Hybrid Gold Nanoparticle-Reduced Graphene Oxide Nanosheets as Active Catalysts for Efficient Reduction of Nitroarenes

Yuri Choi,^a Hee Son Bae,^b Eunyong Seo,^a Seonwan Jang,^b Kang Hyun Park, *^b and Byeong-Su Kim*^a

^a Interdisciplinary School of Green Energy and School of NanoBioscience and Chemical

Engineering, Ulsan National Institute of Science and Technology (UNIST), Ulsan 689-798,

Korea

^b Department of Chemistry and Chemistry Institute for Functional Materials, Pusan National University, Busan 609-735, Korea

E-mail: bskim19@unist.ac.kr, chemistry@pusan.ac.kr



Figure S1. Fluorescence spectra of the hybrid Au-GO nanocomposites with a varying ratio of each component ($\lambda_{ex} = 430$ nm, $\lambda_{em} = 450$ - 700 nm). The intrinsic fluorescence of GO is quenched after the formation of hybrid Au-GO.

Atomic percentage (%)	GO	Au-GO ($r_{Au/GO} = 0.33$)
С	44.497 (0.127)	20.375 (0.230)
Н	2.319 (0.018)	1.105 (1.106)
0	41.380 (0.059)	7.406 (0.172)
N	0 (0)	1.968 (0.024)
S	2.392 (0.011)	0 (0)

Figure S2. Elemental analysis data of the GO and hybrid Au-GO nanocomposites ($r_{Au/GO} = 0.33$). All values are the average of three individual measurements with a standard deviation.



Figure S3. TEM image of hybrid Au-GO nanocomposites ($r_{Au/GO} = 0.33$). More Au NPs are distributed to the edges of GO nanosheets possibly due to the higher distribution of surface functional groups at the edges.



Figure S4. Plot of $\ln(C_t/C_0)$ versus time spectra for the reduction of 4-nitrophenol over hybrid Au-GO catalyst under different mol% of catalyst and equiv. of NaBH₄ used.



Figure S5. Plot of $\ln(C_t/C_0)$ versus time spectra for the reduction of 4-nitrophenol over different catalysts. All catalysts are used at the same molar ratio of 0.50 mol% of catalyst and 50 equiv. of NaBH₄ for the reaction.



Figure S6. (a-c) Time-dependent UV/vis absorption spectra for the reduction of 4nitrophenol over (a) Au, (b) GO, and (c) hybrid Au-GO catalyst in aqueous media at 298 K. (d) Plot of $\ln(C_t/C_0)$ versus time for the reduction of 4-nitrophenol with different catalysts. All catalysts are used at the same molar ratio of 5.0 mol% of catalyst and 50 equiv. of NaBH₄ for the reaction.



Figure S7. (a-c) Time-dependent UV/vis absorption spectra for the reduction of 4nitrophenol over (a) Au, (b) GO, and (c) hybrid Au-GO catalyst in aqueous media at 298 K. (d) Plot of $\ln(C_t/C_0)$ versus time for the reduction of 4-nitrophenol with different catalysts. All catalysts are used at the same molar ratio of 0.50 mol% of catalyst and 300 equiv. of NaBH₄ for the reaction.