

Electronic Supplementary Information (ESI)

Fabrication of gold nanoparticles/graphene oxide using graphene oxide as reducing agent and their excellent catalytic performance

Nana Zhang,^a Haixia Qiu,^a Yu Liu,^{a} Wei Wang,^b Yi Li,^a Xiaodong Wang^a and Jianping Gao^a*

(^aSchool of Science, ^bSchool of Chemical Engineering and Technology,

Tianjin University, Tianjin 300072, P R China)

*Corresponding author. Phone: +022-27403475; fax: +86 22 274 034 75.

Email: liuyuls@163.com.

1. Experimental Details

1.1 Materials

Graphite was from Huadong Graphite Factory; China, chloroauric acid (HAuCl₄), phenylboronic acid and the aryl halides were from Sigma; and all other reagents were from Tianjin Chemical Reagent Co. All chemicals were used as received.

1.2 Preparation of GO

Graphene oxide was prepared from purified natural graphite by a modified Hummer's method.¹ Experimental details, are given in the literature.²

1.3 Preparation of AuNPs/GO

1.4 mL HAuCl₄ aqueous solution (0.29 mg/mL) was mixed with various amounts of an aqueous GO suspension (5 mg/mL). The mixture was stirred with a mechanical stir bar for 15 min at 84° C, during this which time the AuNPs were deposited on the surface of the GO nanosheets to form AuNPs/GO.

1.4 Characterizations of AuNPs/GO

The photo of GO was recorded with a digital camera (COOLPIX S620, Nikon, Japan). Transmission electron microscopy (TEM) and energy dispersive X-ray spectroscopy (EDX) measurements were performed using a Philips Tecnai G2F20 microscope at 200 kV. Ultraviolet-visible (UV-Vis) absorption spectra were recorded with a HP8543 UV-Vis spectrophotometer. X-ray powder diffraction (XRD) analysis was conducted on a BDX3300 X-ray diffractometer at a scanning rate of 4°/min with 2 θ ranging from 10° to 90°, employing Cu K α radiation (λ = 0.15418 nm). X-ray photoelectron spectroscopy (XPS) was conducted on an x-ray photoelectron spectrometer (PHI1600 ESCA System, PERKIN ELMER, USA).

1.5 General procedure for Suzuki-Miyaura coupling reactions

Phenyl halides (22.5 mg, 0.2 mmol), phenylboronic acid (30.5 mg, 0.25 mmol), and NaOH (32.0 mg, 0.8 mmol) were added to an aqueous solution of AuNPs/GO and the reactant mixture was allowed to react for 4.5 h at 82 °C with stirring. The mixture was cooled to room temperature and centrifuged. The supernatant solution was removed and 0.6 mL ethyl acetate was added to it. The product and the un-reacted aryl halides (if any) entered the organic layer, the excess phenylboronic acid remained in the aqueous layer, and the AuNPs/GO settled to the bottom. The organic layer was collected and the ethyl acetate was removed with a rotary evaporator to obtain the

final product (a white solid). NMR was used to calculate the conversion yield. The AuNPs/GO settled on the bottom of centrifuge tube was added with reactants to begin a new cycle of reaction and treatment.

2 Supporting Figures

2.1 Stable GO and AuNPs/GO suspension

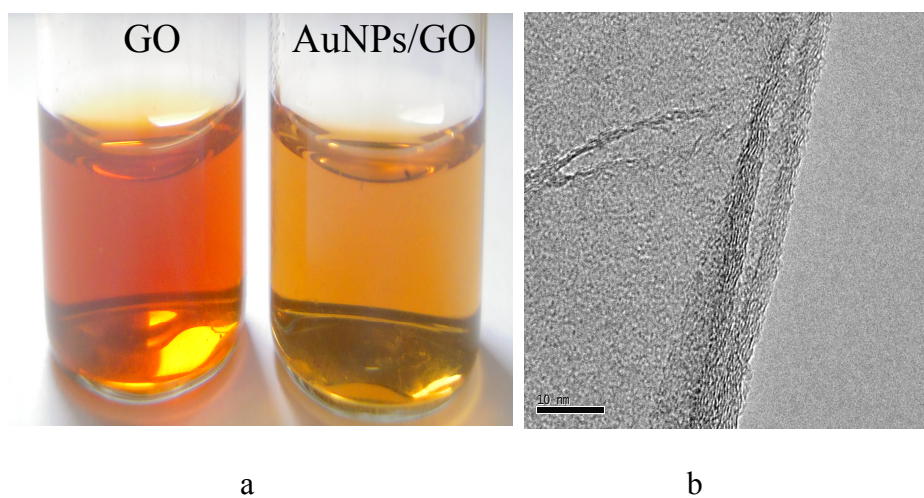


Fig. S1. (a) Optical photos of stable GO (5mg/mL); (b) TEM photo of GO nanosheets

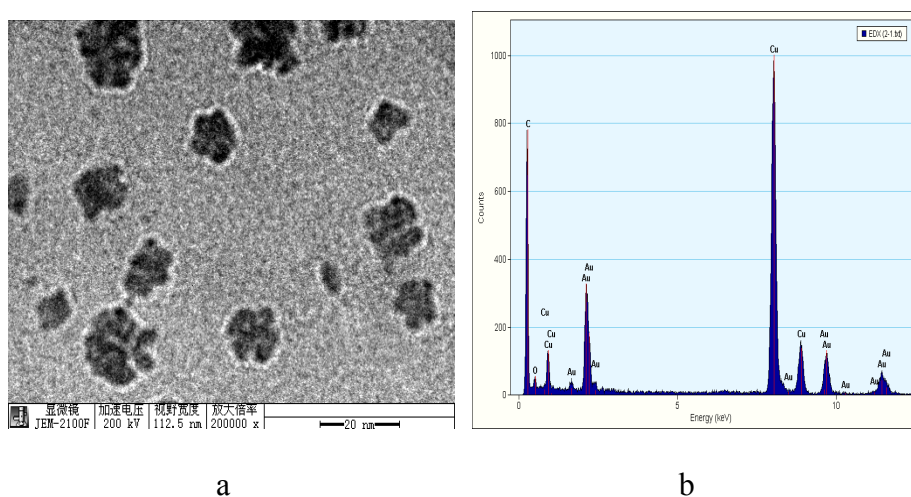
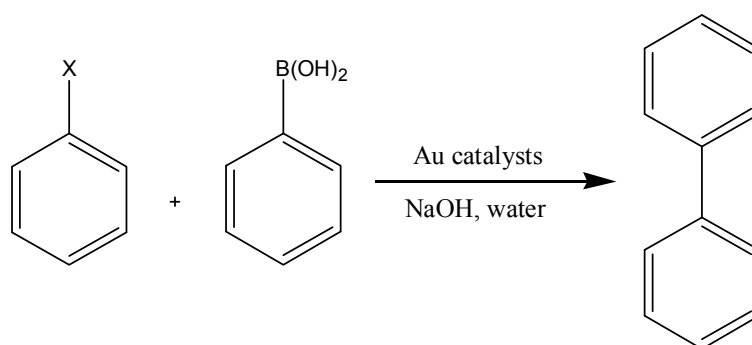


Fig.S2 TEM (magnification of Fig. 1d) and EDX images of AuNPs/GO

2.2 Suzuki-Miyaura coupling reactions of phenyl halides and phenylboronic acid

Table S1. Suzuki-Miyaura coupling of aryl halides and phenylboronic acids



Entry	X	Yield (%)
1	Cl	96
2	Br	95
3	I	38

Reaction conditions: phenyl halides (0.2 mmol), phenylboronic acid (0.25 mmol), Au catalyst (0.2 mol%), NaOH (0.8 mmol).

References

- [1] W. Hummers and R. Offeman, *Am. Chem. Soc.*, 1958, **80**, 1339-1339.
- [2] N. N. Zhang, H. X. Qiu, Y. M. Si, W. Wang and J. P. Gao, *Carbon*, 2011, **49**, 827-837.