

## Electronic Supplementary Information

# Highly reduced graphene oxide supported Pt nanocomposites as high-efficient catalyst for methanol oxidation

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## Experimental section

### Preparation of GO, RGO<sub>Na-NH<sub>3</sub></sub>, Pt/RGO<sub>Na-NH<sub>3</sub></sub> nanocomposites

GO was prepared from natural graphite powder (Bay Carbon, SP-1 graphite) using the modified Hummers method [27,28]. In a typical procedure, 500 mg of GO was dispersed in 100 ml of liquid NH<sub>3</sub>. This dispersion was stirred for 20 min until it became clear. Na (800 mg, cutting into small) was then added and the mixture was stored at dry ice-acetone bath for 30 min with constant stirring. We then removed the ice-acetone bath and let the ammonia volatilized to remove it. The product was isolated by filtration, washed with distilled water and ethanol, and then vacuum dried overnight at room temperature to yield RGO<sub>Na-NH<sub>3</sub></sub>. To obtain the Pt/RGO<sub>Na-NH<sub>3</sub></sub> composites, 10.5 mg RGO<sub>Na-NH<sub>3</sub></sub> was dispersed in 100 mL water (pH=10) by ultrasonic treatment 20 min, and 2 mL 0.02 M H<sub>2</sub>PtCl<sub>6</sub> was added under stirring. Then 20 mg NaBH<sub>4</sub> was slowly added to the mixture, with stirring for 1 h at 85 °C. For comparison, Pt/Vulcan XC-72 (Cabot corp., specific surface area of 237 m<sup>2</sup>/g) (denoted as Pt/Vulcan) catalyst with same Pt loading was also constructed by the same procedure.

### Characterization

TEM and HRTEM and electron diffraction images were obtained using a JEM-1200EX. The TEM samples were prepared by drying a droplet of the graphene suspension on holey carbon grids. X-ray diffraction (XRD) data were collected on a Bruker D8-Advance using Cu-K $\alpha$  radiation ( $\lambda=1.5418 \text{ \AA}$ ).

### Electrochemical measurements

The electrochemical tests for Pt/RGO<sub>Na-NH<sub>3</sub></sub> and Pt/Vulcan catalysis were carried out in a standard three-electrode system controlled with a Princeton Versa Stat 3 electrochemical working station. The working electrode was the catalyst supported glassy carbon electrode, the counter electrode was Pt wire and Ag/AgCl (sat. KCl) was used as the reference electrode. The catalyst ink for electrode preparation was formed by 15 min of ultrasonic mixing of 5 mg catalyst powders with 1 mL of ethanol and 50  $\mu$ L of Nafion solution (5wt %). Subsequently, 10  $\mu$ L of the catalyst ink was pipetted on a mirror-finished glassy carbon electrode. Finally, the electrode was dried under room temperature. The working electrodes were first activated with cyclic voltammograms (CVs) (-0.2 to 1.2 V at 50 mV s<sup>-1</sup>) using a CHI 802 electrochemical workstation (CHI Inc., USA) in N<sub>2</sub>-purged 0.5 M H<sub>2</sub>SO<sub>4</sub> solution until a steady CV was obtained. To measure methanol electro-oxidation, the solution of 0.5 M methanol in 0.5 M H<sub>2</sub>SO<sub>4</sub> was purged with N<sub>2</sub> gas before measurements were taken, and the CV was recorded in the potential between 0 and 1 V at a scan rate of 50 mV s<sup>-1</sup>. The amperometric current density-time (*I-t*) curves were measured at a fixed potential of 0.6 V for 500 s. All of the tests were conducted at room temperature.