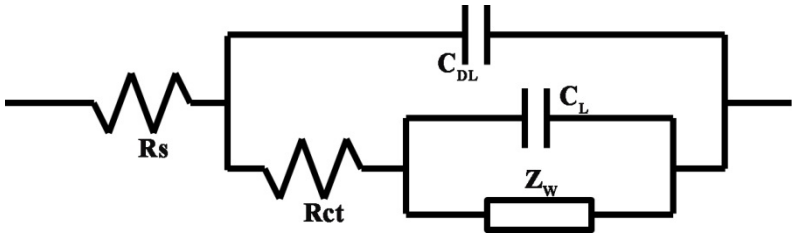

Fig. S4 Equivalent Circuit based on three-electrode system measurement of $CoMoO_4$ NWs and $CoMoO_4$/PPy hybrid NWs electrode

The fitting results are presented in Fig S4 and Table S1. In the equivalent circuit, the R_S is bulk resistance of the electrochemical system (the intersection of the curve at the real part Z' in the high frequency range). Among all the evaluation parameters, R_{ct} of the $CoMoO_4$ NWs electrode is larger than $CoMoO_4$/PPy hybrid NWs electrode, indicating that the $CoMoO_4$/PPy electrode exhibits a higher the rate of charge. Meanwhile, Z_w and Rs of the $CoMoO_4$/PPy hybrid NWs electrode are smaller than the pure $CoMoO_4$ NWs electrode, indicating that the $CoMoO_4$/PPy hybrid NWs electrode exhibits lower diffusion

resistance and bulk resistance than the pure $CoMoO_4$ NWs electrode. In a similar way, the performance of the $CoMoO_4$/PPy hybrid NWs electrode after 2000 cycles is better than the pure $CoMoO_4$ NWs electrode after cycling.

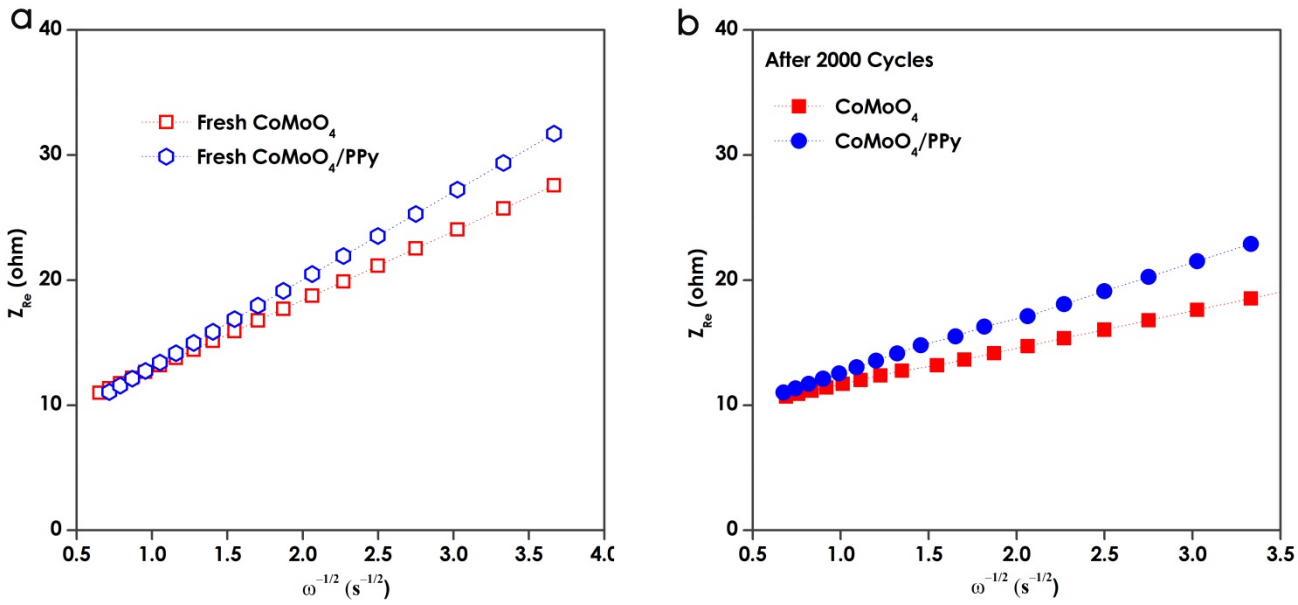

Fig. S5 The real part of the Warburg impedance (Z_{Re}) versus the square root of frequency ($\omega^{-½}$) at open circuit voltage (a) for the fresh $CoMoO_4$ NWs and $CoMoO_4$/PPy hybrid NWs electrode and (b) $CoMoO_4$ NWs and $CoMoO_4$/PPy hybrid NWs electrode after 2000 cycles.

The diffusion coefficients are calculated using the following formulas:[1]

$$Z_{Re} = K + \sigma\omega^{-½},$$

which K is a constant correspongding to R_{ct}, ω is the frequency, and σ is the Warburg factor which corresponds to the slope of the curve shown in Fig S5. We plot the Z_{Re} to $\omega^{-½}$ curve to evaluate the diffusion coefficients. Results demonstrate that diffusion coefficients of fresh $CoMoO_4$/PPy hybrid NWs electrode is larger than the fresh $CoMoO_4$/CC electrode, which indicates that $CoMoO_4$/PPy nanocomposites exhibit a high electronic/ion diffusion coefficient and shorten the diffusion time of electronic/ion to the surface of active materials. Similarly, diffusion coefficients of $CoMoO_4$/PPy hybrid NWs electrode after 2000 cycles are lower than the fresh $CoMoO_4$/PPy hybrid NWs electrode, which maybe the structural damaging of the electrode after cycling leads to reduce the electronic/ion diffusion coefficient.

	$R_S(\Omega)$	$C_{DL}(F)$	Rct (Ω)	Z_w (Ω)	C_L (F)
Fresh $CoMoO_4$	1.84	0.0267	7.40	0.098	0.0675
Fresh $CoMoO_4$/PPy	1.72	0.0201	6.04	0.05	0.0701
After 2000 cycles of $CoMoO_4$	3.12	0.0546	8.54	0.20	0.1842
After 2000 cycles of $CoMoO_4$/PPy	2.36	0.0527	7.76	0.12	0.1625

Table S1 Calculated Values of R_S, $C_{DL}(F)$, Rct (Ω), Z_w (Ω), and C_L (F) through complex nonlinear least-squares (CNLS) fitting method.

1. *L. Peng, Y. Zhao, Y. Ding and G. Yu, Chemical communications, 2014, 50, 9569-9572.*