Electronic Supporting Information

1-Dimensional confinement of Porous Polyethylenedioxythiophene Using Carbon Nanofiber as a Solid Template: An Efficient Charge Storage Material with Improved Capacitance Retention and Cycle Stability

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Calculations of specific capacitance from cyclic voltamatry and chrono charge-discharge methods.[1]

Capacitance calculated from the CV and charge-discharge for the hybrid material is converted into specific capacitance in terms of the weight of the active material (PEDOT) in the composites.

Capacitance ($F\ g^{-1}$) was calculated from the cyclic voltamogram using the following equation:

$$C = 2 * \left(\frac{I}{Scan\ Rate\left(\frac{dv}{dt}\right) * V * M}\right)$$

I = Average current during the anodic and cathodic sweep.

V= Potential window (1 V)

M= Weight of the active electrode material coated in one of the electrodes (g)

Capacitance was also calculated from the charge-discharge experiments using the following equation:

$$C = 2 * \left(\frac{I}{\frac{dV}{dt} * M}\right)$$

$\left(\frac{dv}{dt}\right)$ *= Calculated from the slope of Discharge curve after the IR drop*

I *= Constant current used for charging and discharging*

$M \quad = Weight\ of\ active\ electrode\ material\ in\ one\ of\ the\ electrode$

Energy density (E_d) and power density (P_d) are calculated from the capacitance value obtained by cyclic voltamatry[2]

$$Energy\ density\ E_d\ (Wh\ Kg^{-1})\ = \frac{1}{8}\ C_s V^2$$

$\boldsymbol{C_s}$ = Specific capacitance calculated by cyclic voltamatry

$$Power\ density\ \ P_d\ (W\ Kg^{-1})\ = \frac{E_d}{V}\ (\frac{dv}{dt})$$

V= Voltage window

$\frac{dv}{dt}$ = scan rate (V s^{-1})

Calculation of the imaginary capacitance and time constant from the EIS measurements:[1, 3]

$$Imaginary\ capacitance\ \ C''\ (w) = \frac{Z^{'}(W)}{\omega|Z(w)|^2}$$

$$Where\ Z(w)\ is\ called\ impedance\ modulus \quad |Z(w)|^2 = Z(w)^{'2} + Z(w)''^2$$

$$Z^{'}(W) = real\ Impedance\ (\Omega)$$

$$Z''((w) = Imaginary\ Impedance\ (\Omega)$$

$$\omega = 2\pi f \qquad \textit{where } f = \textit{AC frequency } (H_z)$$

In the plot of the imaginary capacitance *Vs* frequency, a maxima occurs at a particular frequency which is known as the relaxation frequency (f_0). Time constant (t) of the material is given by the reciprocal of (f_0)

Calculation of the four probe electrical conductivity:

Conductivity was measured by placing the sample pellets on a non-conducting surface and the measurement was done by the four probe method by using the following equations:

$$K = \frac{1}{\rho}$$

$$\rho = \frac{2\,\pi\,\mathrm{S}\,\frac{V}{I}}{G_7\,(\frac{\mathrm{W}}{\mathrm{S}})}$$

where K = conductivity (S cm^{-1})

ρ = resistivity (Ω cm)

$G_7\,(\frac{\mathrm{W}}{\mathrm{S}})$ = correction factor $= \frac{2\mathrm{S}}{\mathrm{W}} \log_e 2$, when sample thickness is less than 0.5mm

W = thickness of the pellet

S = Probe spacing (2mm)

V = voltage (V)

I = current (A)

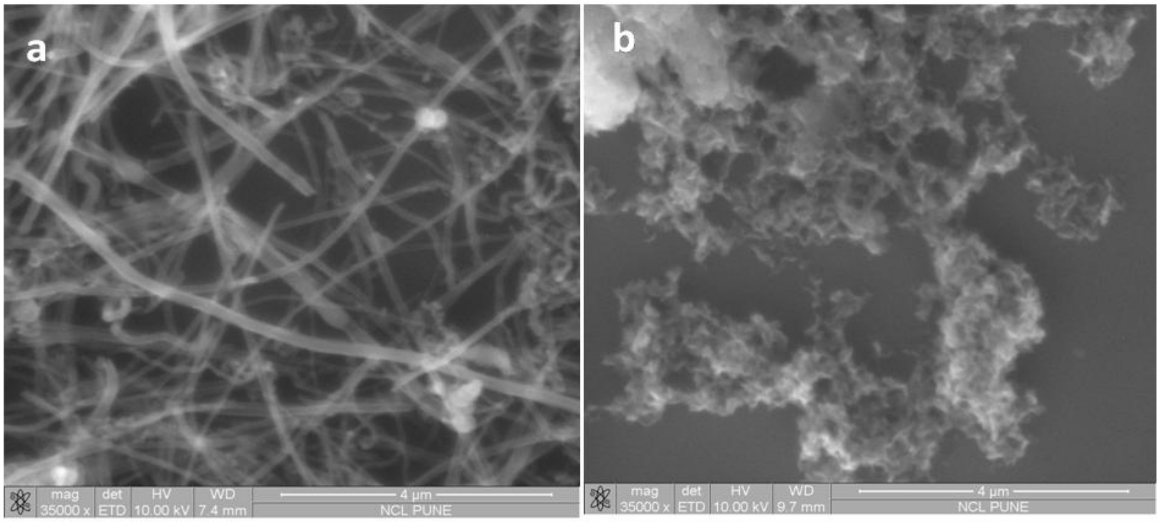

Figure S1. SEM images of a) CNF b) PEDOT.

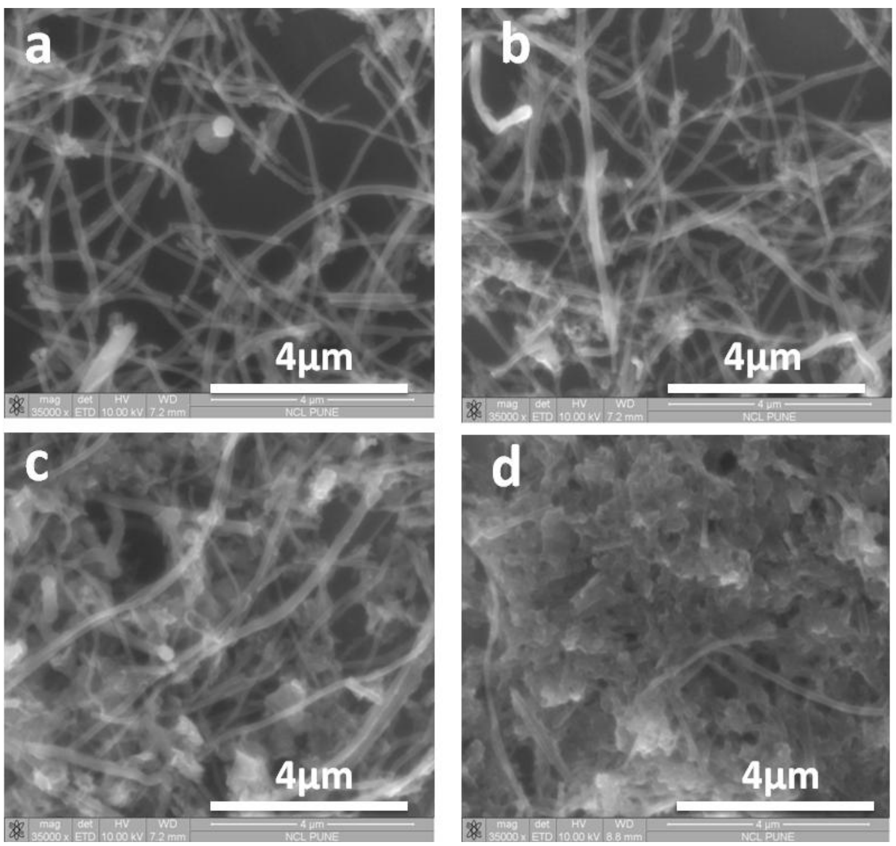

Figure S2. SEM images of the hybrid materials: a) CP-25 b) CP-40 C) CP-60 d) CP-80

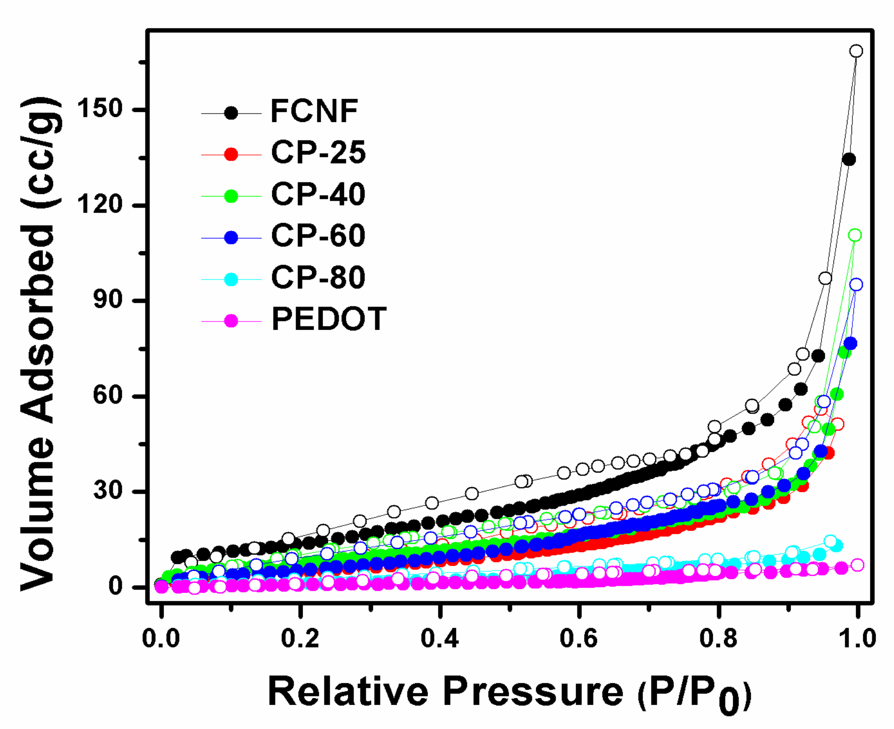

Figure S3. Nitrogen adsorption isotherm of CNF, PEDOT and their hybrids.

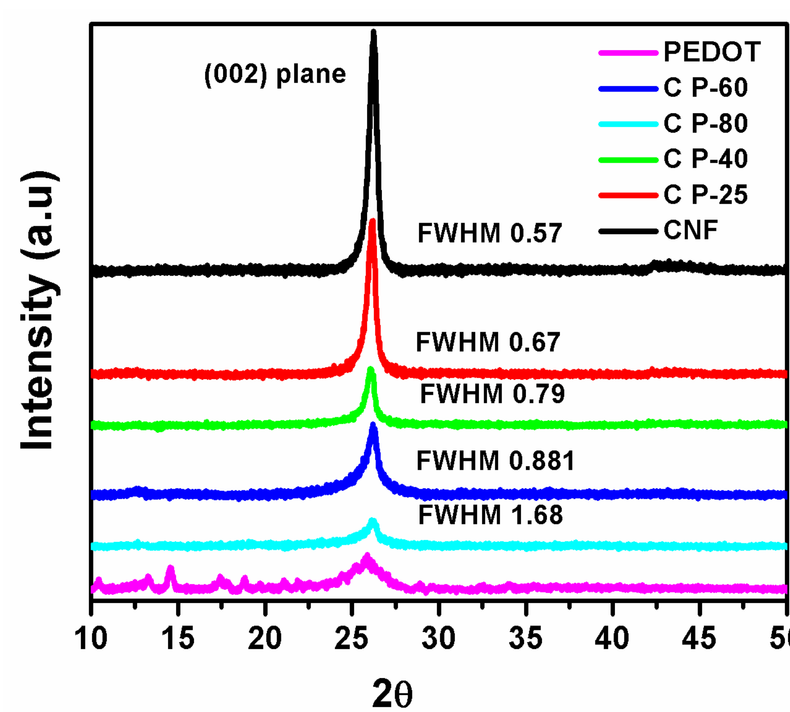

Figure S4. XRD patterns of CNF, CP-25, CP-40, CP-60, CP-80 and PEDOT.

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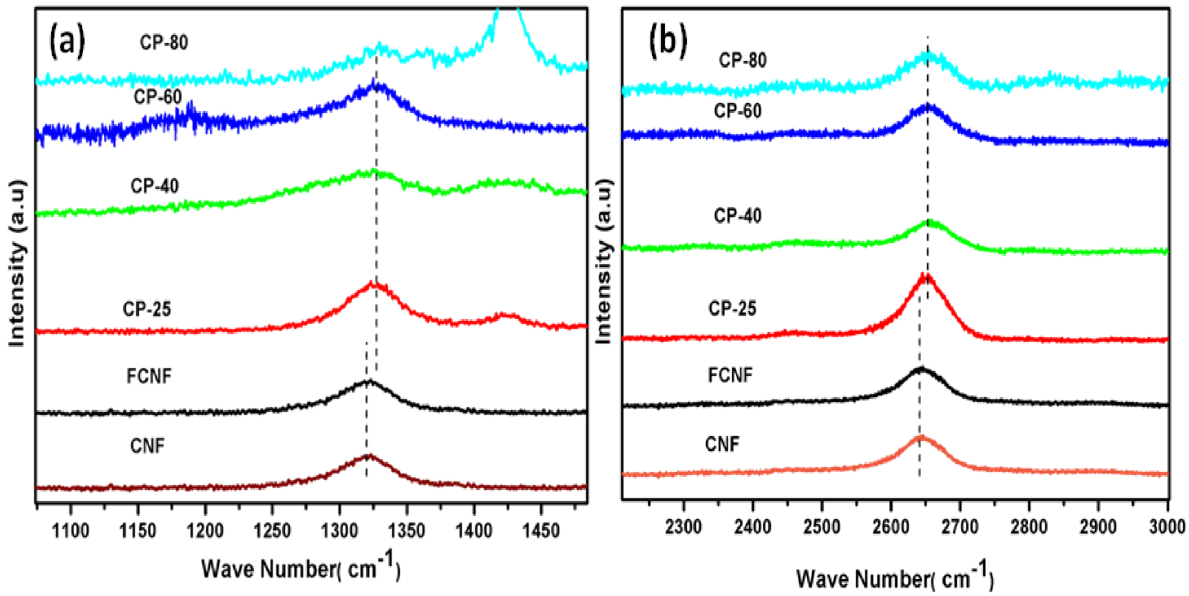

Figure S5. Raman spectra of the samples which compare (a) D band and (b) 2D band shifts of CP-25, CP-40, CP-60, CP-80 and PEDOT ..

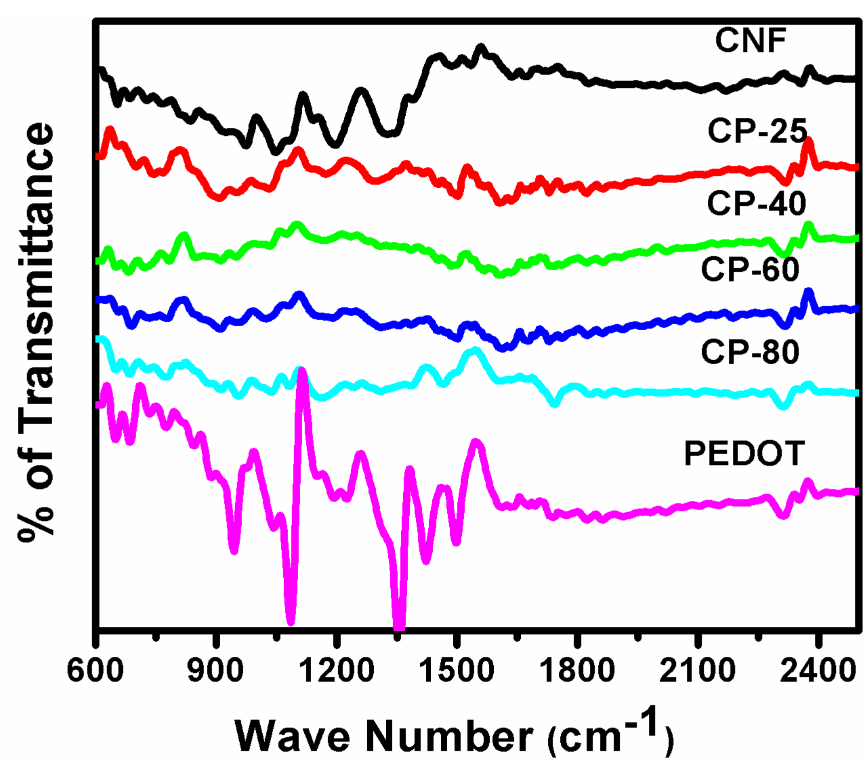

Figure S6. FT-IR spectra of CNF, CP-25, CP-40, CP-60, CP-80 and PEDOT.

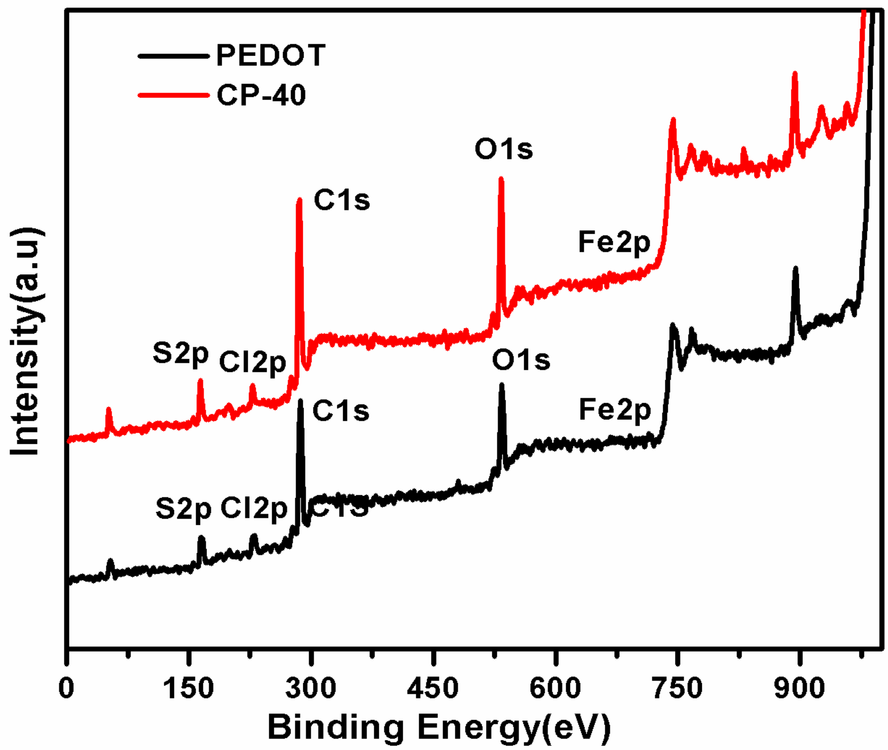

Figure S7. XPS survey scan spectra of CP-40 and PEDOT.

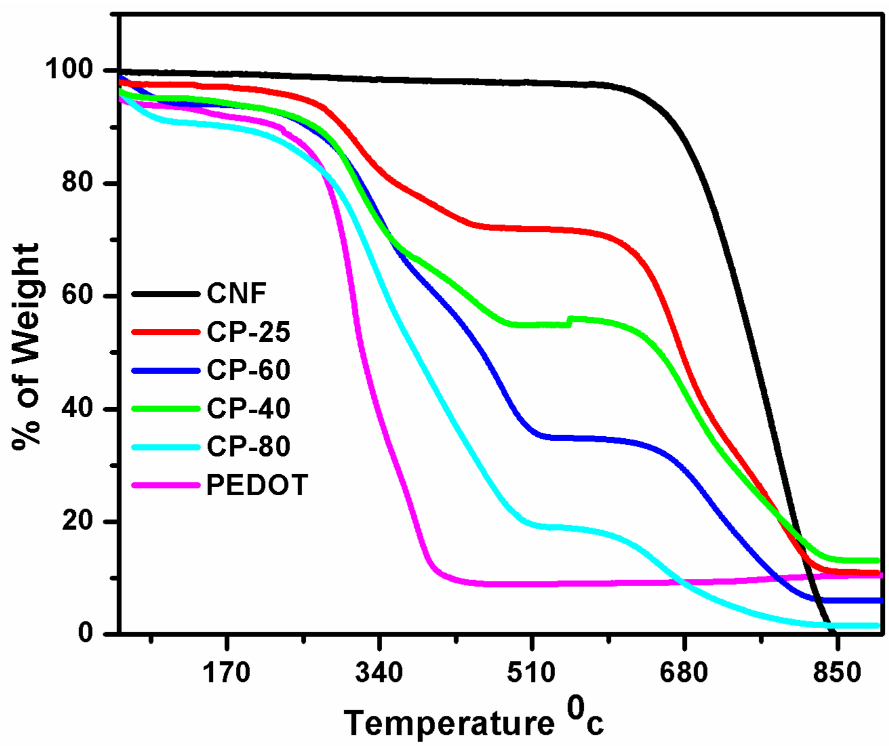

Figure S8. TGA of CNF, CP-25, CP-40, CP-60, CP-80 and PEDOT.

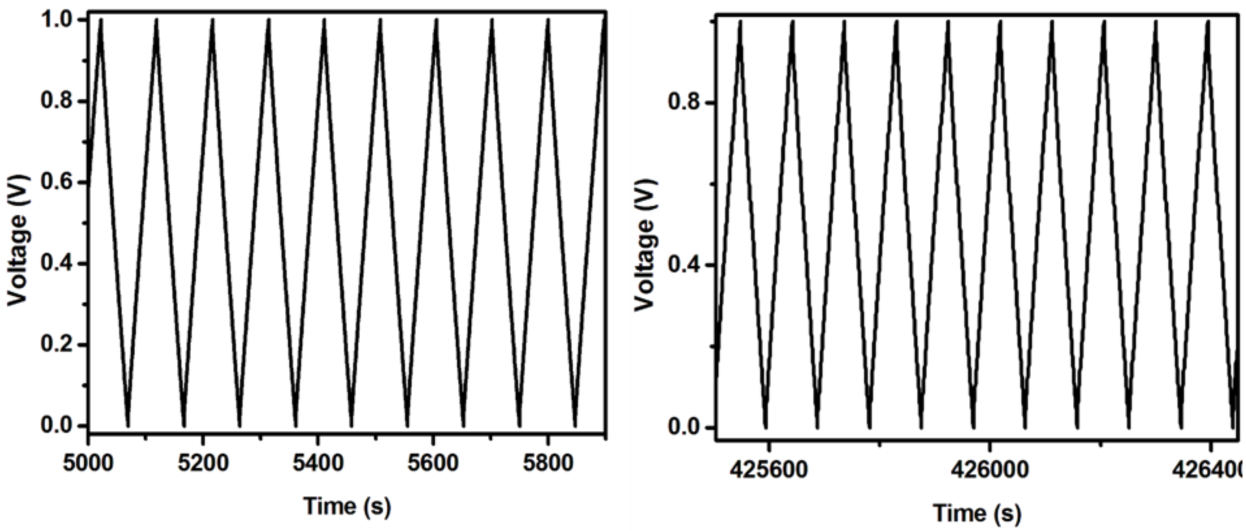

Figure S9. Initial and final charge-discharge cycles profile of CP-40 during the 4500 stability cycling.

1. **Conway, B. E.**, *Electrochemical Supercapacitors Scientific Fundamentals and Technological Applications*. Springer: 1999.

2. Jang, J. H.; Kato, A.; Machida, K.; Naoi, K., *J. Electrochem. Soc.* **2006,** 153, A321-A328.

3. Taberna, P. L.; Simon, P.; Fauvarque , J. F., *J. Electrochem. Soc.* **2003,** 150, A292-A300.