

## Supporting Information

### **Plasma synthesis of oxidized graphene foam supporting Pd nanoparticles as a new catalyst for one-pot synthesis of dibenzyls**

Liang Ren,<sup>‡a</sup> Fan Yang,<sup>‡a</sup> Chunxia Wang,<sup>b</sup> Yongfeng Li,<sup>a\*</sup> Hailing Liu,<sup>a</sup> Zhiqiang Tu,<sup>a</sup> Liqiang Zhang,<sup>a</sup> Zhichang Liu,<sup>a</sup> Jinsen Gao<sup>a</sup> and Chunming Xu<sup>a</sup>

<sup>a</sup>State Key Laboratory of Heavy oil Processing, China University of Petroleum, Changping 102249, Beijing, China. Fax: +86-10-89739028; Tel: +86-10-89739028

<sup>b</sup>Beijing National Laboratory for Molecular Sciences, Key Laboratory of Analytical Chemistry for Living Biosystems, Institute of Chemistry, the Chinese Academy of Science, Beijing 100190, China

## 1. The high-resolution XPS spectrum for C1s of GF, OGF, GO and RGO

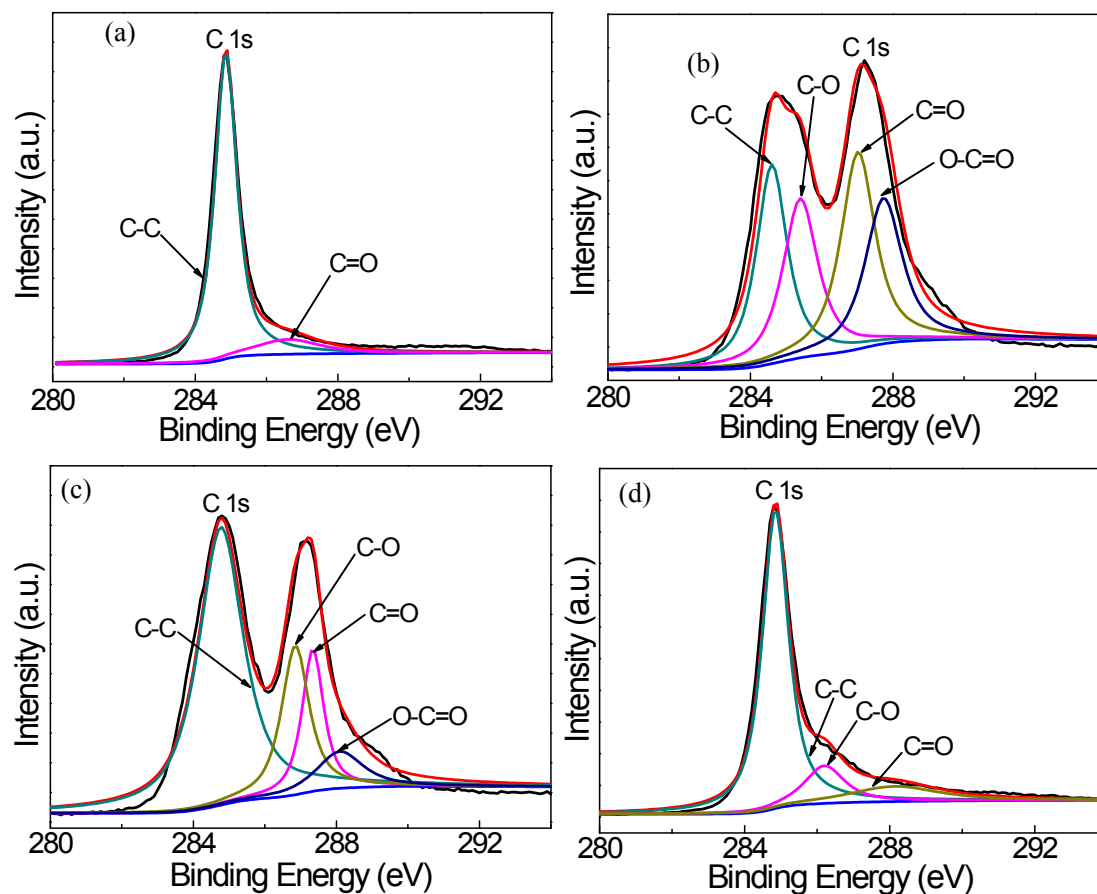


Figure S1 The high-resolution XPS spectrum for C1s of GF (a), OGF (b), GO (c) and RGO (d)

The high-resolution XPS spectrum for C1s of GF, OGF, GO and RGO are shown in Figure S1. The C1s spectrum of GF is split into two functional groups, including a C-C bond at 284.9 eV and a C=O bond at 286.6 eV, as indicated in Figure S1(a). Figure S1(b) shows the high-resolution C1s XPS spectrum of OGF which is divided into four components, a C-C bond at 284.6 eV, a C-O bond at 285.4 eV, a C=O bond at 287.0 eV and an O-C=O bond at 287.7 eV. Figure S1(c) demonstrates the high-resolution C1s XPS spectrum of GO which is split into four peaks, a C-C bond at 284.8 eV, a C-O bond at 286.8 eV, a C=O bond at 287.3 eV and an O-C=O bond at 288.1 eV. The C1s spectrum of RGO is divided into three functional groups, a C-C bond at 284.8 eV, a C-O bond at 286.2 eV, and a C=O bond at 288.2 eV, as shown in Figure S1(d).

## 2. The high-resolution XPS spectrum for C1s of Pd/GF, Pd/OGF, Pd/RGO and Pd/GO

The high-resolution XPS spectrum for C1s of Pd/GF, Pd/OGF, Pd/RGO and Pd/GO are shown in Fig. S2. The C1s spectrum of Pd/GF is split into two functional

groups, including a C-C bond at 284.8 eV and a C=O bond at 285.6 eV, as indicated in Figure S2(a). Figure S2(b) shows the high-resolution C1s XPS spectrum of Pd/OGF which is divided into four components, a C-C bond at 284.7 eV, a C-O bond at 285.2 eV, a C=O bond at 286.7 eV and an O-C=O bond at 287.4 eV. Figure S2(c) demonstrates the high-resolution C1s XPS spectrum of Pd/RGO which is split into three peaks, a C-C bond at 284.8 eV, a C-O bond at 286.5 eV and a C=O bond at 288.4 eV. The C1s spectrum of Pd/GO is divided into four functional groups, a C-C bond at 284.5 eV, a C-O bond at 285.2 eV, a C=O bond at 286.6 eV and an O-C=O bond at 287.4 eV, as shown in Figure S2(d).

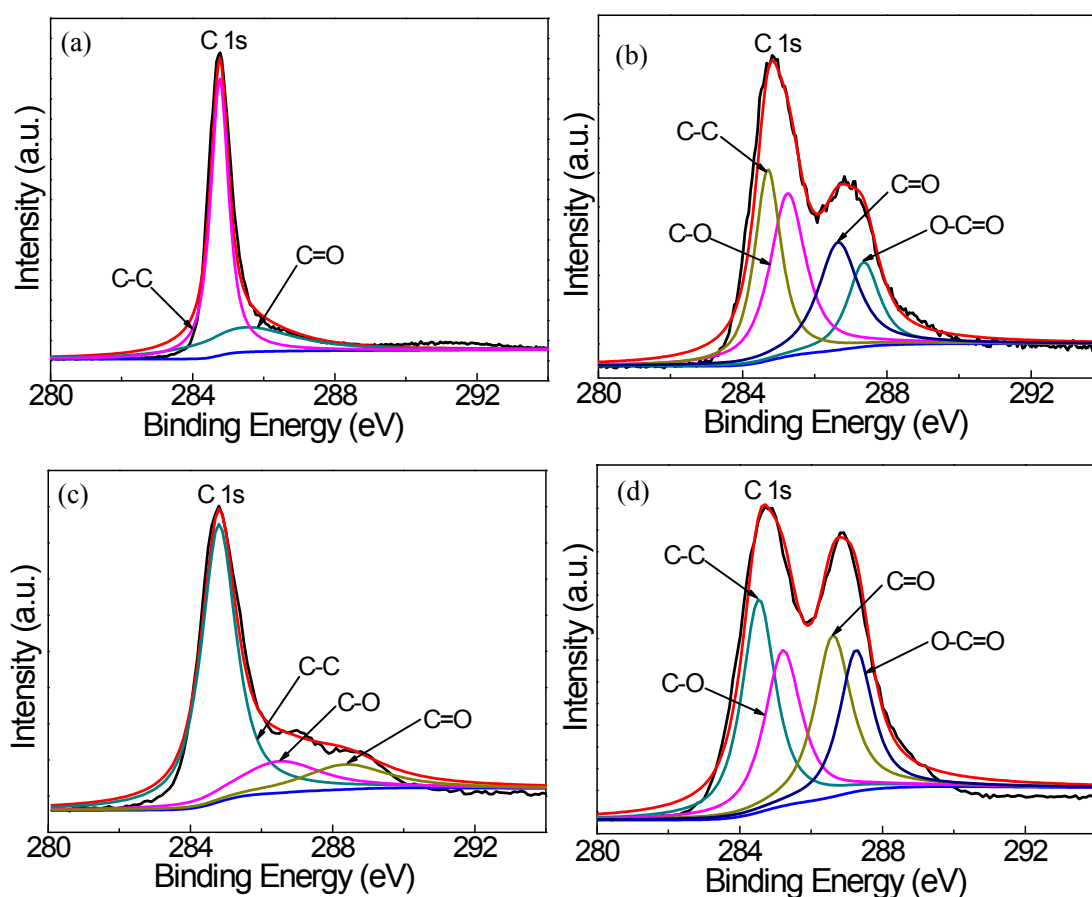


Figure S2 The high-resolution XPS spectrum for C1s of Pd/GF(a), Pd/OGF(b), Pd/RGO(c) and Pd/GO(d)

### 3. TEM image of only Pd particles

The TEM image of only Pd particles shows that Pd nanoparticles prepared by GLIP method aggregated seriously. (Figure S3).

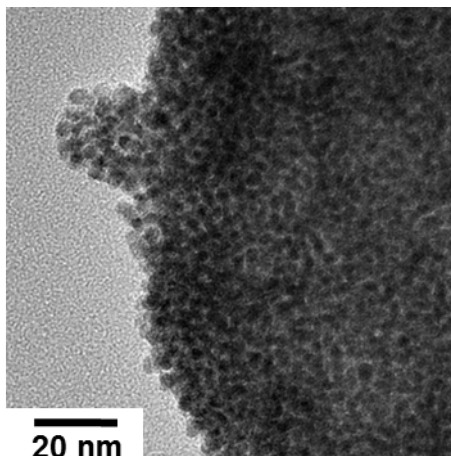


Figure S3 A TEM image of only Pd particles

### 4. Study on the recycle activity of Pd/OGF

The recycle activity of Pd/OGF is not good. We use 4-bromoacetophenone reacted with styrene to study the recycle activity of Pd/OGF. After the reaction, the Pd/OGF catalyst was removed by filtration and washed by ethyl acetate, deionized water and ethanol for several times. The catalyst was repeatedly used for the second time, and the product yield was very low. The TEM image (Figure S4) indicates that Pd nanoparticles were aggregated after reaction, which caused the deactivation of Pd/OGF. Compared with homogeneous catalyst Pd(OAc)<sub>2</sub> (the product yield is 66%) under same conditions, Pd/OGF (the product yield is 95%) has higher reaction activity.

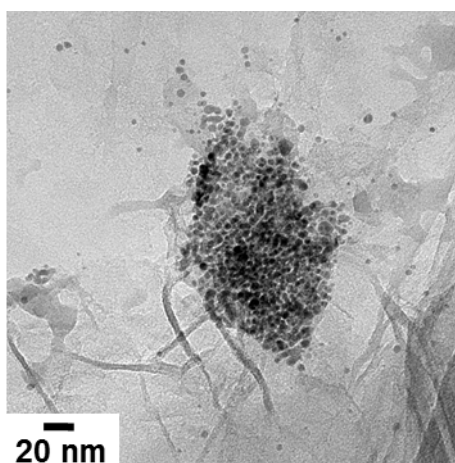
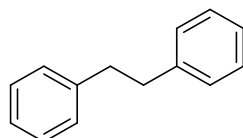


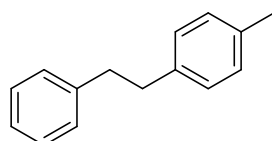
Figure S4 A TEM image of Pd/OGF after reaction

## 5. $^1\text{H}$ NMR data for products in Table 4

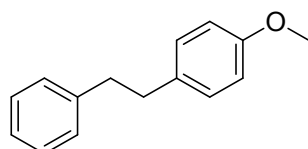
$^1\text{H}$  NMR spectra are recorded on a Bruker DMX-300 (300 MHz) spectrometer. Chemical shifts ( $\delta$ ) are reported in ppm from the solvent resonance as the internal standard ( $\text{CDCl}_3$ : 7.26 ppm). Data are reported as follows: chemical shift, multiplicity (s = singlet, d = doublet, t = triplet, q = quartet, m = multiplet), coupling constants (Hz) and integration.



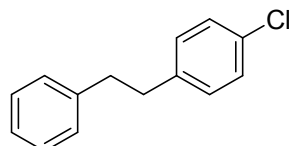
**1,2-diphenylethane (Table 4, entry 1);**  $^1\text{H}$  NMR was reported before.<sup>1</sup>



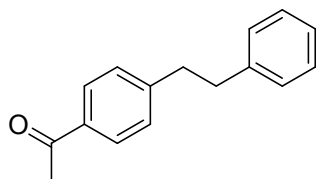
**1-methyl-4-phenethylbenzene (Table 4, entry 2);**  $^1\text{H}$  NMR was reported before.<sup>2</sup>



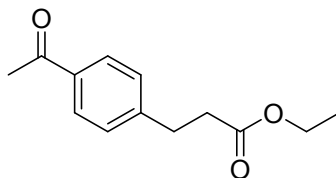
**1-methoxy-4-phenethylbenzene (Table 4, entry 3);**  $^1\text{H}$  NMR was reported before.<sup>2</sup>



**1-chloro-4-phenethylbenzene (Table 4, entry 4);**  $^1\text{H}$  NMR was reported before.<sup>3</sup>



**1-(4-phenethylphenyl)ethanone (Table 4, entry 5);**  $^1\text{H}$  NMR was reported before.<sup>2</sup>



**Ethyl 3-(4-acetylphenyl)propanoate (Table 4, entry 6);**  $^1\text{H}$  NMR (300 MHz,  $\text{CDCl}_3$ ):  $\delta$  7.88 (d,  $J$  = 8.2 Hz, 2H), 7.49–7.11 (m, 2H), 4.12 (q,  $J$  = 7.1 Hz, 2H), 3.00 (t,  $J$  = 7.7 Hz, 2H), 2.74–2.42 (m, 5H), 1.23 (t,  $J$  = 7.1 Hz, 3H). The  $^1\text{H}$  NMR spectrum of ethyl 3-(4-acetylphenyl)propanoate is shown in Fig. S7.

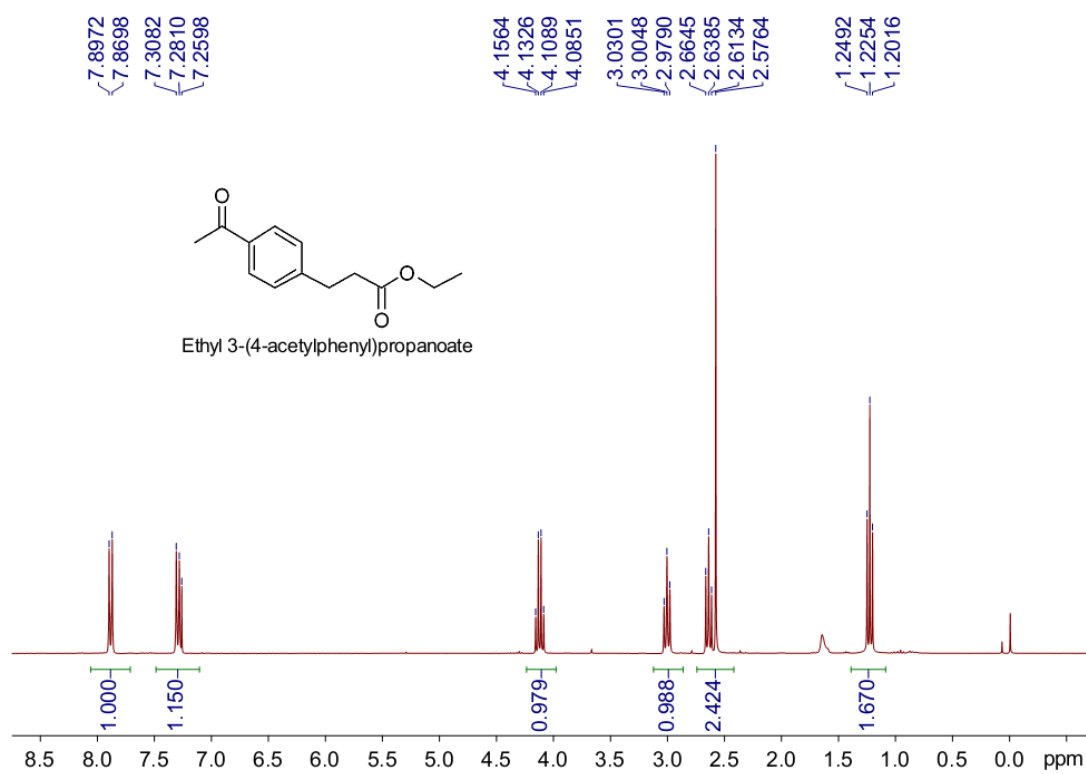


Figure S5  $^1\text{H}$  NMR spectrum (300 MHz,  $\text{CDCl}_3$ ) of ethyl 3-(4-acetylphenyl)propanoate.

## References

1. J. C. Sheehan and F. S. Guziec, Jr., *J. Org. Chem.*, 1973, **38**, 3034.
2. M. L. Kantam, R. Chakravarti, V. R. Chintareddy, B. Sreedhar and S. Bhargava, *Adv. Synth. Catal.*, 2008, **350**, 2544.
3. G. A. Molander and C. S. Yun, *Tetrahedron*, 2002, **58**, 1465.