

*Supporting information*

**Shape Regulated High Yield Synthesis of Electrocatalytically Active  
Branched Pt Nanostructures for Oxygen Reduction and Methanol  
Oxidation Reactions**

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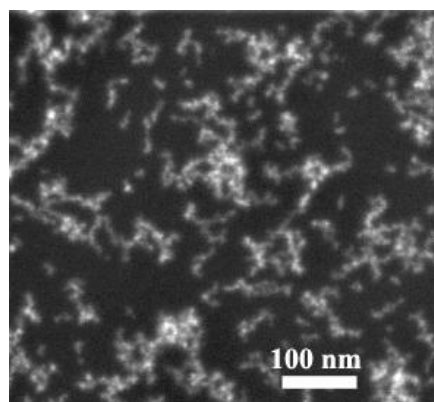
\* Corresponding author.

**Synthesis of spherical Pt nanoparticles:** The MWCNT-supported spherical Pt nanoparticles were synthesized by the following procedure. An aqueous  $\text{H}_2\text{PtCl}_6$  solution (500  $\mu\text{L}$  of 0.04 M) and 0.005 gm of MCNT were mixed with 10 mL of aqueous D-glucose solution (1 mM) and stirred for 30 min. Then 0.1 M aqueous NaOH solution was added as required, to maintain the pH of the solution at 8. Afterwards, 200  $\mu\text{L}$  of 0.05 M of aqueous  $\text{NaBH}_4$  solution was added to the mixture with vigorous stirring for another 30 min. The resulting suspension was filtered off and the residue, Pt nanoparticle deposited MCNT were collected and dried.

The electrochemically accessible surface area of spherical nanoparticle was calculated to be 1.9  $\text{cm}^2$ .

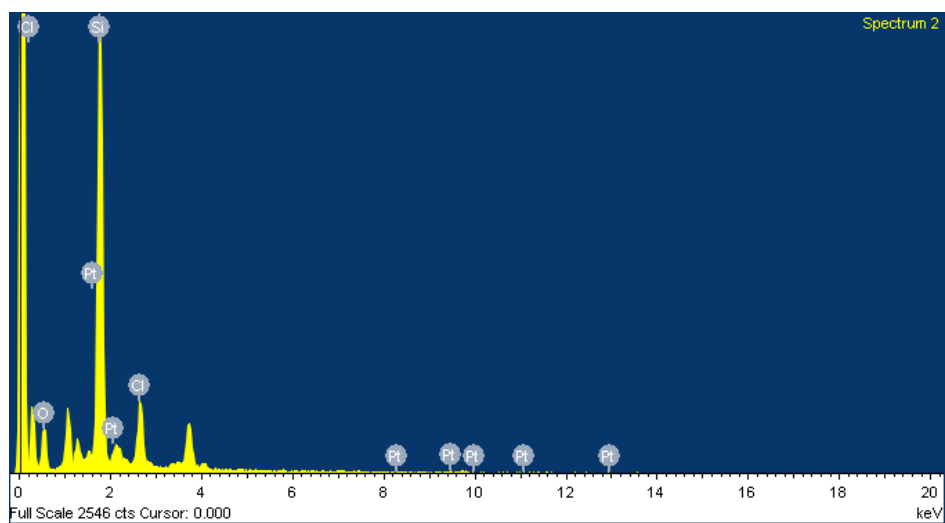
**Figure ESI-1**

SEM image obtained for the nPts.



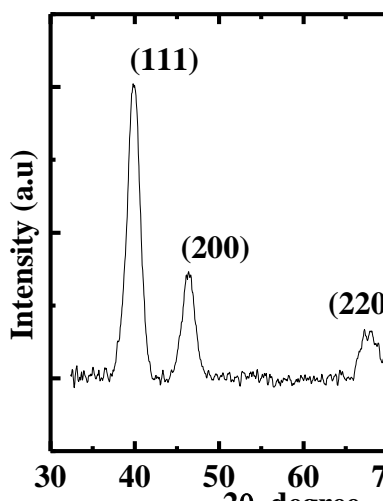
### Figure ESI-2

EDS pattern obtained for the nPts.



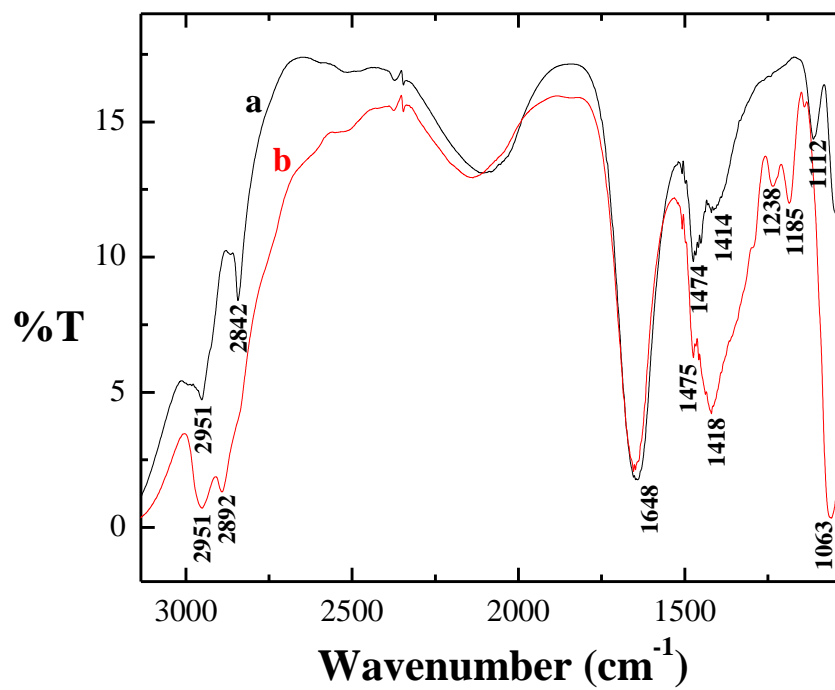
**Figure ESI-3**

X-ray diffraction pattern for the nPts.



**Figure ESI-4**

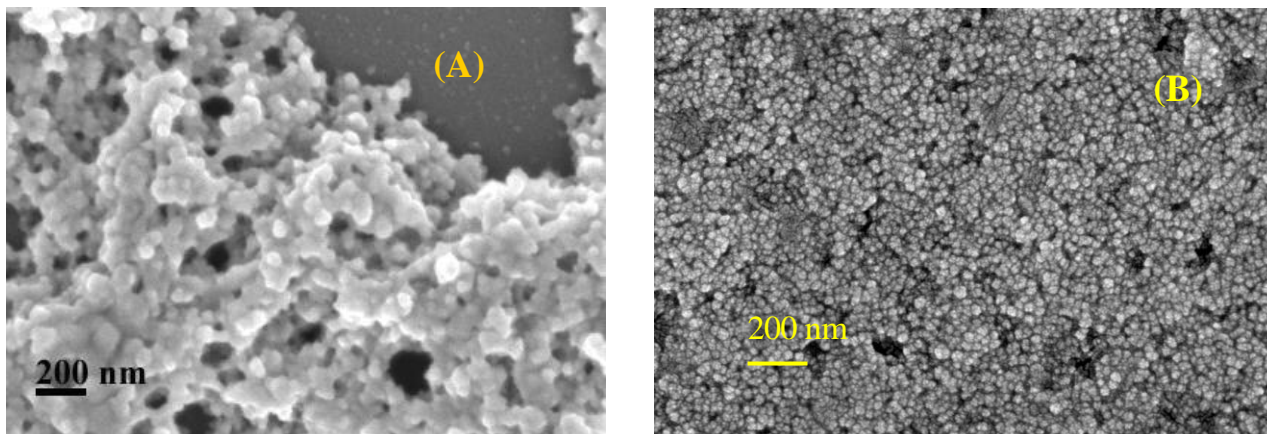
FTIR spectra obtained for (a) PDDA and (b) PDDA stabilized nPts.



**Figure ESI-5**

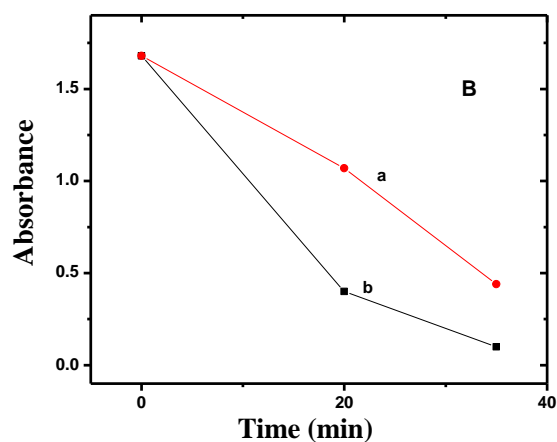
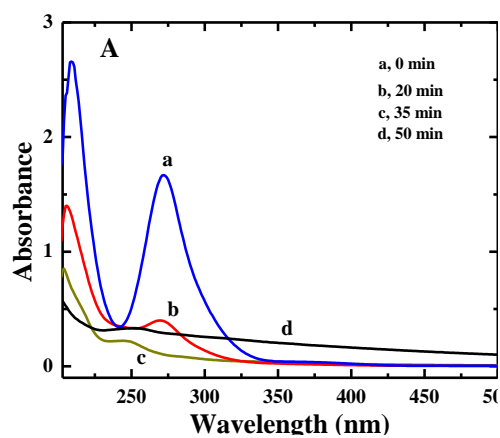
(A) FESEM image of Pt nanoparticle obtained in the absence of PDDA in 1,3-propanediol.

(B) FESEM image obtained for Pt nanoparticle synthesized using ethylene glycol as a solvent in the presence of PDDA. All the experimental conditions used in the synthetic procedure are same as in the branched Pt nanostructures.



**Figure ESI-6**

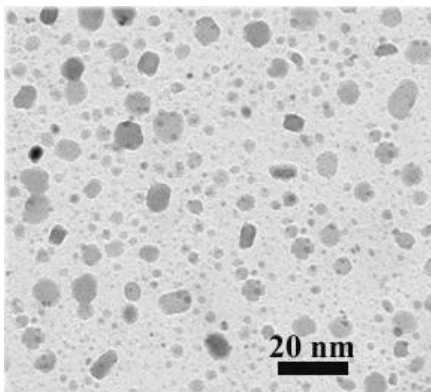
- (A) Time dependent UV-vis spectral measurement for the synthesis of Pt nanoparticles using ethylene glycol as solvent/reducing agent.
- (B) Plot illustrating the reduction rate of  $\text{PtCl}_6^{2-}$  in 1,3-propanediol (a) and ethylene glycol (b). The absorbance at 270 nm is plotted against reaction time. All the experimental conditions are same in both the cases.





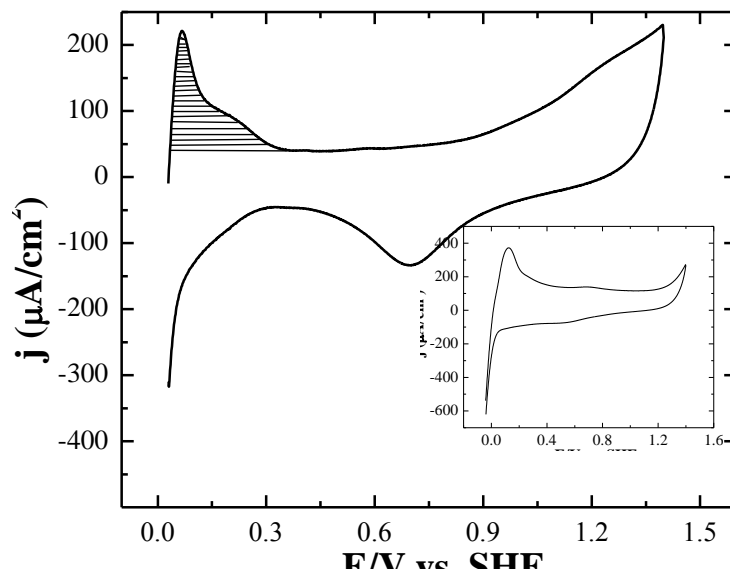
**Figure ESI-7**

TEM image of the nanoparticles obtained after 45 min of the reaction.



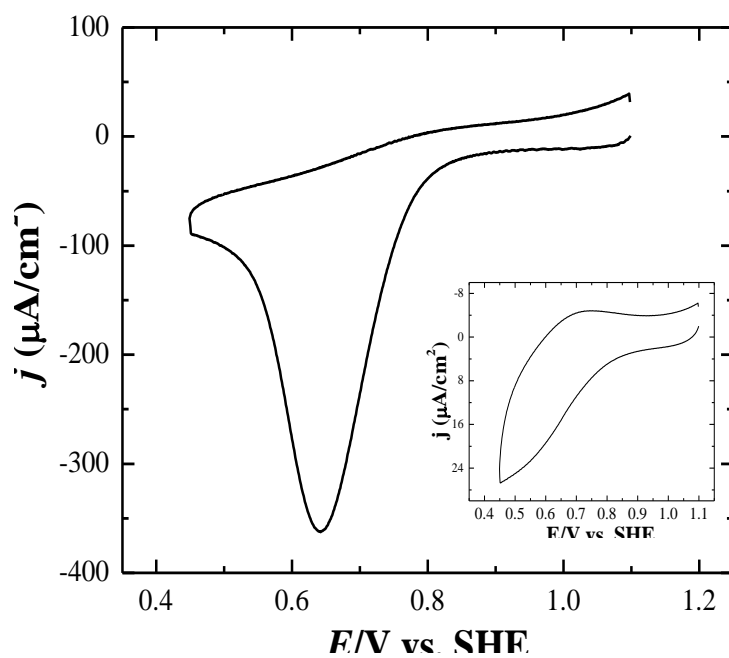
**Figure ESI-8**

Cyclic voltammogram obtained for the nPts-modified electrode in 0.5 M H<sub>2</sub>SO<sub>4</sub>. Scan rate: 100 mV/s. Shaded area was used to calculate the electrochemical surface area. (Inset: CV profile for commercial catalyst modified electrode in identical condition.)



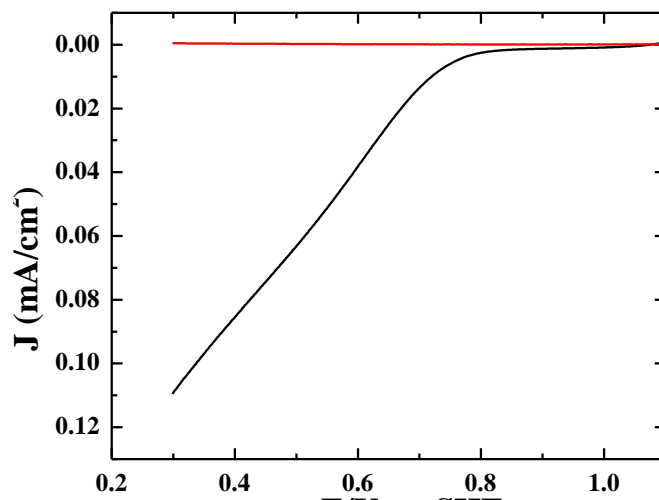
**Figure ESI-9**

Cyclic voltammogram illustrating the electrocatalytic activity of nPts towards ORR in 0.5 M H<sub>2</sub>SO<sub>4</sub>. Scan rate: 25 mV/s. Inset shows the voltammogram obtained for ORR on the commercial catalyst-modified electrode.



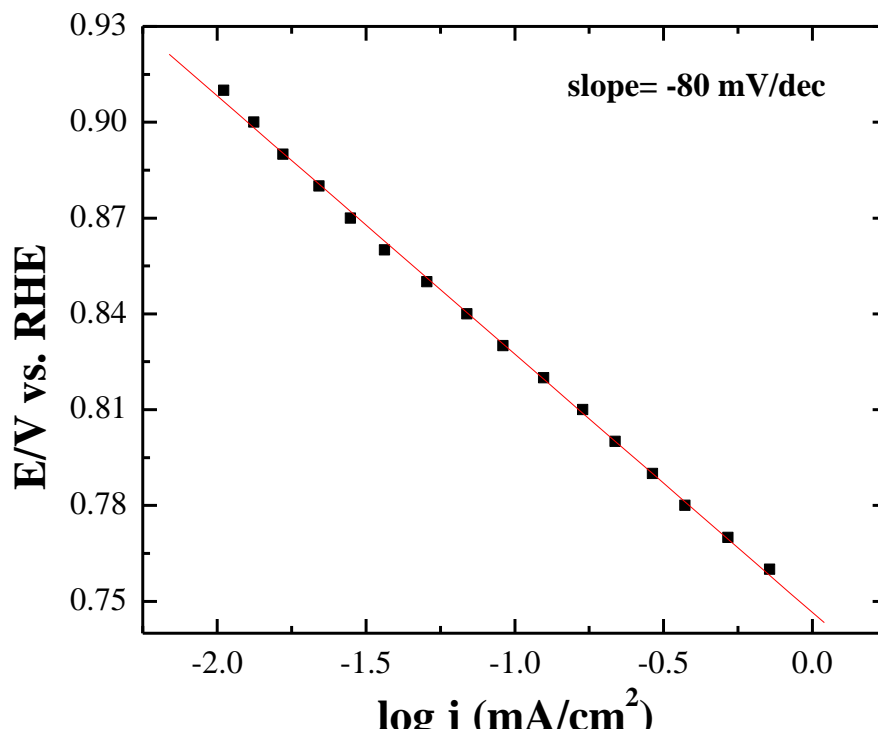
### Figure ESI-10

Polarization curves obtained for ORR on commercial catalyst modified electrodes in 0.5 M H<sub>2</sub>SO<sub>4</sub> at rotation rate of 1200 rpm. Scan rate: 2 mV/s. Ring potential: 0.85 V.



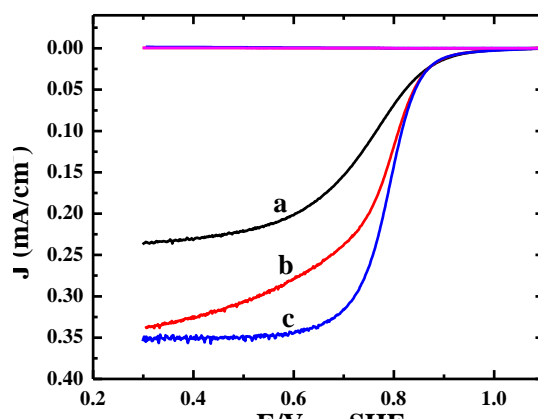
**Figure ESI-11**

Tafel plot obtained for ORR. The kinetic current density obtained from Figure 5B is plotted against potential.



### Figure ESI-12

Polarization curves for ORR on (a) spherical nanoparticle (b) aggregated nanoparticle obtained in absence of PDDA (c) nPts modified electrodes in 0.5 M H<sub>2</sub>SO<sub>4</sub>. Rotation rate: 1200 rpm. Scan rate: 2 mV/s. Ring potential: 0.85 V. All nanoparticles were supported on MWCNT.



**Figure ESI-13**

Potential dependent (capacitive region) Nyquist complex impedance plot obtained for the oxidation of methanol on nPts-modified electrode in 0.5 M H<sub>2</sub>SO<sub>4</sub>.

