

Electronic Supplementary Information: A General Strategy to Prepare Graphene-Metal/Metal Oxide Nanohybrids

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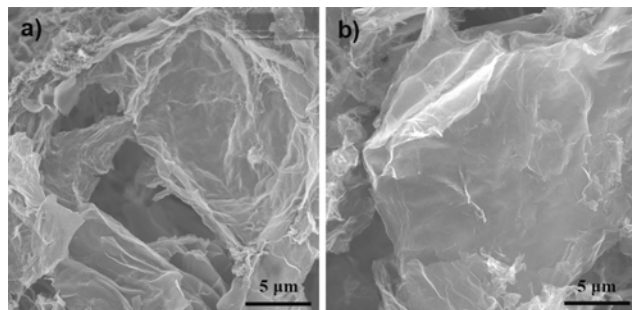


Figure S1. The SEM images of sulfonated graphene (a) and sulfhydrylated graphene (b).

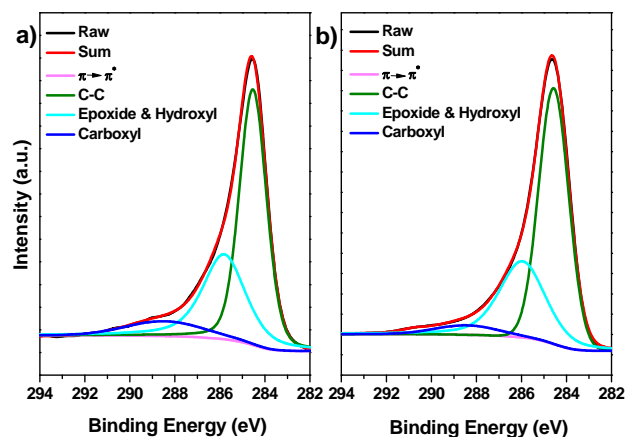


Figure S2. The XPS C 1s spectrum of the sulfonated graphene (a) and sulfhydrylated graphene (b).

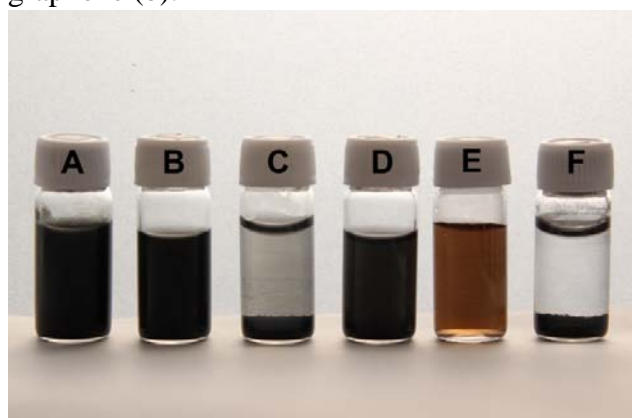


Figure S3. Solution of the sulfonated graphene in water (a), sulfonated graphene in ethanol (b), sulfhydrylated graphene in water (c), sulfhydrylated graphene in ethanol (d), Au nanorods (e) and sulfhydrylated graphene mixed with Au nanorods (f).

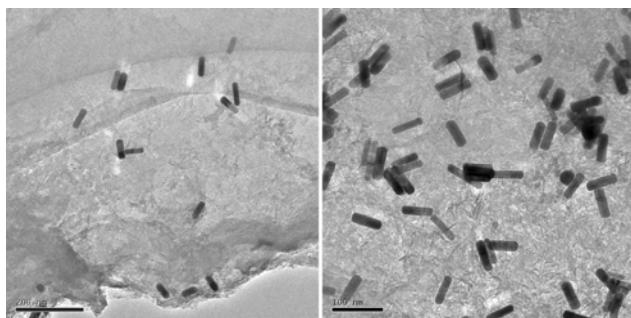


Figure S4. The composition of the graphene–Au nanorod hybrid controlled by changing the dosages of Au nanorods and sulfhydrylated graphene.

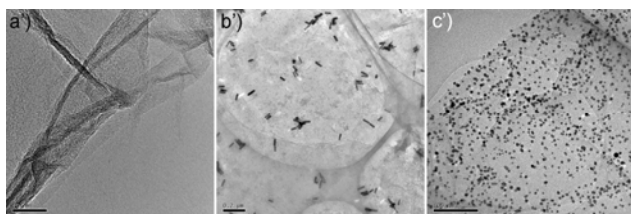
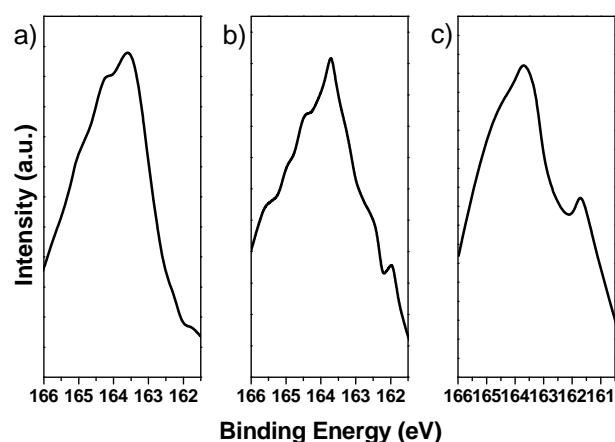


Figure S5. The XPS S2p peaks of sulfhydrylated graphene and its Au hybrid and their corresponding TEM images. In Figure S5b', only a small portion of the thiol groups on the sulfhydrylated graphene were bound to Au nanoparticles, and excess unbound thiol groups were still available in the graphene–Au hybrids. When the ratio of the Au nanoparticles increased, more Au nanoparticle could be attached to the surface of the sulfhydrylated graphene (Figure S5c') through Au–S bonds, and a steady increase of the bound thiol (161.8 eV) could be observed (Figure S5a-c). This result rules out the possibility of the adsorption of Au nanoparticles to the sulfhydrylated graphene.

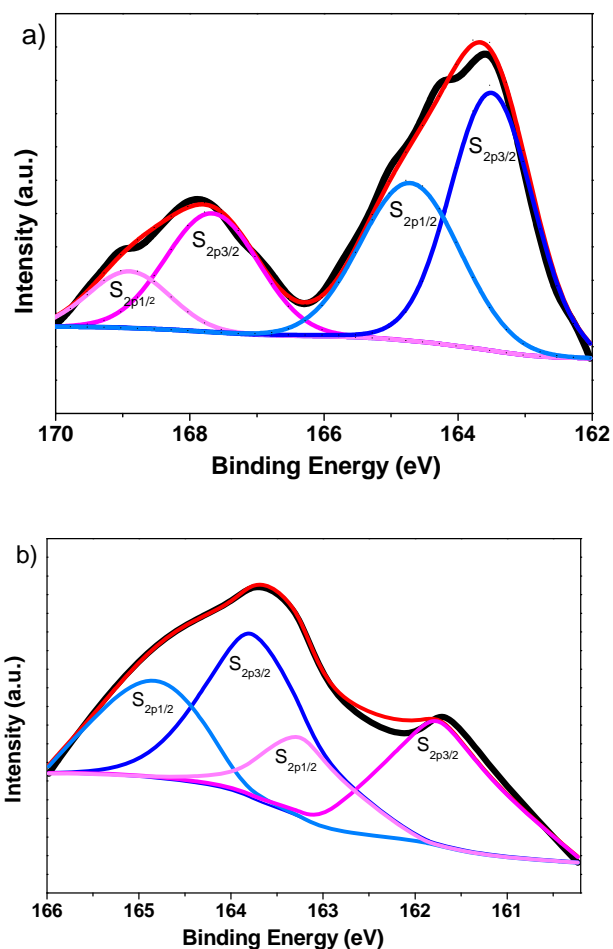


Figure S6 The XPS S2p peaks of sulfhydrylated graphene (a) and graphene–Au hybrid (b). Two S2p doublets with 5:3 area ratios and splitting of 1.2 eV were used to fit the peak of sulfhydrylated groups and residual sulfonated groups in the sulfhydrylated graphene, due to the presence of the S_{2p3/2} and S_{2p1/2} peaks (Figure S6a). The S2p peak of the unbounded thiol groups and bonded thiol groups in the graphene–Au hybrids can be also fit to two doublets with 5:3 area ratios and splitting of 1.2 eV (Figure S6b). According to previous studies,¹⁻² the S_{2p3/2} peaks of about 161.8 eV and 163.7 eV are representative of the bound thiol and unbound thiols or disulfides, respectively.

References:

1. D. G. Castner, K. Hinds and D. W. Grainger, *Langmuir* 1996, **12**, 5083.
2. Y. Joseph, I. Besnard, M. Rosenberger, B. Guse, H. G. Nothofer, J. M. Wessels, U. Wild, A. Knop-Gericke, D. S. Su, R. Schlogl, A. Yasuda, T. Vossmeier, *J. Phys. Chem. B* 2003, **107**, 7406.