Supplementary Information

Development of high-performance asymmetrical supercapacitor based on conductive polythiophene and waste tissue paper derived porous carbon

Prashant Dubey[a], Rekha Yadav[a], Priyanka H. Maheshwari[a], R. K. Seth[a], and Shashank Sundriyal[a,b]*

[a]Advanced Carbon Products and Metrology Department, CSIR-National Physical Laboratory (CSIR-NPL), New Delhi 110012, India;

[b]Regional Center of Advanced Technologies and Materials, The Czech Advanced Technology and Research Institute (CATRIN), Palacký University Olomouc, Šlechtitelů 27, 779 00 Olomouc, Czech Republic

***Correspondence:** sundriyal.s.1991@ieee.org (**Dr. Shashank Sundriyal**)

Equations for electrochemical calculations:

For three-electrode system:

From CV curves, the specific capacitance can be computed using the following equation:

$$C_s = \frac{1}{ms(\Delta V)} \int I(V)dV \tag{S1}$$

where ($\int I\,(V)\,dV$) represents integral area of CV curve, ΔV = total potential deviation of the voltage window (V), m = mass of active material on the electrode (g), s denotes the scan rate (mV/s) and the subscript c and a denotes cathodic and anodic region respectively.

From GCD curves, the corresponding specific capacity for the electrode was determined using the equations given below:

$$C = \frac{I \times \Delta t}{m \times \Delta V} \tag{S2}$$

where *C* represents the specific capacitance (F/g), Δ*t* is discharging time, *I* represent the applied current (mA), *m* denotes the active material mass (mg), and ΔV represents potential difference (V).

For two-electrode system:

From GCD curves, specific capacitance for asymmetric supercapacitor device was determined using the equations given below:

$$C = \frac{I \times \Delta t}{m \times \Delta V} \tag{S3}$$

The energy density was determined using the equation:

$$E = \frac{CV^2}{2 \times 3.6} \tag{S4}$$

and the power density, P (W/kg) was evaluated using the equation:

$$P = \frac{3600 \times E}{\Delta t} \tag{S4}$$

where *C* represents the specific capacitance (F/g), Δ*t* is discharging time, ΔV represents potential difference (V), *I* represent the applied current (mA), *m* denotes the sum of active material mass on both electrode (mg), E represents energy density (Wh/kg), and P denotes power density (W/kg).

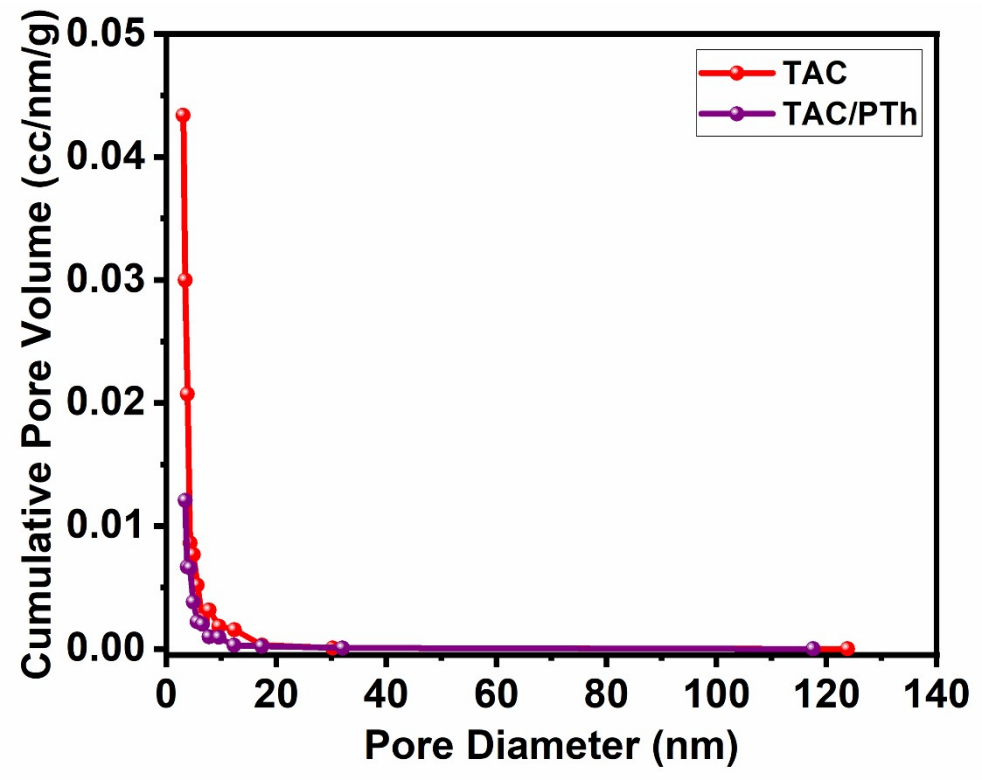

Figure S1. BJH pore size distribution plot of TAC and TAC/PTh.

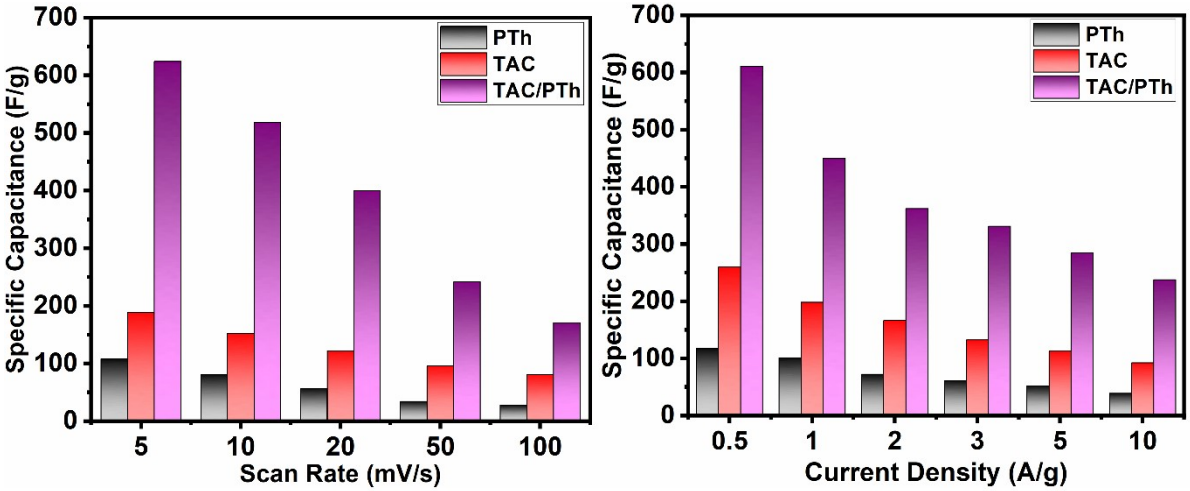

Figure S2. Comparison of variation of specific capacitance of PTh, TAC and TAC/PTh wrt. (a) current density; and (b) scan rates

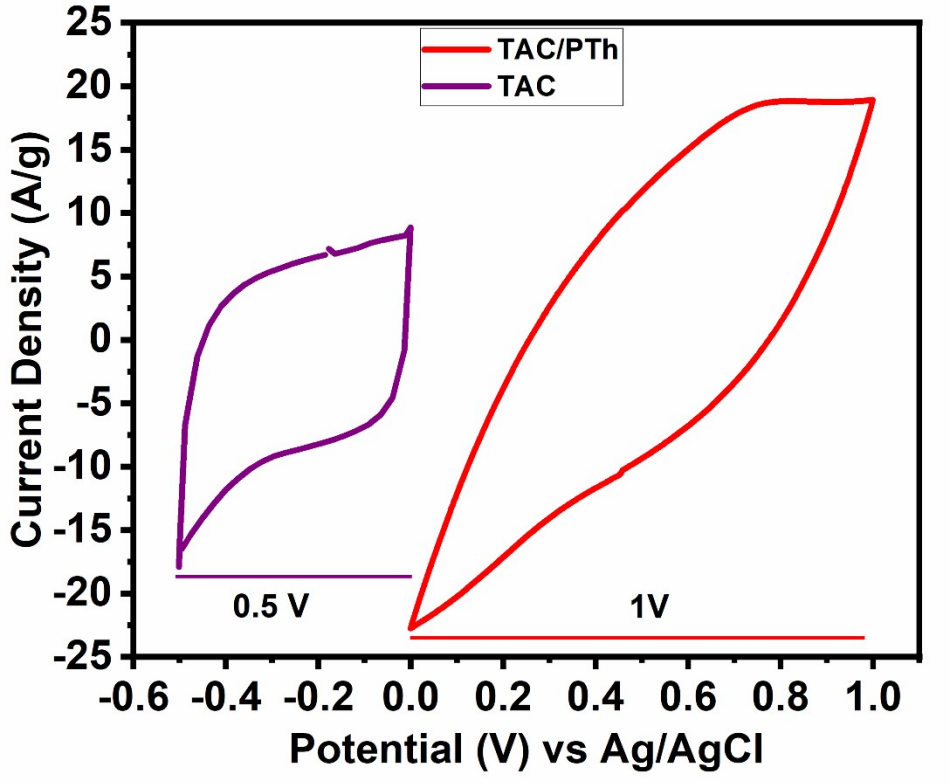

Figure S3. Combined CV of TAC and TAC/PTh