Environment-friendly facile synthesis of Pt nanoparticles supported on polydopamine modified carbon materials

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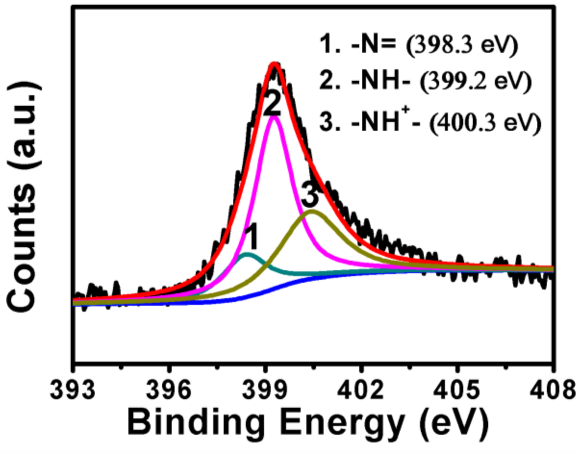

Figure S1. The N1s region XPS spectra of monomer Pdop.

Figure S1 shows the N1s region XPS spectra of monomer Pdop. The presence high resolution N 1s of Pdop monomer can be deduced from three additional peak components at the BE of 398.3 eV for the -N=H species, 399.2 eV for the -N-H species and 400.3 eV for the partially protonated -N-H species (–N^{+}-).[1] The -N-H species attribute to the amine group of the dopamine, while the -N=H species may form through structure evolution during the dopamine self-polymerization process.[2,3] However, the physicochemical details of dopamine–surface interaction and the mechanism for dopamine self-polymerization remain elusive.

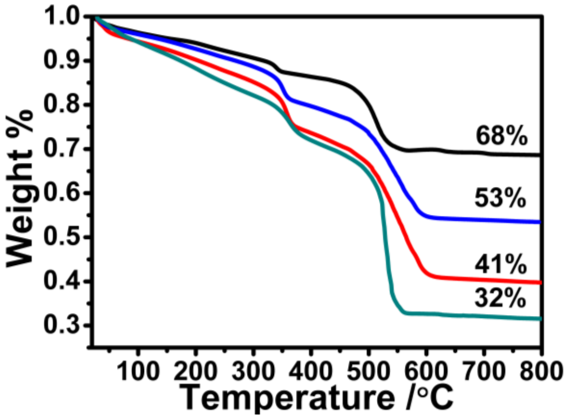

Figure S2. Thermogravimetric analysis at a heating rate of 10 °C min^{-1} under air atmosphere of the MWNTs/Pdop-Pt nanocomposites synthesized form 1:3, 1:4, 1:6 and 1:8 mass ratio of MWNTs/Pdop to H_2PtCl_6, respectively.

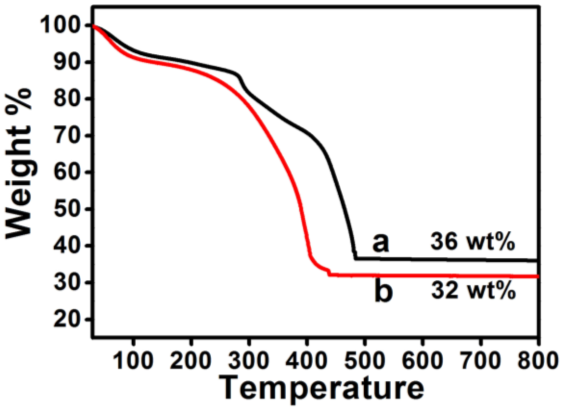

Figure S3. Thermogravimetric analysis at a heating rate of 10 °C min^{-1} under air atmosphere of a) CNs/Pdop-Pt, b) CB/Pdop-Pt nanocomposites.

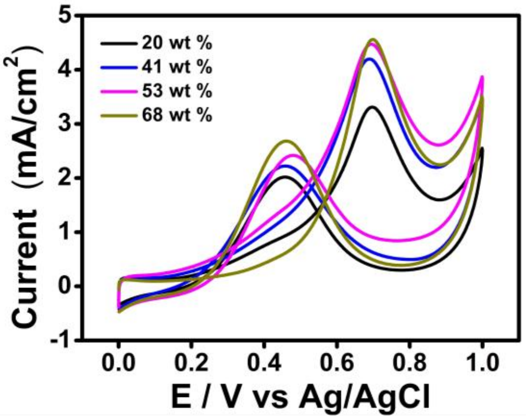

Figure S4. Cyclic voltammograms for methanol oxidation of of the different mass ratios of MWNTs/Pdop to H_2PtCl_6 (20, 41, 53, 68 wt%) catalysts recorded at room temperature in 1.0 M H_2SO_4 solution containing 2.0 M methanol at a scan rate of 50 mV/s.

The electrocatalytic properties of Pt/MWNT nanocomposites toward the methanol oxidation reaction were tested. To investigate the electrocatalytic activity of the MWNTs/Pdop-Pt nanocomposites with different Pt loading, room-temperature CVs for methanol oxidation reaction were carried out in 1.0 M H_2SO_4 solution containing 2.0 M methanol at a scan rate of 50 mV/s (Figure S4). The electrocatalytic activity is expected to increase with increasing Pt loading. Decreasing the loading of Pt NPs would reduce the catalytic surface coverage and the effective contact between Pt NPs and supporting materials. With the increased loading of Pt NPs leads to the significant increase the number of adjacent Pt NPs for subsequent adsorption of Pt-COad and Pt-OHad and thus promotes the oxidation rate of absorbed CO on Pt surface. Thus, the increased loading of Pt NPs enhanced the electrocatalytic activity for the methanol oxidation. Finally the electrocatalytic activity reaching its limits attributed to the part agglomeration of Pt NPs at higher Pt loadings.[4, 5]

Notes and references

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