

Au/graphene oxide/carbon nanotube flexible catalyst film: synthesis, characterization and its application for catalytic reduction of 4-nitrophenol

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1. Materials

All chemicals were used as received without further purification: graphite powder (200 mesh) (Alfa Aesar, Johnson Matthey Company); H₂AuCl₄·4H₂O (Sinopharm Chemical Reagent Beijing Co., Ltd); 1-methyl-2-pyrrolidone (C₅H₉NO) (Aladdin Industrial Corporation); KMnO₄, H₂O₂, Ethanol, methylene chloride (CH₂Cl₂), Acetone, acetic ether, tetrahydrofuran, toluene, N,N-Dimethylformamide (DMF) (Beijing chemical works).

2. The TEM images of G/C-Au-1, G/C-Au-3, G-Au, C-Au

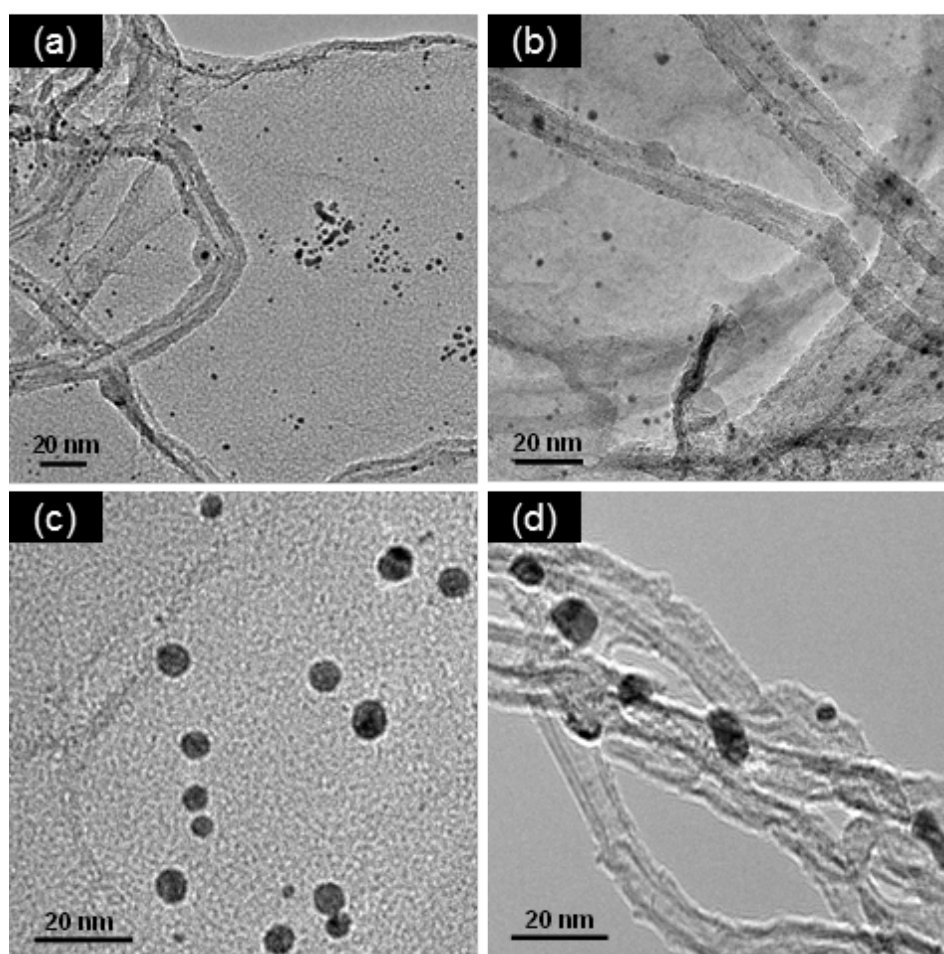


Figure S1. TEM images of G/C-Au-1 (a), G/C-Au-3 (b), G-Au (c), C-Au (d).

3. The size distribution of Au nanoparticles decorated on the surface of carbon materials.

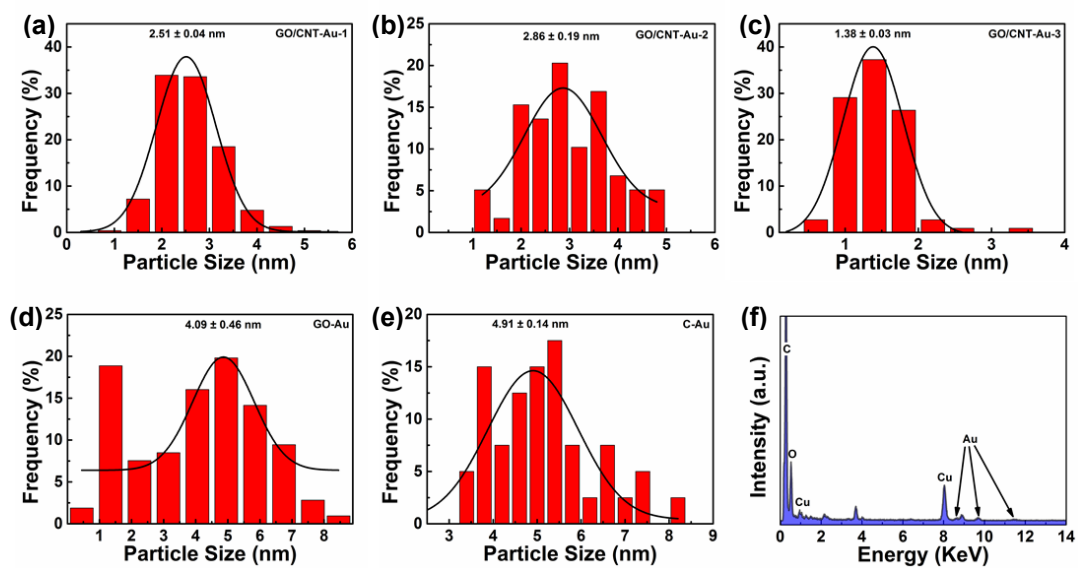


Figure S2. Particle size distributions of G/C-Au-1 (a), G/C-Au-2 (b), G/C-Au-3 (c), G-Au (d), C-Au (e) from the TEM images in Fig. S1, and EDX pattern of G/C-Au-2 (f).

4. Images of before and after the Au catalyst 4-NP reduction reaction

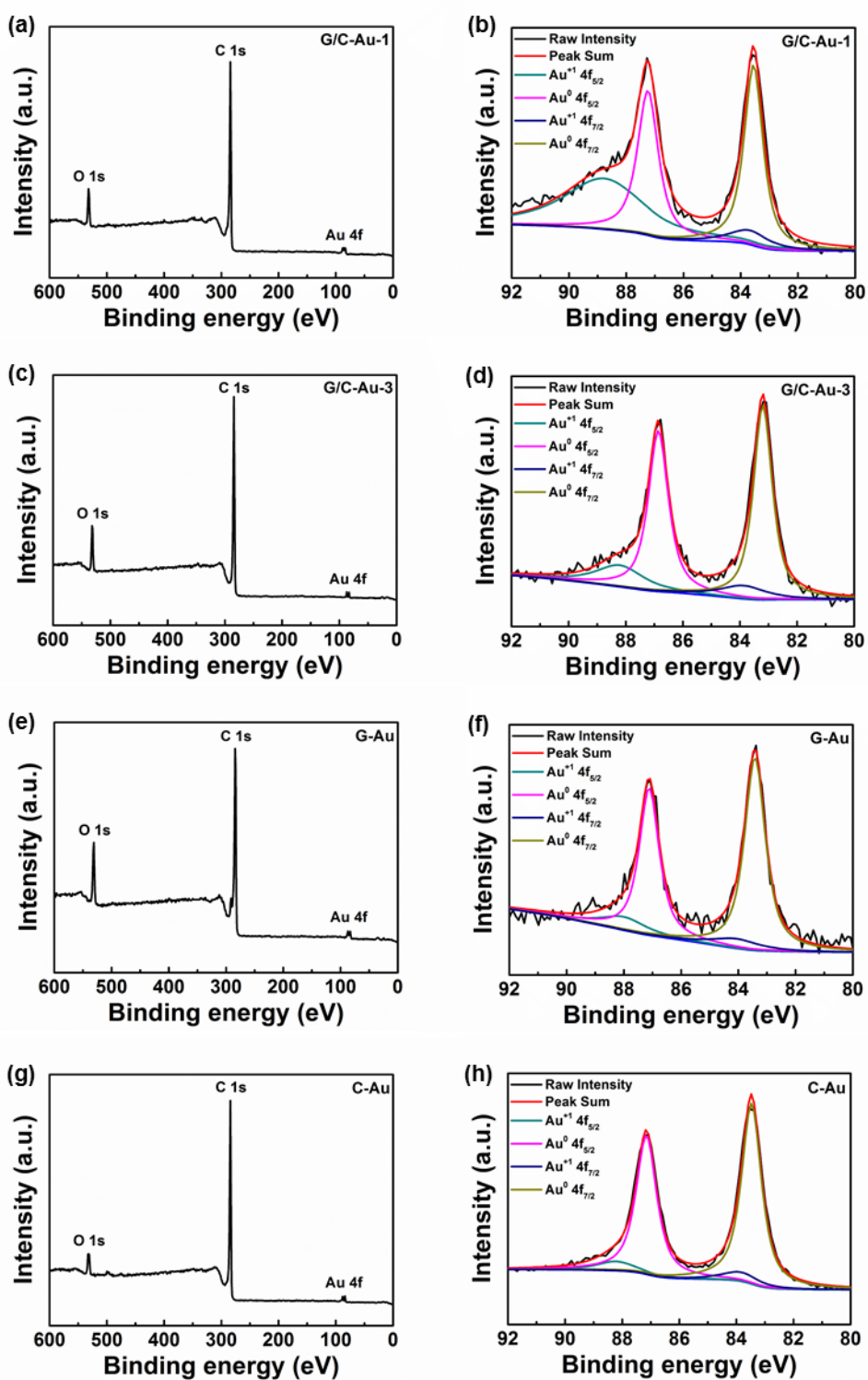


Figure S3. XPS spectra of G/C-Au-1 (a), G/C-Au-3 (c), G-Au (e), C-Au (g); high-resolution XPS spectra of Au 4f of G/C-Au-1 (b), G/C-Au-3 (d), G-Au (f), C-Au (h).

4. Images of before and after the Au catalyst 4-NP reduction reaction

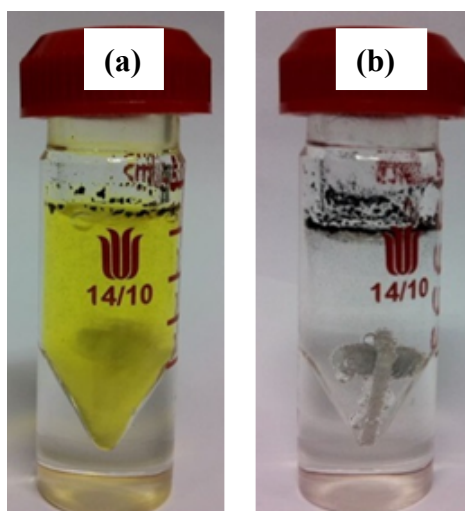


Figure S4. Images of the Au catalysts catalyze the 4-NP reduction in water before (a) and after (b) the reactions.

5. Images of before and after the G/C-Au-2 catalytic film catalyst 4-NP reduction reaction

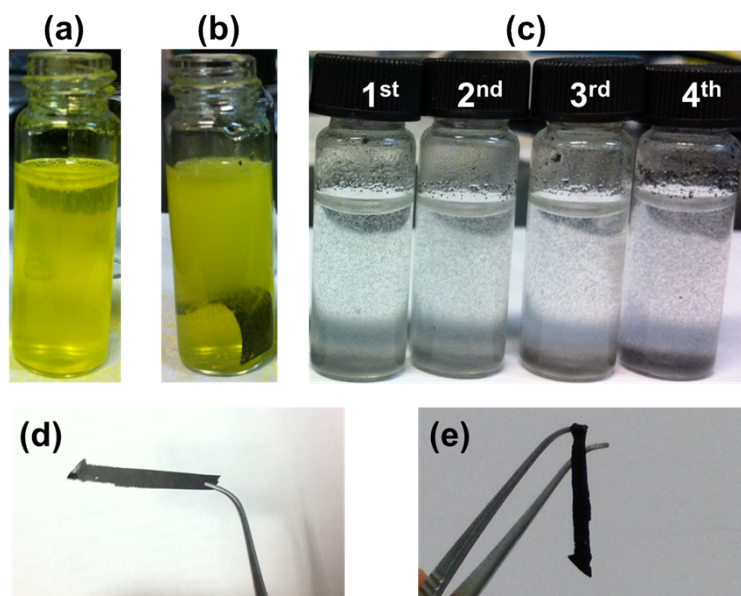


Figure S5. (a) The 4-NP and NaBH_4 water solution, (b) after addition of the G/C-Au-2 catalytic film, (c) the recycle reaction of the G/C-Au-2 catalytic film, (d) the G/C-Au-2 catalytic film before reaction, (e) the G/C-Au-2 catalytic film before reaction.

6. The TEM images of the reused G/C-Au-2 catalyst

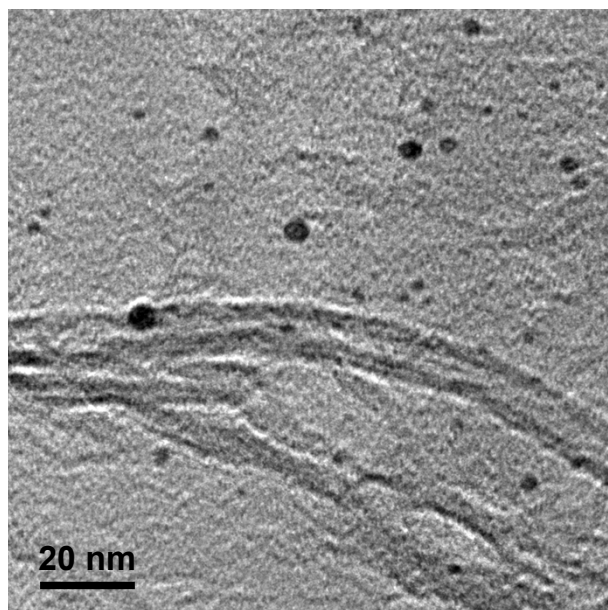


Figure S6. TEM image of G/C-Au-2 catalyst after 10 cycles

Table S1. Au nanoparticle size (nm)^a, Au loading on support (wt.%)^b, Apparent reaction rates k_{app} values, reaction time, TOF values for the Au catalysts for 4-NP reduction.

Sample	G-Au	C-Au	G/C-Au-1	G/C-Au-2	G/C-Au-3
Au size (nm)	4.1	4.9	2.5	2.9	1.4
Au loading (wt.%)	19.6	24.0	11.1	9.8	9.4
K_{app} (min ⁻¹)	0.16	0.12	0.34	0.75	0.22
Reaction time (min)	15	18	13	4	8
TOF values (h ⁻¹)	402	274	819	3015	1571

^a Average size obtained from the size distribution histogram.

^b Calculated by TGA.