Supporting information

Facile In Situ Synthesis of Multiwall Carbon Nanotube Supported Flower-like Pt Nanostructures: An Efficient Electrocatalyst for Fuel Cell Application

Sourov Ghosh and C. Retna Raj*

Department of Chemistry
Indian Institute of Technology, Kharagpur, West Bengal, India.
Fax: 91-3222-282252; Tel: 91-3222-283348
E-mail: crraj@chem.iitkgp.ernet.in

Figure 1S

XRD pattern obtained for nPtFs.

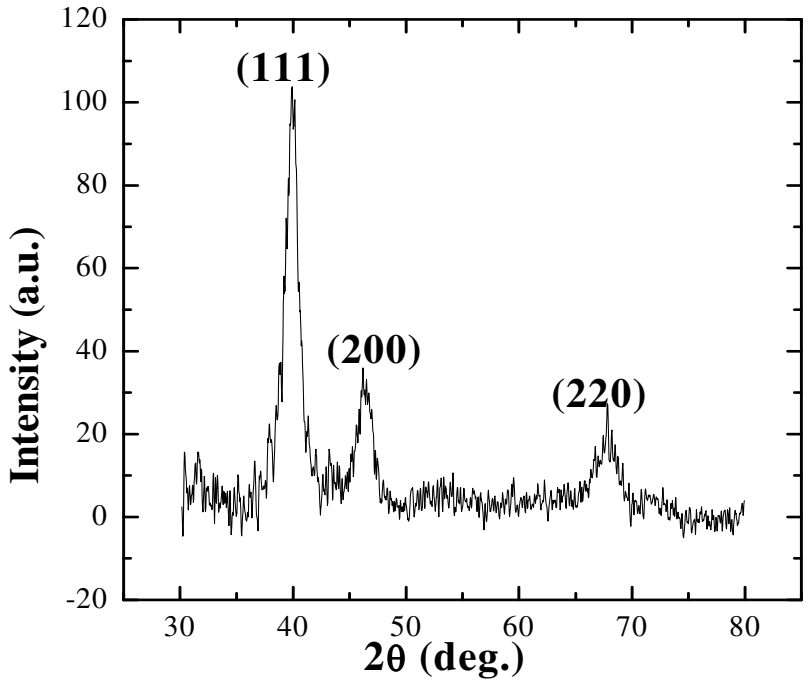


Figure 2S

Energy dispersive spectral pattern obtained for nPtFs.

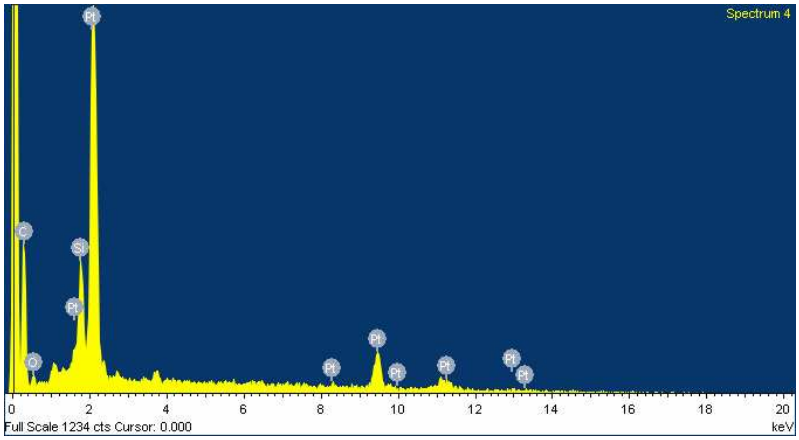


Figure 3S

Cyclic voltammogram obtained for nPtF modified electrode in 0.1 M H_2SO_4. Scan rate: 25 mV/s. Electrochemically accessible area was obtained by integrating the shaded area.

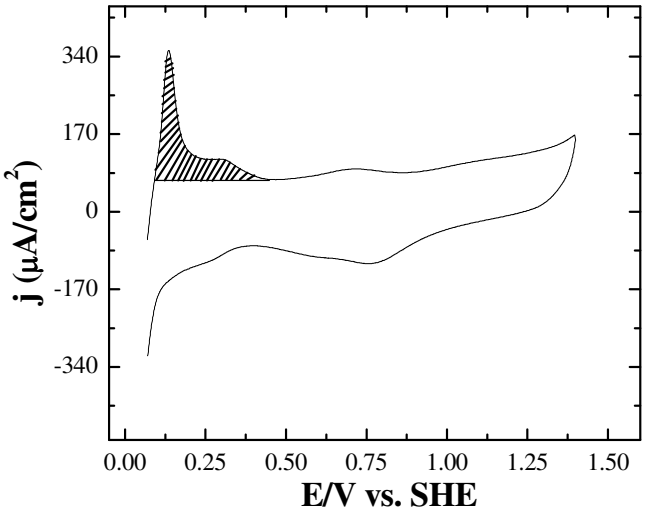


Figure 4S

Plot illustrating the loading dependent specific area (area per unit mass) of nPtFs. The MWCNT supported nPtFs (mg/mL) is plotted against the surface area of nPtFs ($cm^2/\mu g$ of nPtFs).

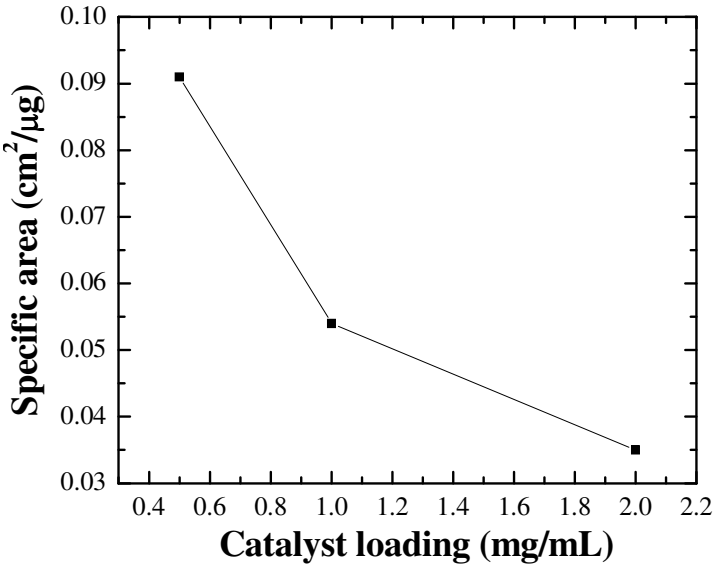


Figure 5S

Particle loading dependent electrocatalytic activity of nPtF in ORR. Loading: (a) 14, (b) 28 and (c) 56 µg/cm^2. Refer Table 1 for details.

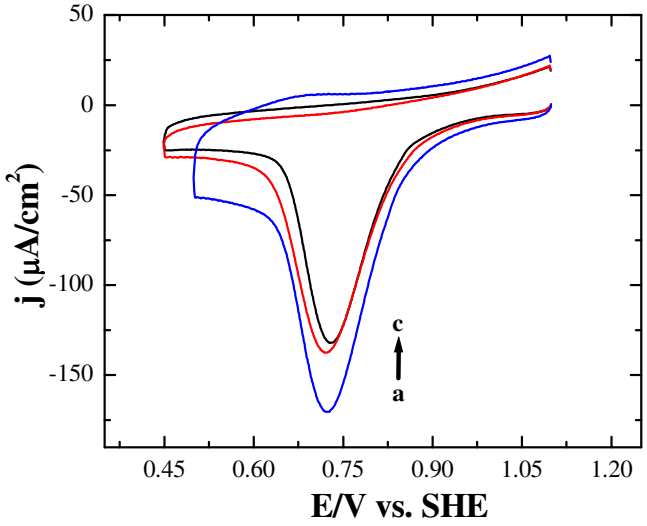
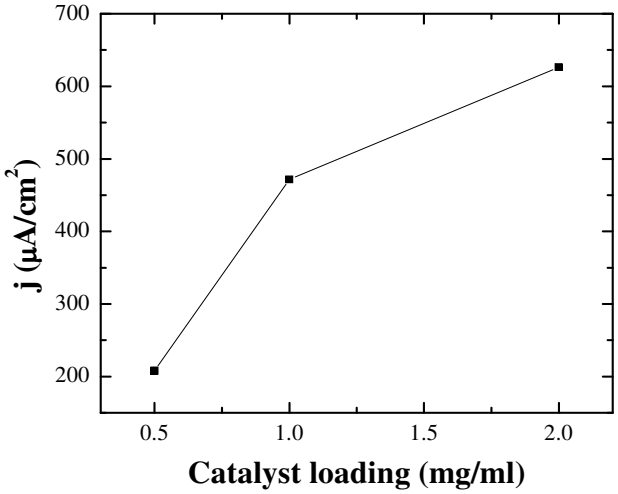


Figure 6S

Plot illustrating the particle loading dependent electrocatalytic performance of MWCNT supported spherical nanoparticles towards ORR. The MWCNT supported spherical nanoparticles were synthesized and characterized according to the procedure given below.



Synthetic procedure for spherical Pt nanoparticles: An aqueous mixture of D-glucose and H_2PtCl_6. $6H_2O$ was mixed with 5 mg of MWCNT and stirred for 30 min. The pH of the solution was adjusted to 8. Afterwards, 80 μL of 0.05 M of aqueous $NaBH_4$ solution was added to the mixture with vigorous and continuous stirring for another 30 min. The resulting suspension was filtered off and the catalyst was dried under argon atmosphere. The nanoparticle was characterized by TEM measurements. The TEM image confirms the existence of spherical Pt nanoparticles on the walls of MWCNTs. The scale bar in the TEM image given below is 100 nm.

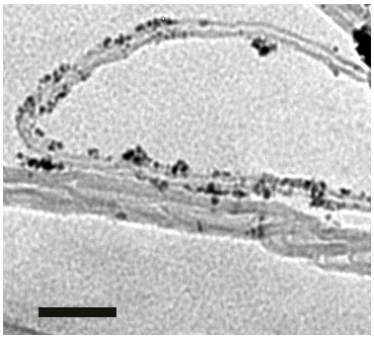


Figure 7S

Polarization curve obtained for ORR on (a) 10% Pt on activated carbon, and (b) nPtF modified electrode having identical loading. Rotation rate:1200 r.p.m. Scan rate = 2 mV/s.

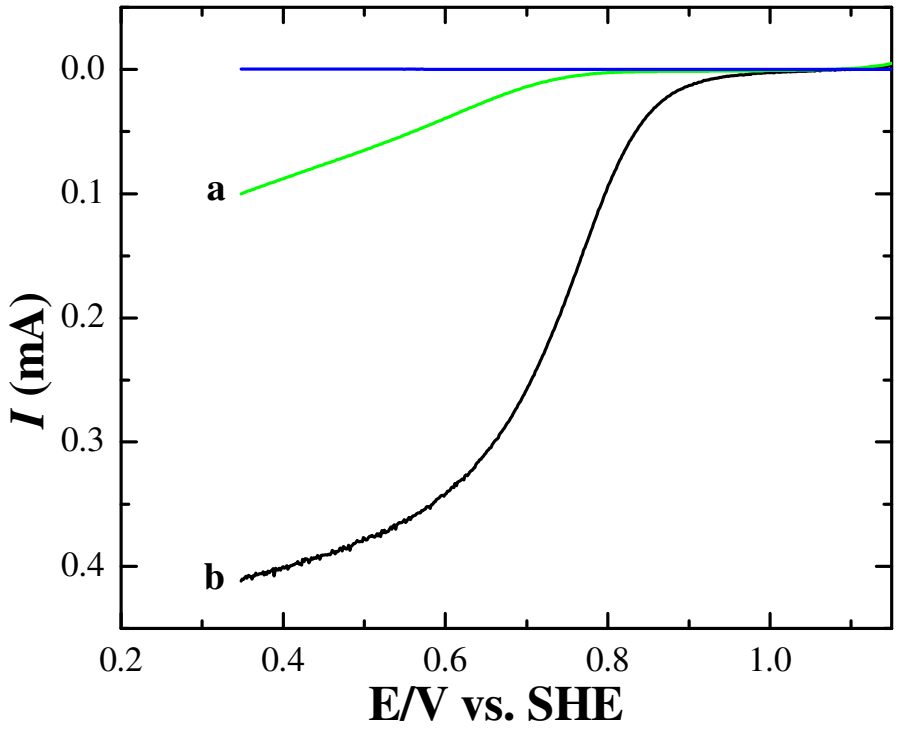


Figure 8S

Tafel plot obtained for ORR in 0.5 M H_2SO_4 on nPtF modified electrode.

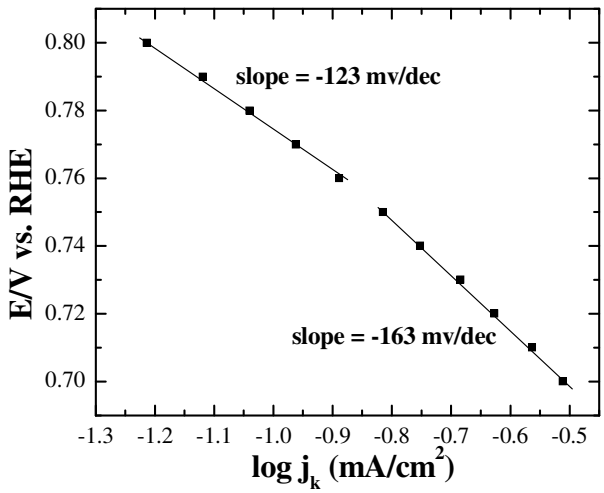


Figure 9S

Voltammogram illustrating the loading dependent electrocatalytic activity of nPtF towards methanol oxidation. Laoding: (a) 14, (b) 28 and (c) 56 µg/cm^2. Refer Table 1S for details.

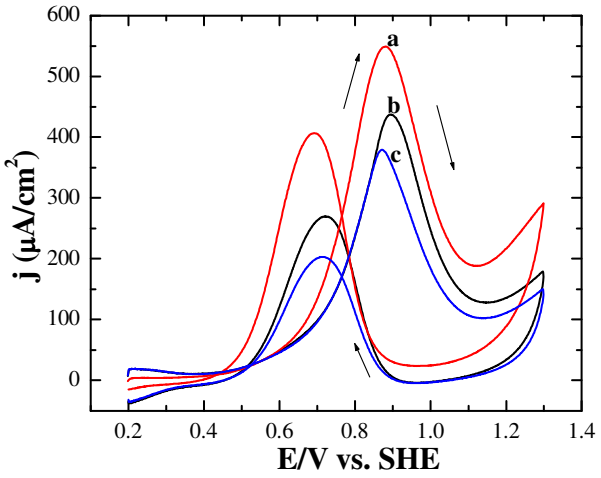


Figure 10S

(A) Potential dependent 3-D Nyquist complex impedance plot obtained for the oxidation of methanol (0.1 M) on MWCNT supported spherical Pt nanoparticle based electrode in 0.5 M H_2SO_4. Electrode Potential: (a) 0.4, (b) 0.6, (c) 0.8 V. (B) Cyclic voltammogram obtained for the oxidation of methanol on MWCNT supported spherical Pt nanoparticle modified electrode. Other experimental conditions are same as Figure 5.

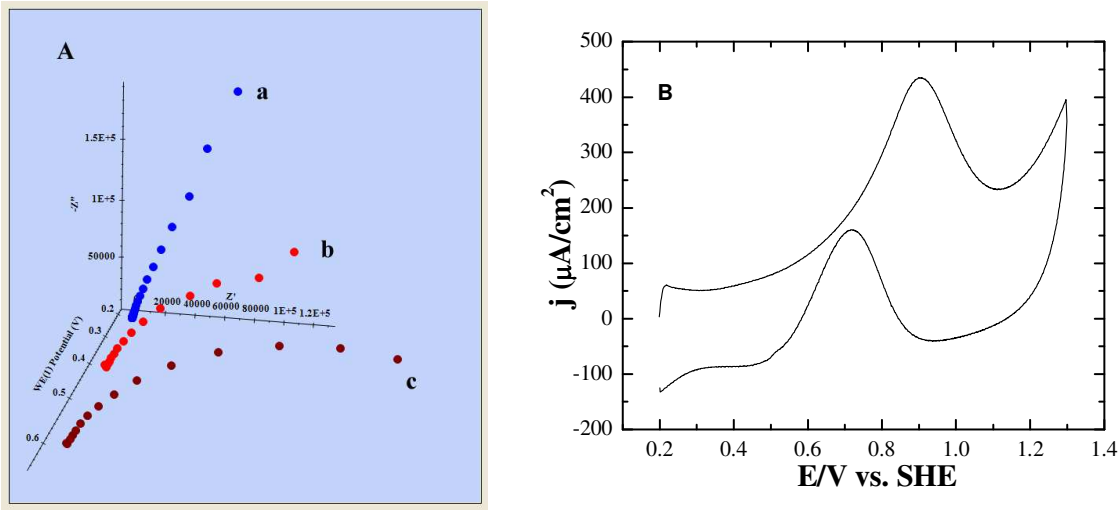


Figure 11S

Bode plot obtained for the oxidation of methanol on nPtF modified electrode at different potential.