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Naked Au nanoparticles monodispersed onto multifunctional cellulose nanocrystals-graphene hybrid sheets：towards efficient and sustainable heterogeneous catalysts

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Supplementary Figures

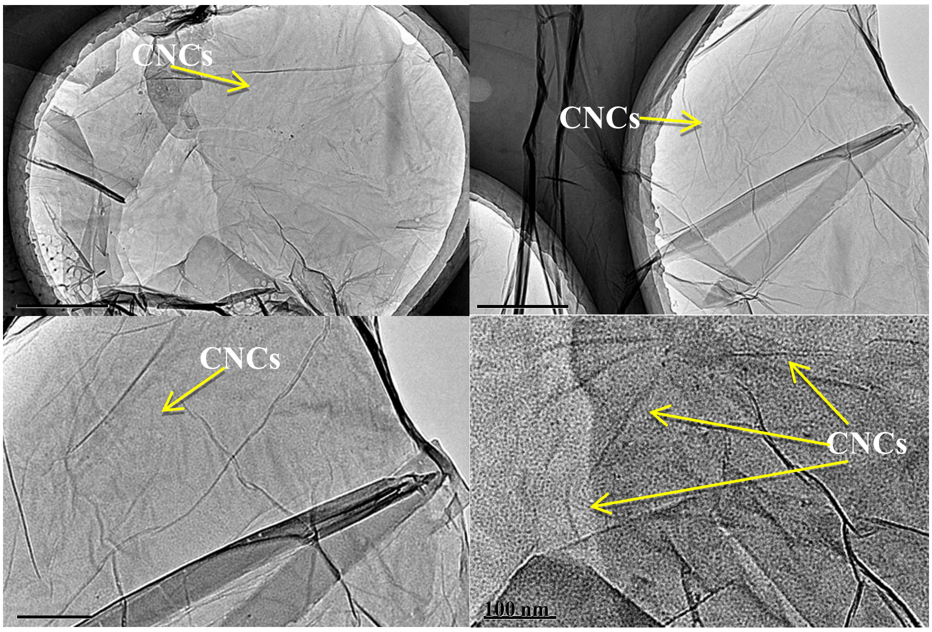

Figure S1. The TEM of multifunctional CNC-G hybrid sheets (CNCs were homogeneously coated well on the surface of graphene sheets).

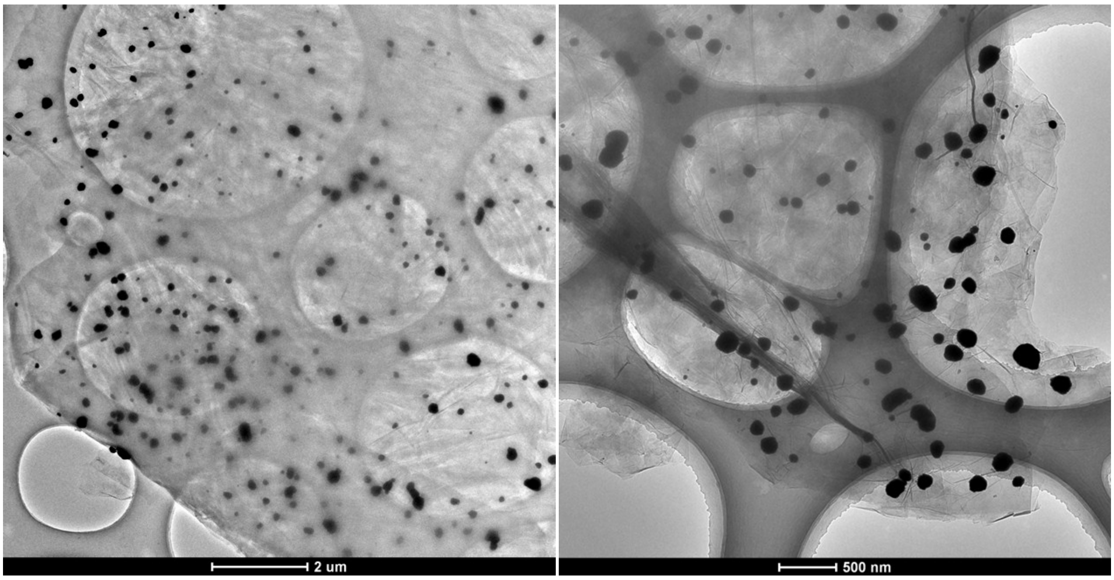

Figure S2. TEM of the Au@G sample displayed a several hundred naometer size of Au NPs.

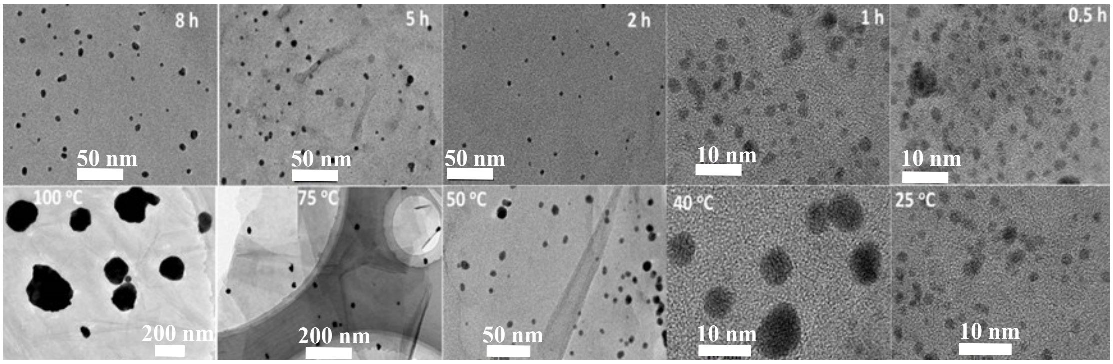

Figure S3. Effect of synthetic time and temperature on Au NPs diameter.

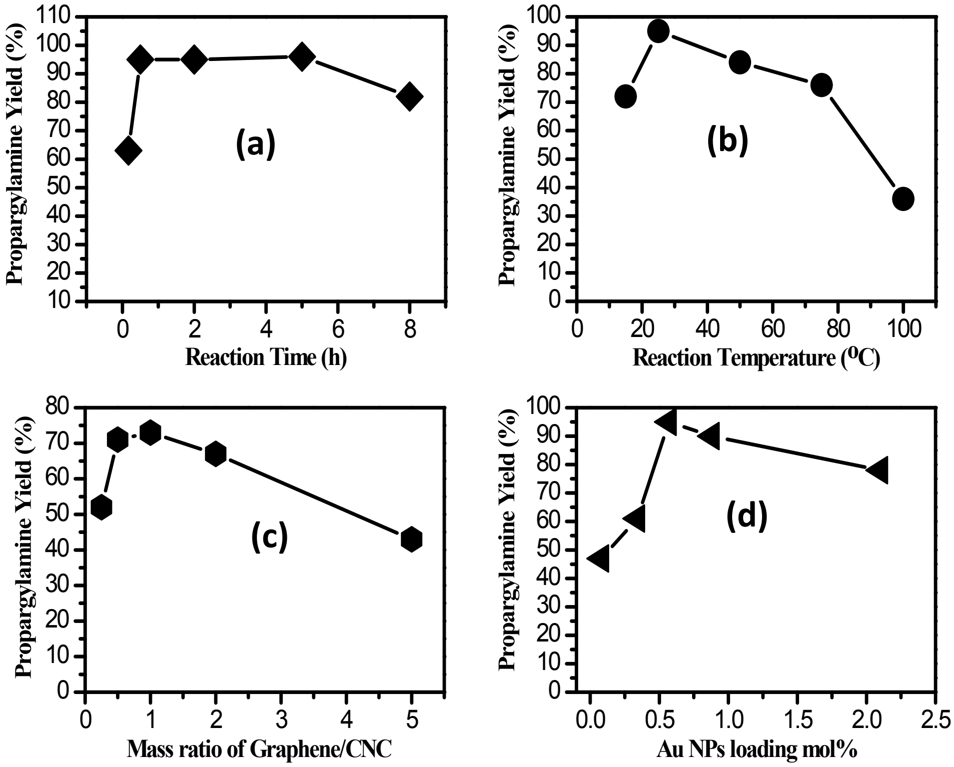

Figure S4. Optimization of synthetic conditions (the optimal conditions: T = 25°C, t = 30 min, Graphene/CNC = 1, AuNPs loadind 0.57 mol%), (a) reaction time (b) reaction temperature (c) mass ratio of graphene/CNC and (d) Au NPs loading for the Au@CNC-G catalysts in water-medium A^3-coupling reaction.

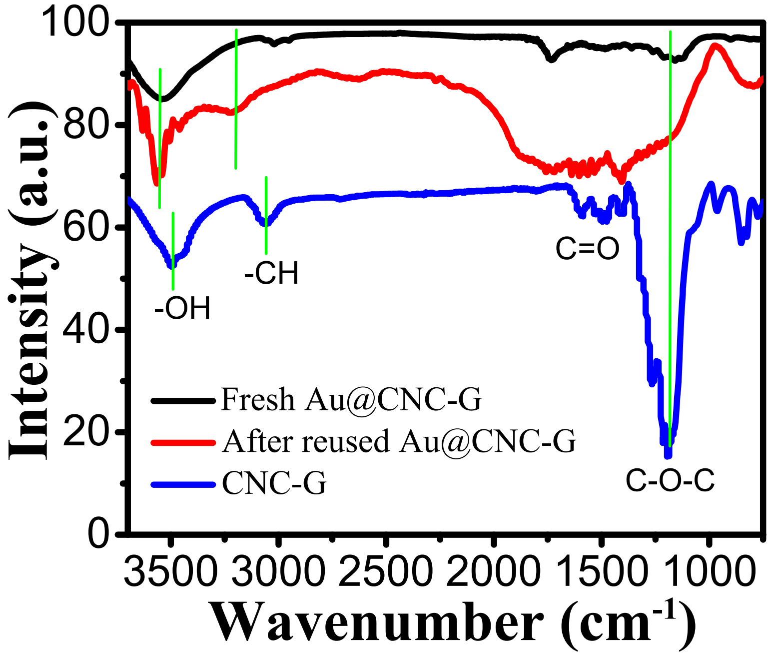

Figure S5. FT-IR spectra of the CNC-G, and Au@CNC-G catalyst for fresh and after being used repetitively for 10 times respectively.

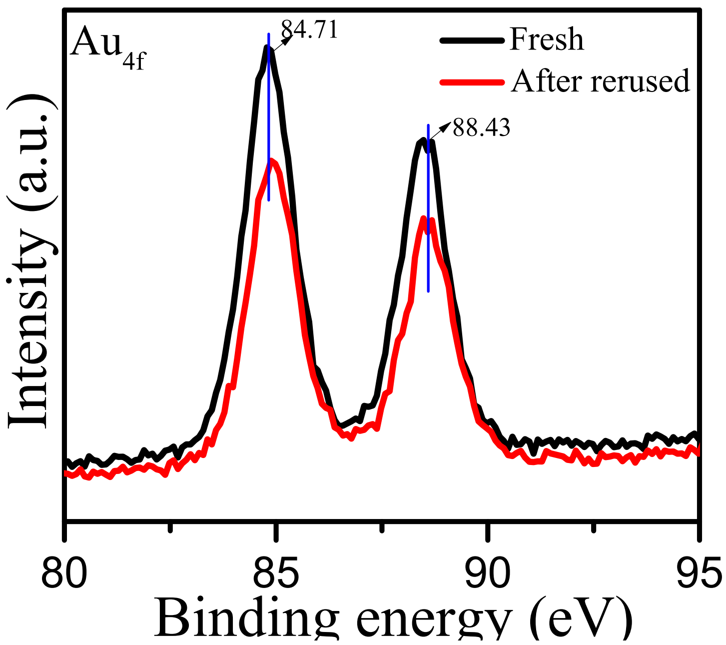

Figure S6. XPS spectra of the Au@CNC-G catalyst for fresh and after being used repetitively for 10 times respectively.

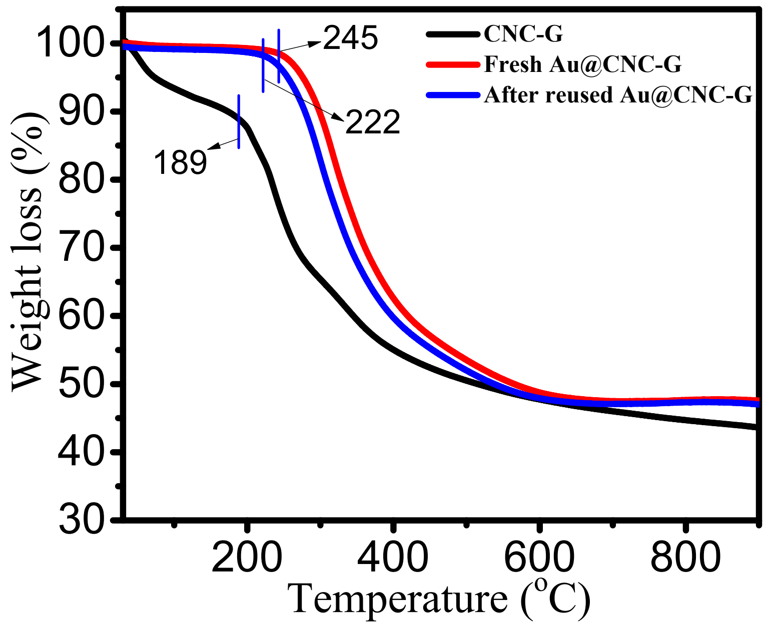

Figure S7. TG cures of the CNC-G and Au@CNC-G catalyst for fresh and after being used repetitively for 10 times respectively.

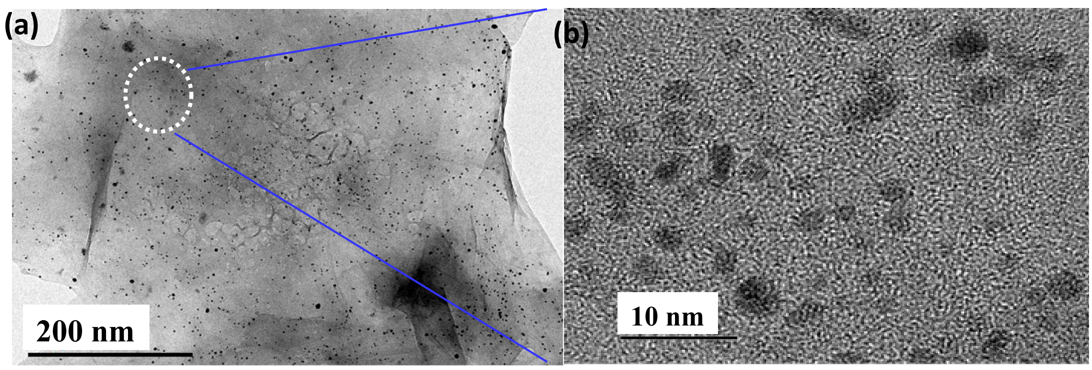

Figure S8. TEM images of the Au@CNC-G catalyst after being used repetitively for 10 times.

Table S1. Comparison of A^3-Coupling reaction performance of the highly active supported Au NPs catalysts reported recently with Au@CNC-G under same reaction conditions.

Catalysts	Average size of Au NPs (nm)	Au NPs loading (mol %)	solvent/temp (^oC)/time (h)	Propargylamine Yield (%)	Ref.
Au@HS-CNC	2~3	4.4	H_2O/80/24	73	1
Au-HS/SO_3H-PMO(Et)	1~2	6	H_2O/70/12	98	2
Au/MOF	3.7	2.53	Dioxane/120/4	92 (86)	3
Au NPs@HS-G-PMS	2	7.5	H_2O/100/24	89	4
Au0-Mont.-I	6	0.84	Toluene/100/3	94 (89)	5
Au/CUP-1(PM)	13.9	6.42	Dioxane/120/4	89 (82)	6
Au/CUP-1(OP)	2.1	0.14	Dioxane/150/21	79 (77)	6
NAP-Mg-Au(0)	10	0.236	H_2O/100/24	21	7
Au-MCN	7	/	Toluene/100/24	62 (96)	8
Au@CNC-G	~3	0.57	H_2O/80/12	95	This work

The data in brackets were obtained from the optimum catalyst Au@CNC-G in this work.

References

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