

Supplementary Information:

Electrochemically fabricated flower-like graphene as highly efficient Pt electrocatalysts support for methanol oxidation

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► **Electrochemical characterization:**

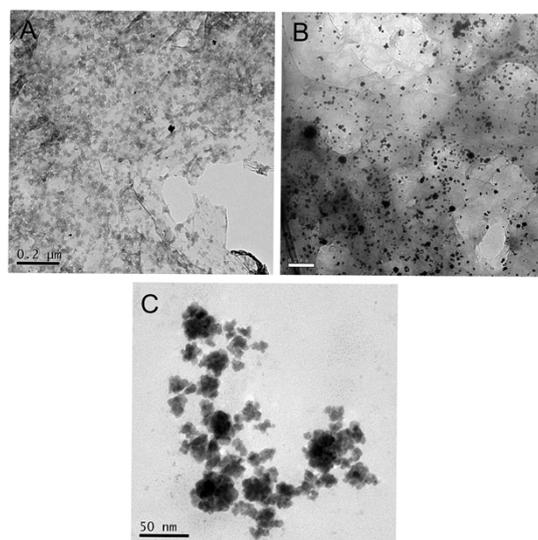


Fig. S1 TEM images of Pt/*f*-RGO (A), Pt/RGO (B) and Pt (C)

The TEM images of the Pt/*f*-RGO, Pt/RGO and Pt catalysts scraped from Pt/*f*-RGO/GCE, Pt/RGO/GCE, and Pt/GCE have been provided in Fig. S1. TEM images of Pt/*f*-RGO (A), Pt/RGO (B) and Pt (C) catalysts are presented in Fig. S1. Compared to Pt/RGO (B) and Pt (C) catalysts, the TEM images of Pt/*f*-RGO show that Pt particles with the narrowest average size are well-dispersed on the surface of *f*-RGO without obvious aggregations, which is particularly desirable to electrocatalytic performance towards methanol oxidation.

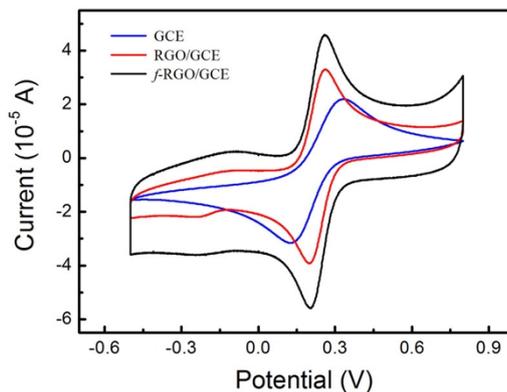


Fig. S2 CVs of the bare GCE, RGO/GCE, and *f*-RGO/GCE in 5 mM $K_3Fe(CN)_6$ aqueous solution containing 1 M KCl at scan rate of 20 mV s^{-1} .

In our experiments, the Pt/*f*-RGO/GCE and Pt/RGO/GCE are controlled with the same mass loading of RGO (0.107 mg cm^{-2}). The higher double layer capacitance of Pt/*f*-RGO/GCE originates from the porous 3D structure of *f*-RGO as well as its high electrochemical active surface area (ECSA). We calculated the ECSA of *f*-RGO/GCE on the basis of the charge associated with the oxidation and reduction of 5 mM $K_3Fe(CN)_6$ containing 1 M KCl (Fig.S2), which can be also an important criterion to evaluate the electrochemical performance of porous materials. For comparison, the ECSA of the bare GC electrode (GCE) and the RGO on GC electrode (RGO/GCE) were also calculated based on the Randles-Sevcik equation, assuming mass transport only by the diffusion process,^{1,2}

$$I_p = 2.69 \times 10^5 AD^{1/2} n^{3/2} \gamma^{1/2} C$$

where I_p refers to the anodic peak current, A is ECSA of the electrode, n is the number of electrons participating in the redox reaction, D is the diffusion coefficient of the molecule (equal to $(6.70 \pm 0.02) \times 10^{-6} \text{ cm}^2 \text{ s}^{-1}$), C is the concentration of the probe molecule in the solution (mol cm^{-3}), and γ is the scan rate (V s^{-1}). From the slope of the $I_p\text{-}\gamma^{1/2}$ relation, the ECSA of the bare GCE, RGO/GCE and *f*-RGO/GCE were calculated as 0.051 cm^2 , 0.068 cm^2 , and 0.102 cm^2 , respectively. It is obvious that the as-formed *f*-RGO/GCE showed the largest ECSA as compared to that of bare GCE and RGO/GCE, confirming the formation of *f*-RGO on GCE. Hence, the larger ECSA of Pt/*f*-RGO/GCE results in the higher double layer capacitance of Pt/*f*-RGO/GCE as compared to other electrodes.

1. L. Wang and Y. Yamauchi, *Chem. Mater.*, 2009, **21**, 3562.

2. J. Lu, I. Do, L.T. Drzal, R.M. Worden and I. Lee, *ACS Nano*, 2008, **2**, 1825.

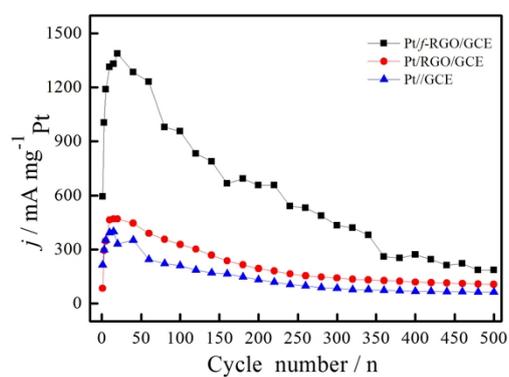


Fig. S3 The current densities of methanol oxidation at Pt/*f*-RGO/GCE, Pt/RGO/GCE and Pt/GCE as a function of CV cycle numbers in the presence of 1.0 M CH₃OH + 0.5 M H₂SO₄ at 0.5 V. Scan rate: 50 mV s⁻¹.