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Towards efficient capacitive energy storage of porous polyimide nanopolymers via a layer by layer approach

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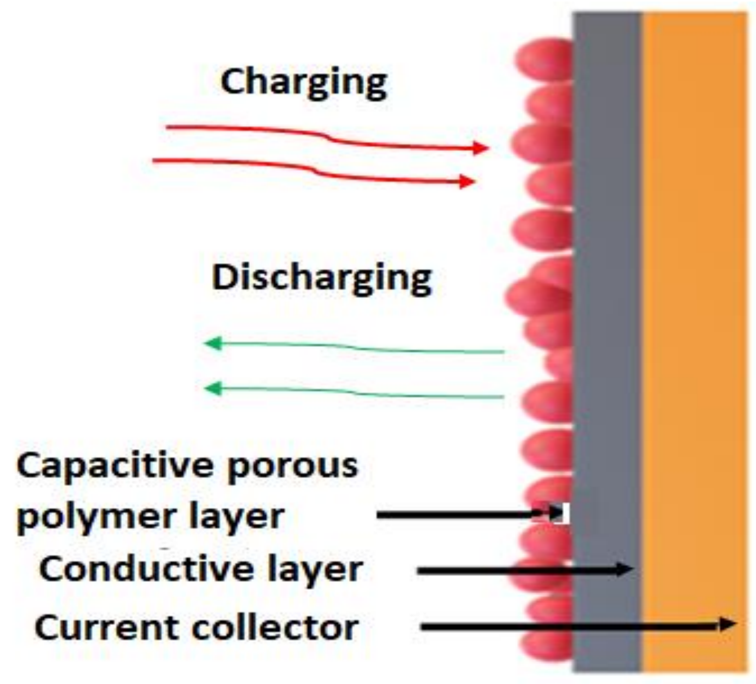
Motivation

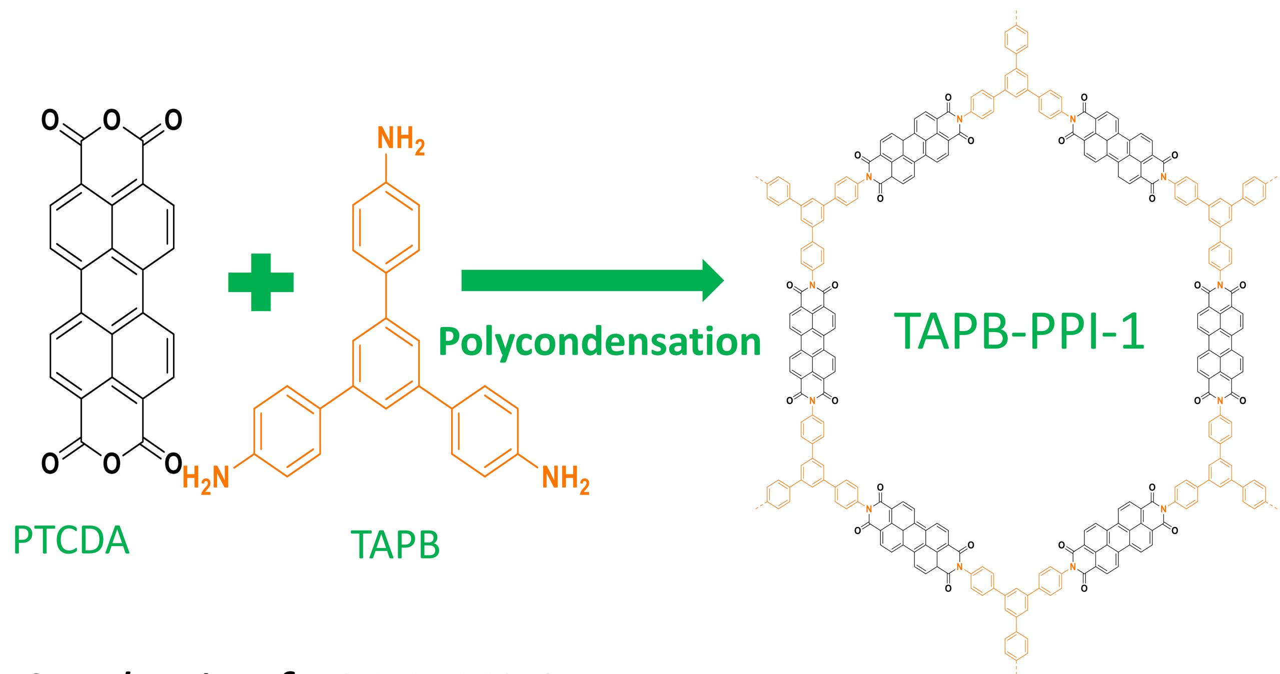
- Despite high surface area, excellent porosity and tuneable redox-active backbone polyimide porous polymers exhibit very limited sole application in energy storage due to their poor conductivity.[1,2]
- Therefore to cope with limited conductivity here we introduced a layer-by-layer electrode fabrication approach over traditional mixing technique and utilize porous polymers to their maximum capacity.
- In this study, a particular polyimide based TAPB-PPI-1 porous polymer was investigated in super capacitor application.



Graphical illustration of layered electrode functioning

Materials and methods

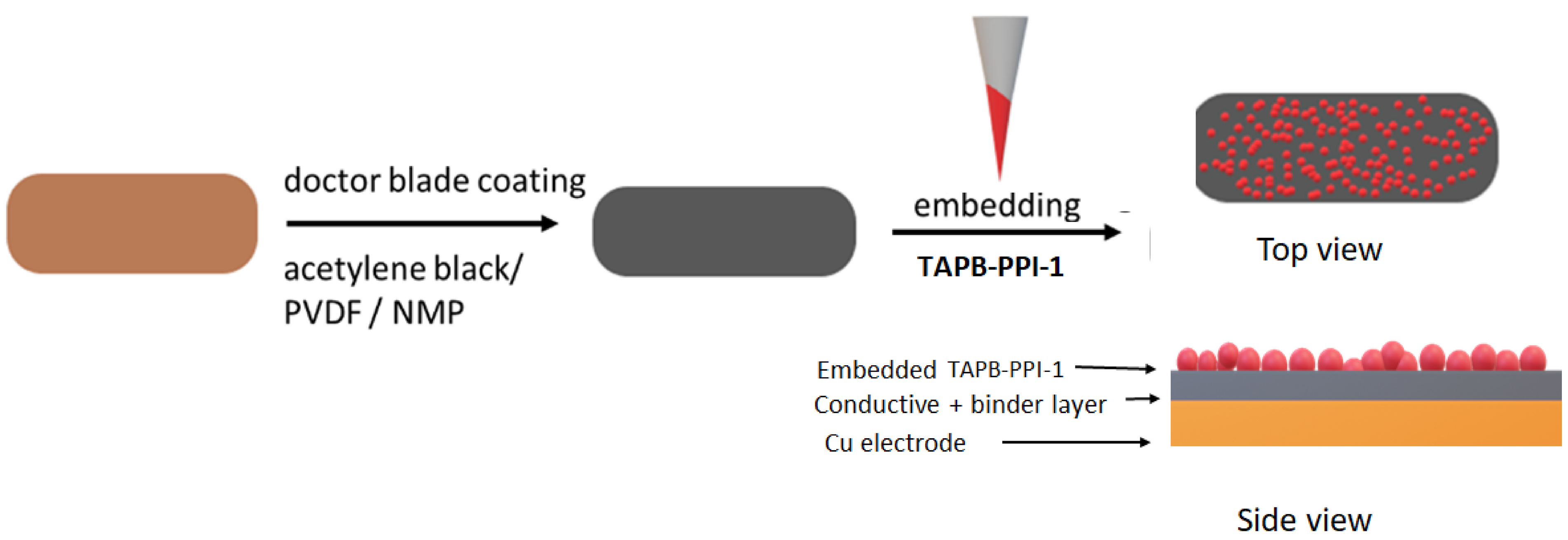
1. Materials



TAPB –PPI-1 was characterized X-ray diffraction (XRD) and scanning electron microscopy (SEM).

Synthesis of TAPB-PPI-1

2. Electrode fabrication

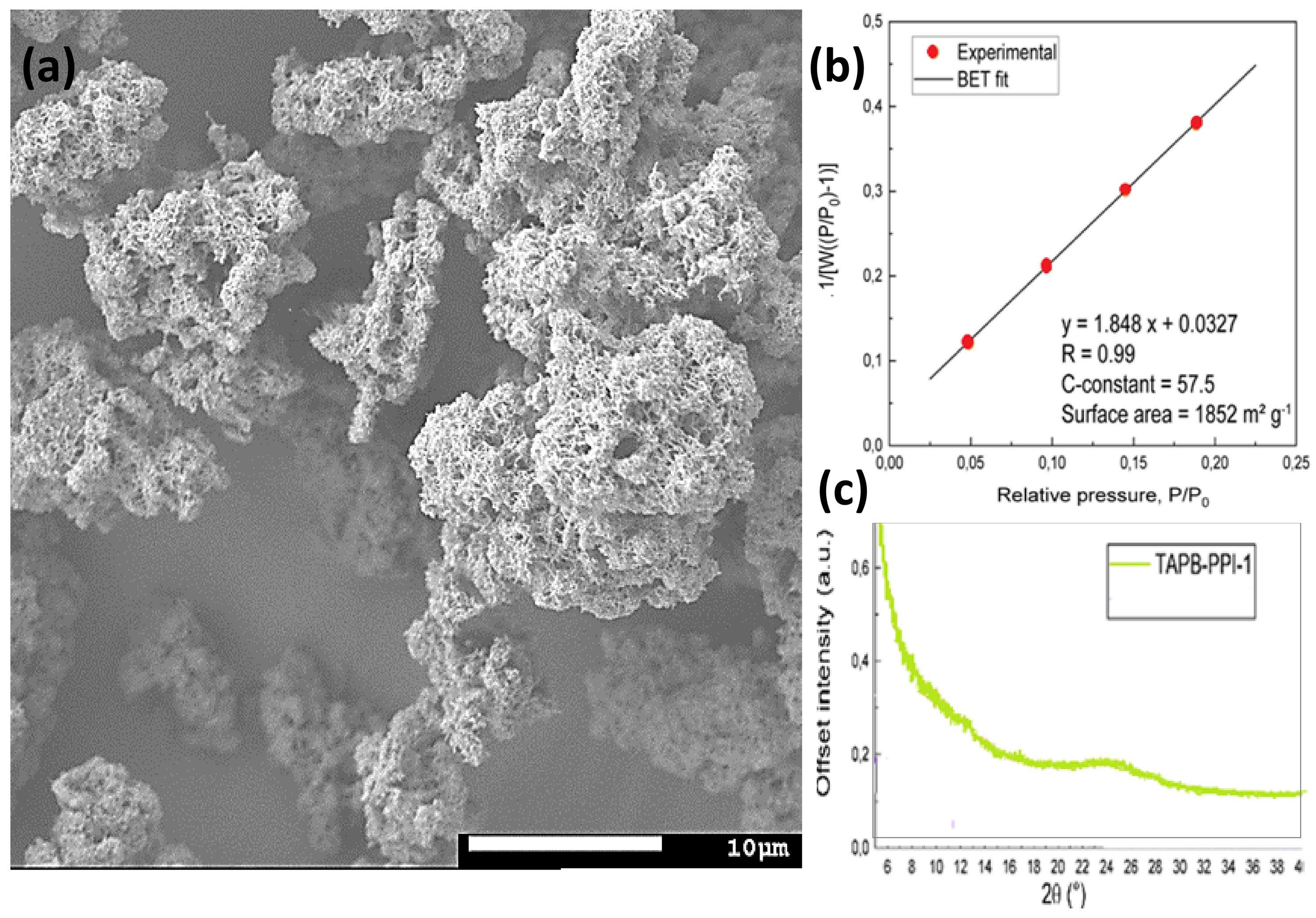


Layer by layer electrode fabrication

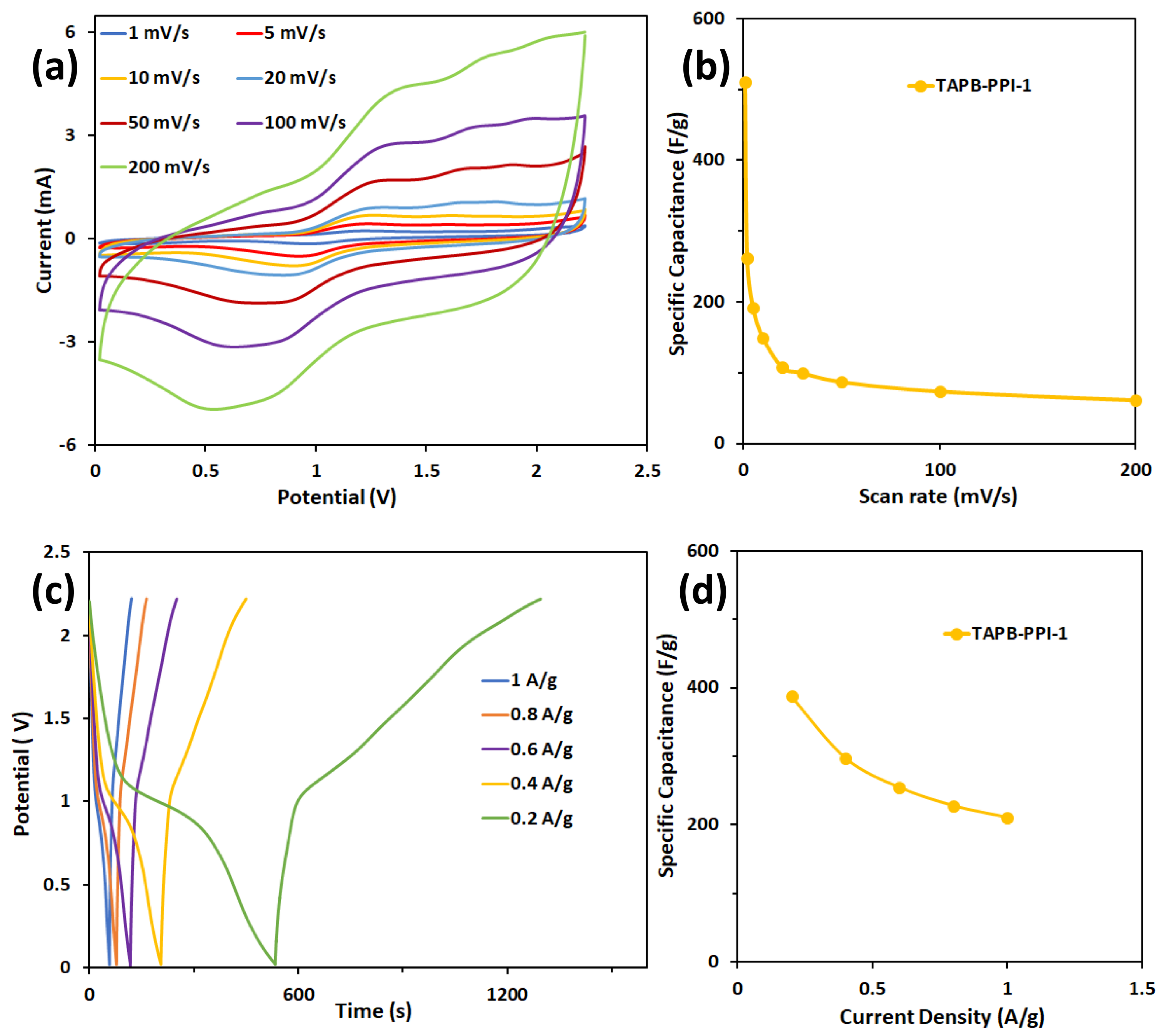
3. Electrochemical testing

- 2032 coin cells
- Electrolyte - 1 M LiPF6 in EC/EMC (1:1, v/v), CV and GCD measurements- 0.02 - 2.22 V

Results



(a) SEM image (b) BET surface area calculation (c) PXRD pattern of TAPB-PPI-1



(a) CVs (b) capacitance at different scan rates (C) GCD profiles (d) and the corresponding capacitance of TAPB-PPI-1 SC cell in 1 M LiPF6 electrolyte.

Concluions and future work

- Despite the poor conductivity, TAPB-PPI-1 showed excellent capacitance of 510 F g^{-1} at 1 mV s^{-1} scan rate while 388 F g^{-1} at 0.2 A g^{-1} due to maximum utilization of porous polymer through layer by layer casting approach.
- The capacitance was comparable to reported porous polymer performances , covalent triazine frameworks/ LiPF6 electrolyte (251 F g^{-1} at 0.5 A g^{-1}) [3] and [TEMPO]100%-NiP-COF in [EMIM][BF4] electrolyte (222 F g^{-1} at 0.5 A g^{-1}) [4] .
- Electrode resistance and cycling ability to be analysed.

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