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Supplementary information

Ultrathin Au nanowires supported on RGO/TiO_2 as an efficient photoelectrocatalyst

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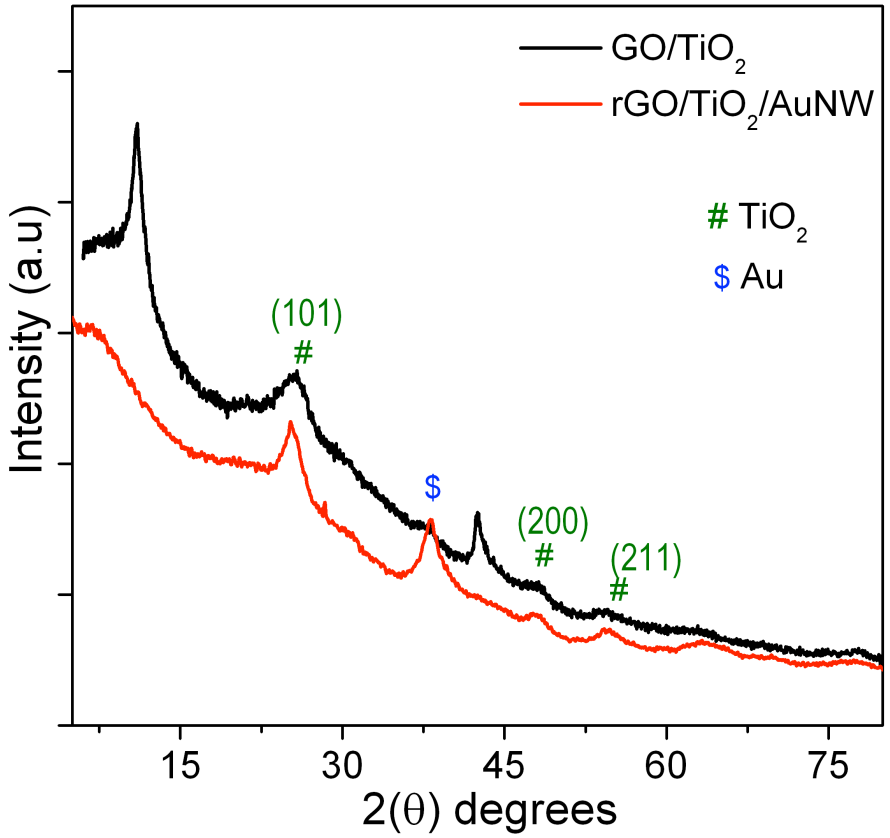

Fig. S1 pXRD patterns of GO/TiO_2 before and after growth of Au nanowires. GO, basal spacing decreased from 8 Å to ~3.7 Å after incubating in nanowire growth solution, which validates that the room temperature reduction of GO.[1] Indexed phase corresponds to anatase TiO_2.

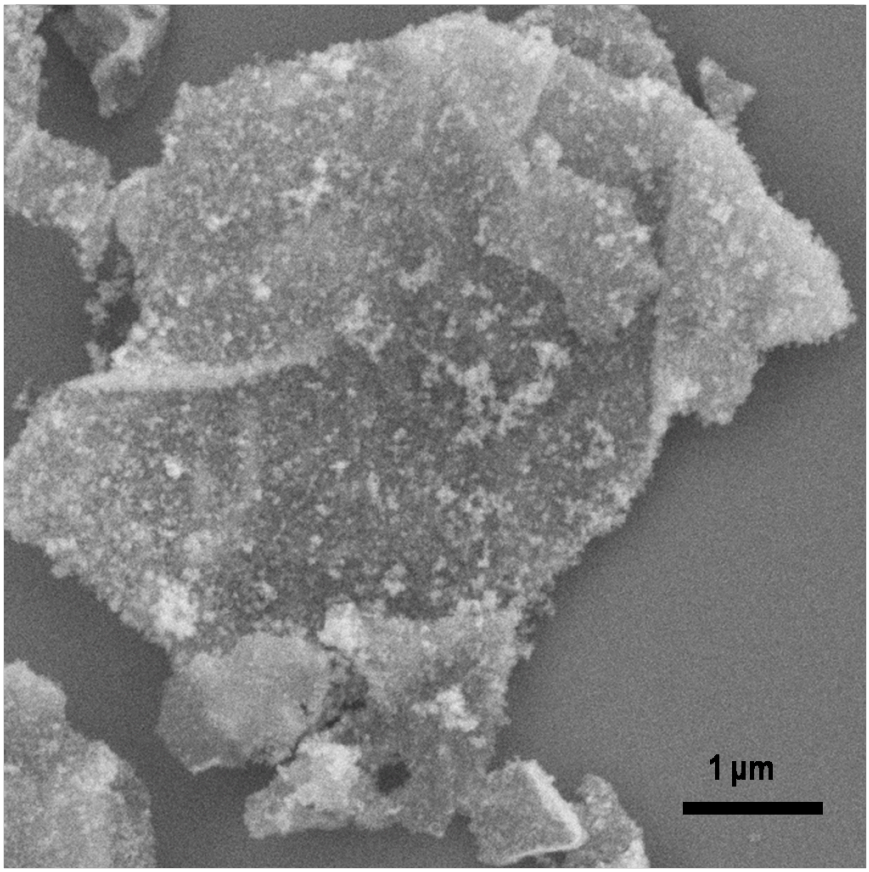

Fig. S2 SEM micrograph of GO/TiO_2, indicating that the heterogeneous nucleation of TiO_2 on sheets.

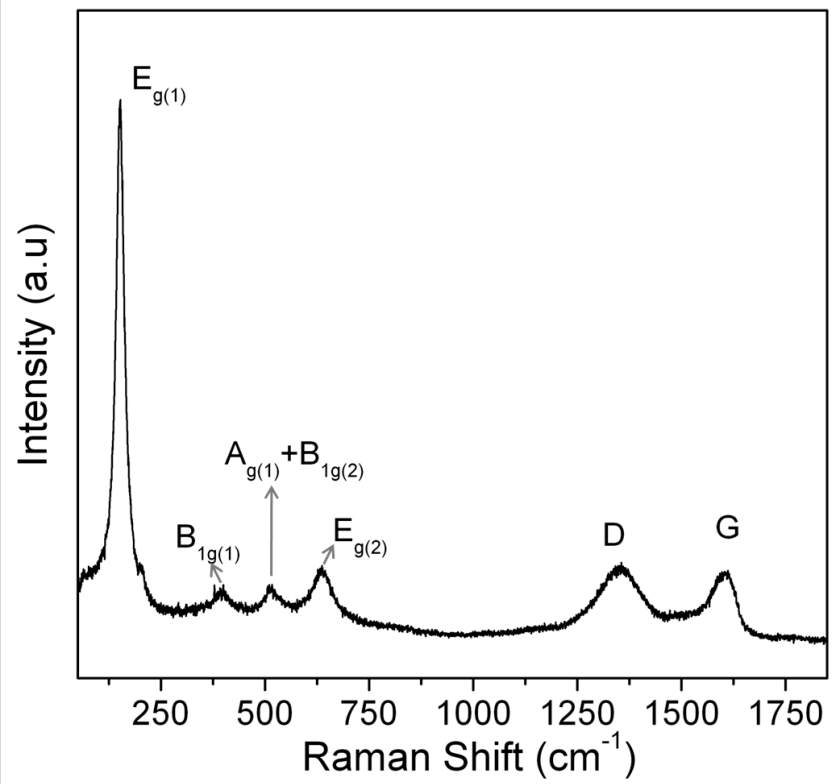

Fig. S3 Raman spectrum of GO/TiO_2 synthesized through microwave, using titanyl nitrate precursor. Shows the typical features of GO with the presence of D and G band. Appearance of Raman modes around 150 cm^{-1} ($E_{g(1)}$), 396 cm^{-1} ($B_{1g(1)}$), 513 cm^{-1} ($A_{1g}+B_{1g(2)}$) and 639 cm^{-1} ($E_{g(2)}$) confirms the presence of anatase phase TiO_2 on GO sheets.[2]

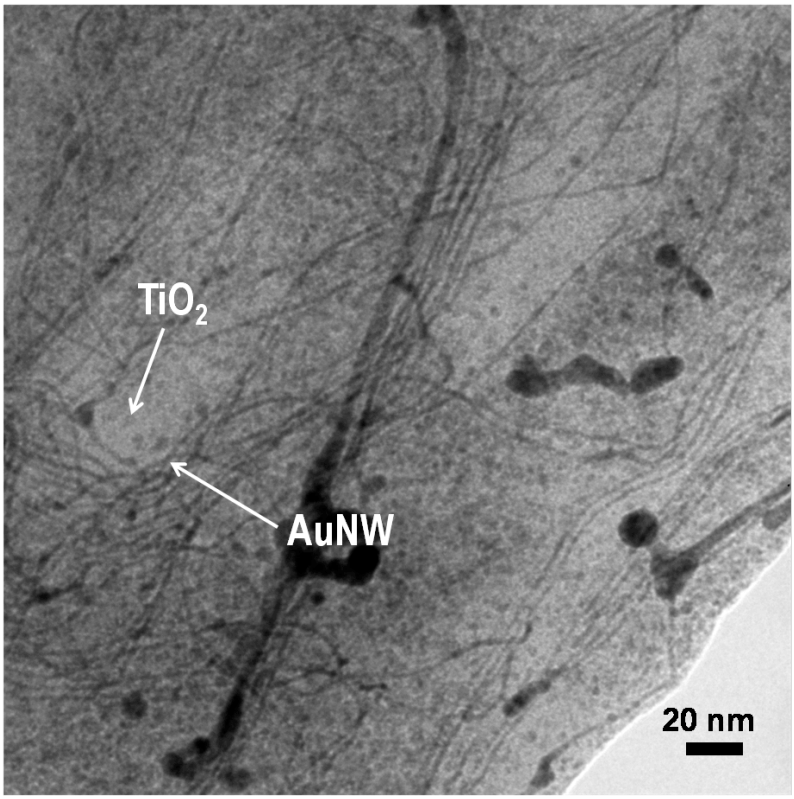

Fig. S4 TEM micrograph of rGO/TiO_2/AuNW, displays that the nanowires are dispersed on the support rGO/TiO_2.

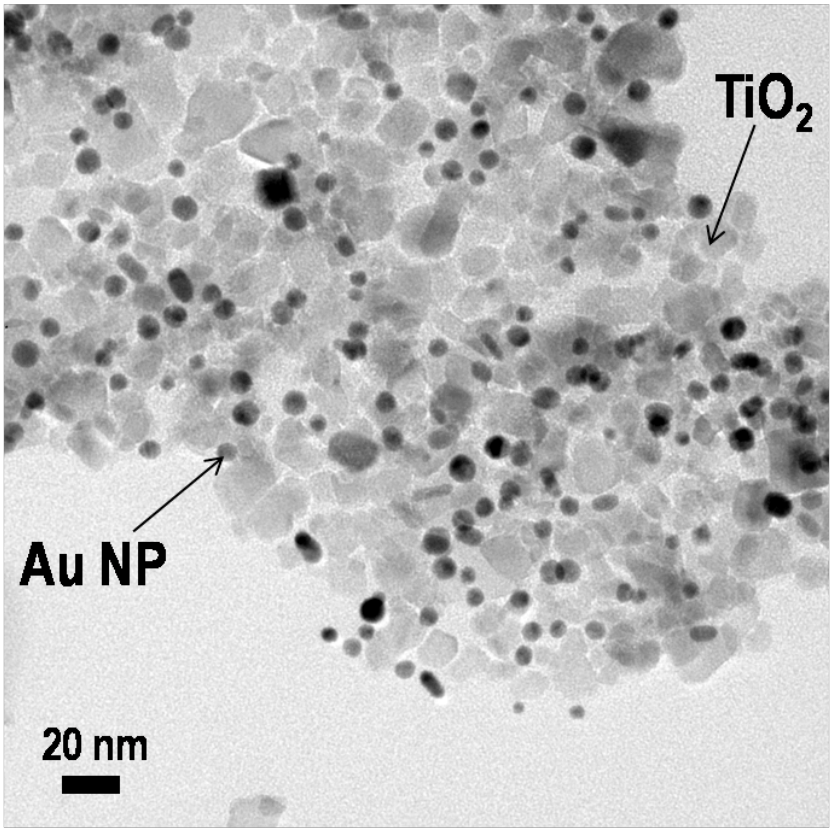

Fig. S5 Bright field micrograph displays that unmodified TiO_2 favors for the Au nanoparticles formation.

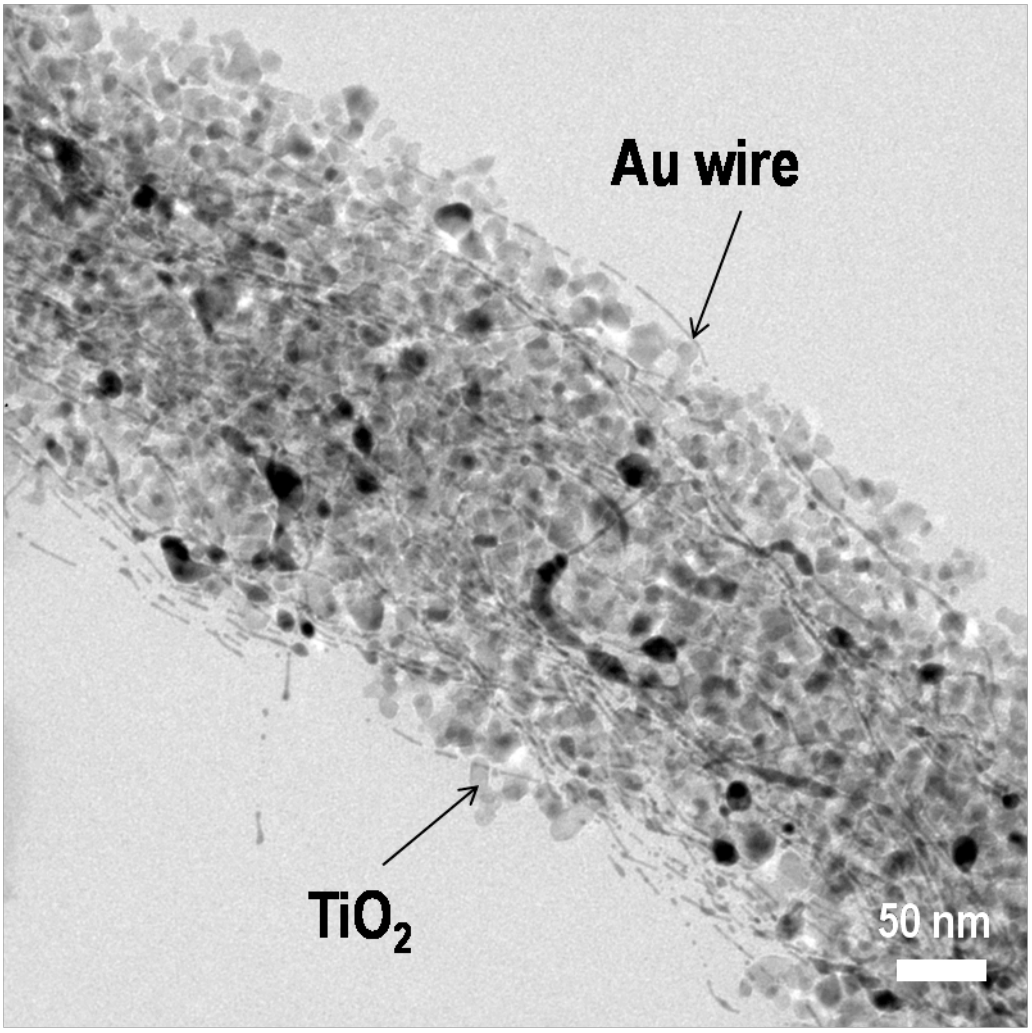

Fig. S6 Bright field TEM image reveals the growth of nanowires on amine modified TiO_2 nanoparticles.

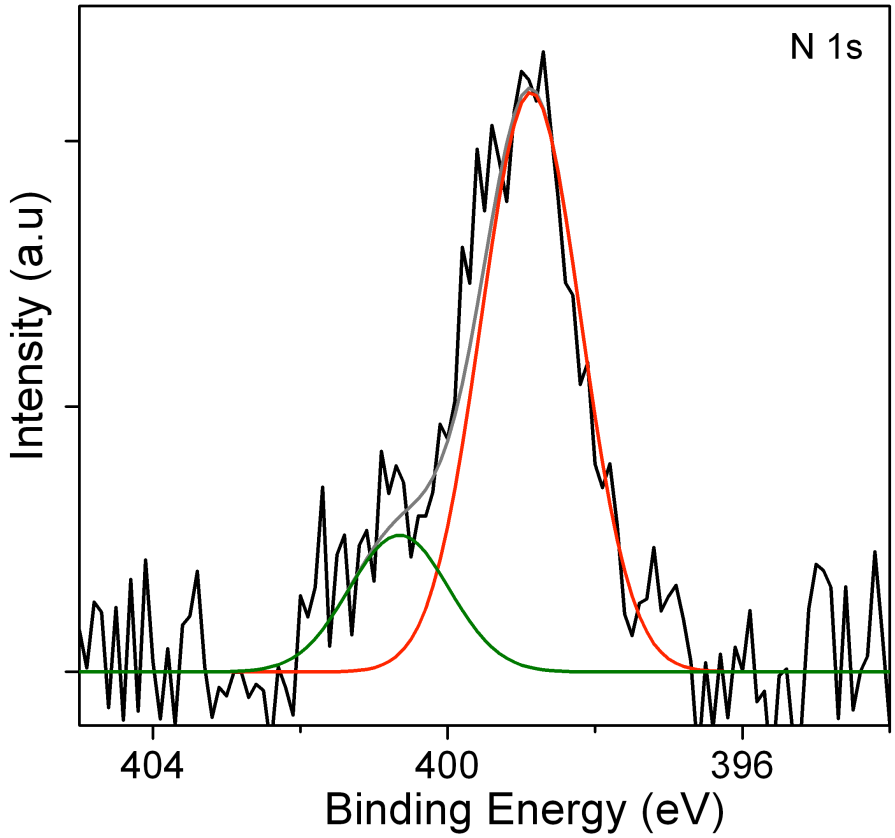

Fig. S7 Deconvoluted N 1s spectra of rGO/TiO_2/Au nanowires, displaying the existence of nitrogen species.

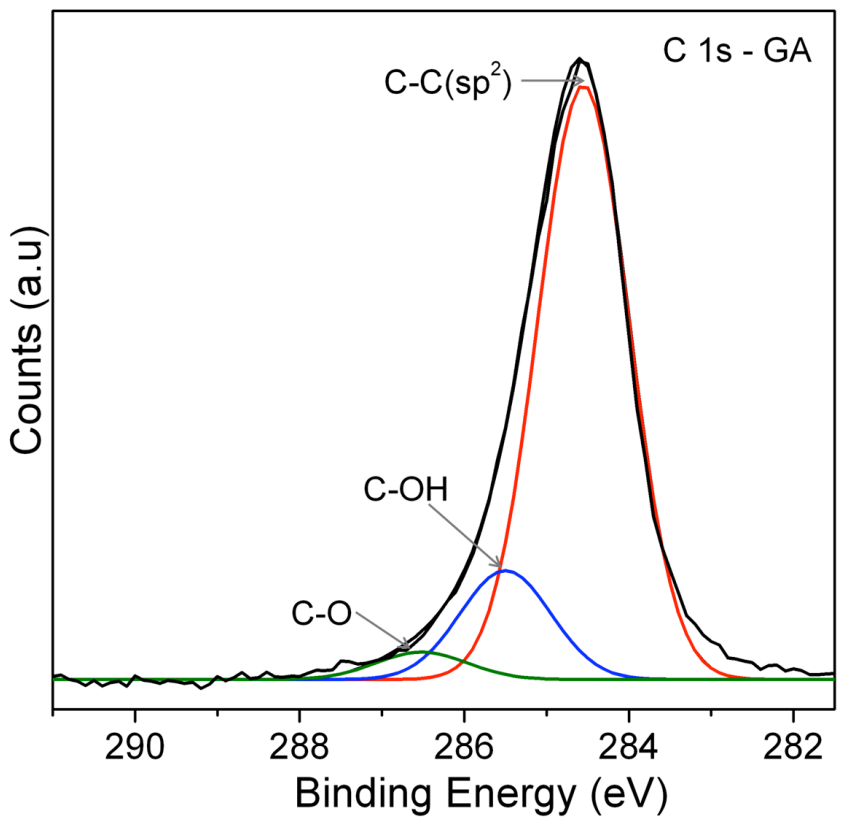

Fig. S8 XPS C 1s of rGO/AuNW(GA), showing the room temperature reduction of GO after incubating with Au nanowires growth solution for 6 h.

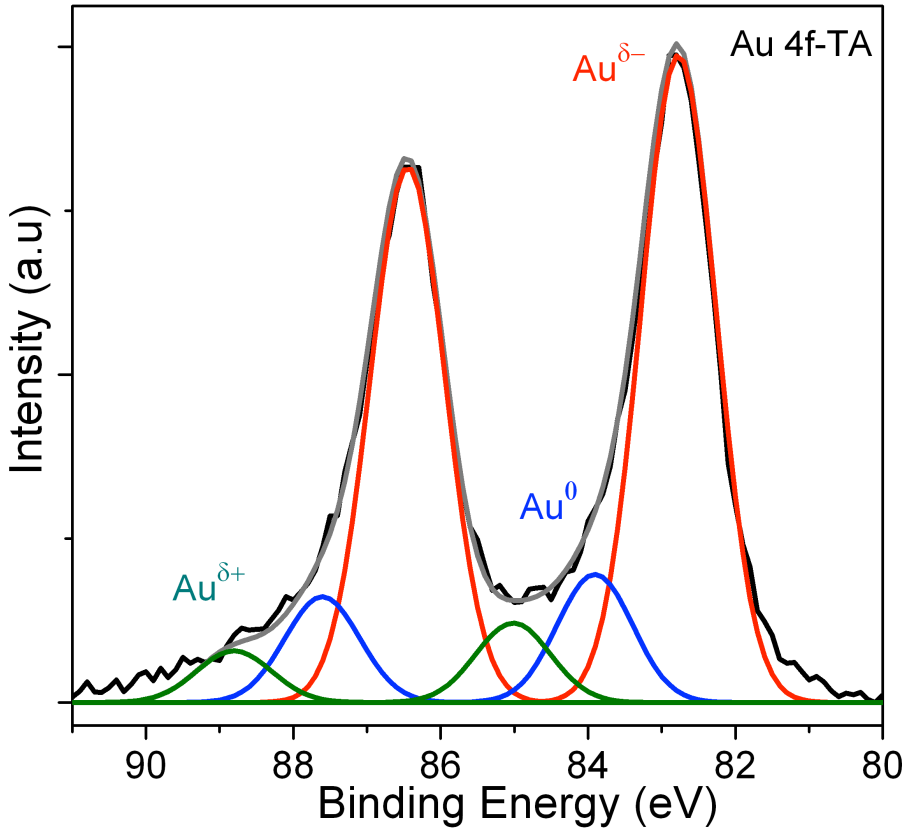

Fig. S9 Deconvoluted Au 4f of TiO_2/AuNW (TA) showing the presence of Au anionic species, predominantly electron-rich Au surface.

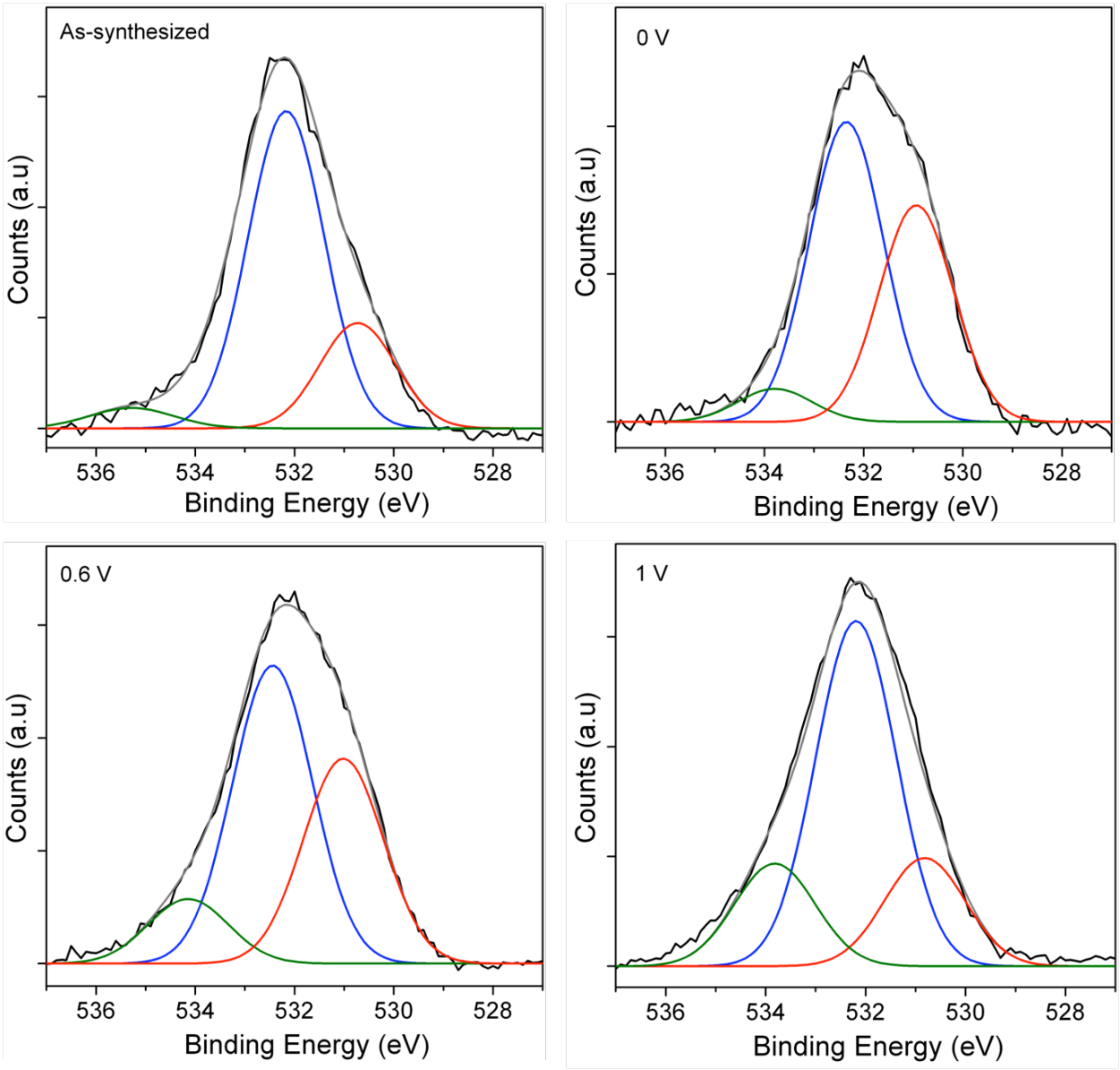

Fig. S10 O 1s spectra of rGO/AuNW before (as-synthesized) and after CV scans at different positive potential limit. The fitted peaks are C=O at 530.7 eV, C-OH 532.2 at eV and –O-C at 534.4 eV. Indicates that compared to other oxygenated species, relative content of C=O (amide) drastically varies with respect to positive potential limit. The increase in C=O content at 0.6 V may be the reason for featureless voltammogram (absence of redox features).

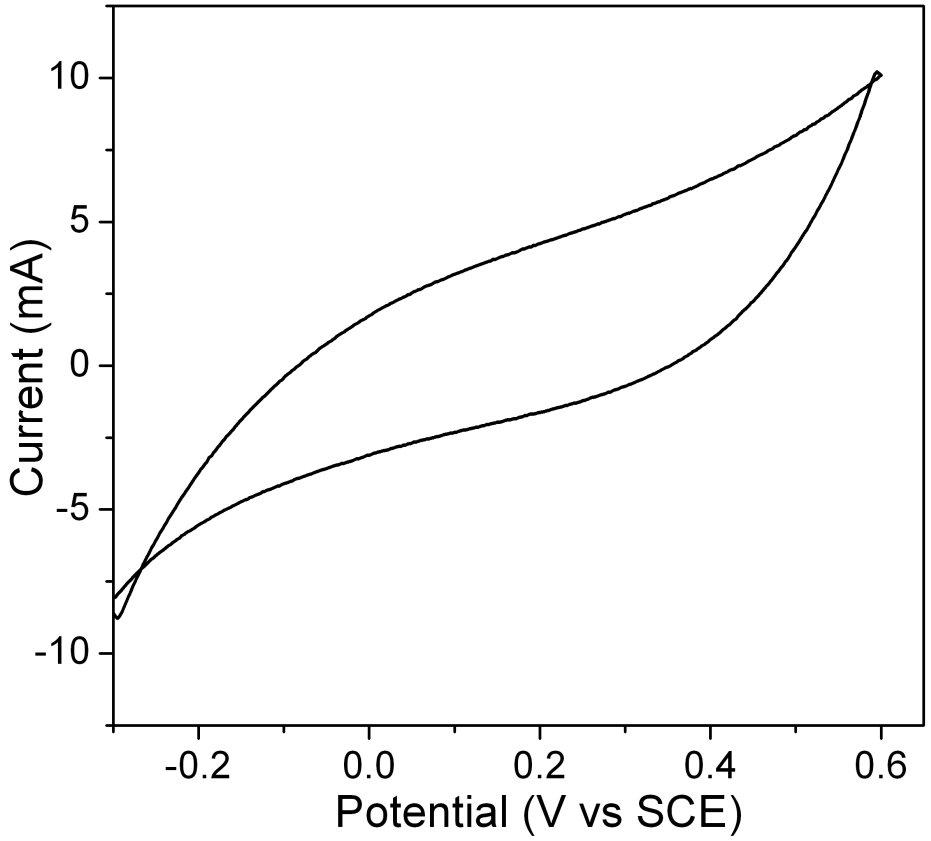

Fig. S11 CV of GO/TiO_2 measured in 1M NaOH containing 1.5 M ethanol, showing the absence of ethanol oxidation peak.

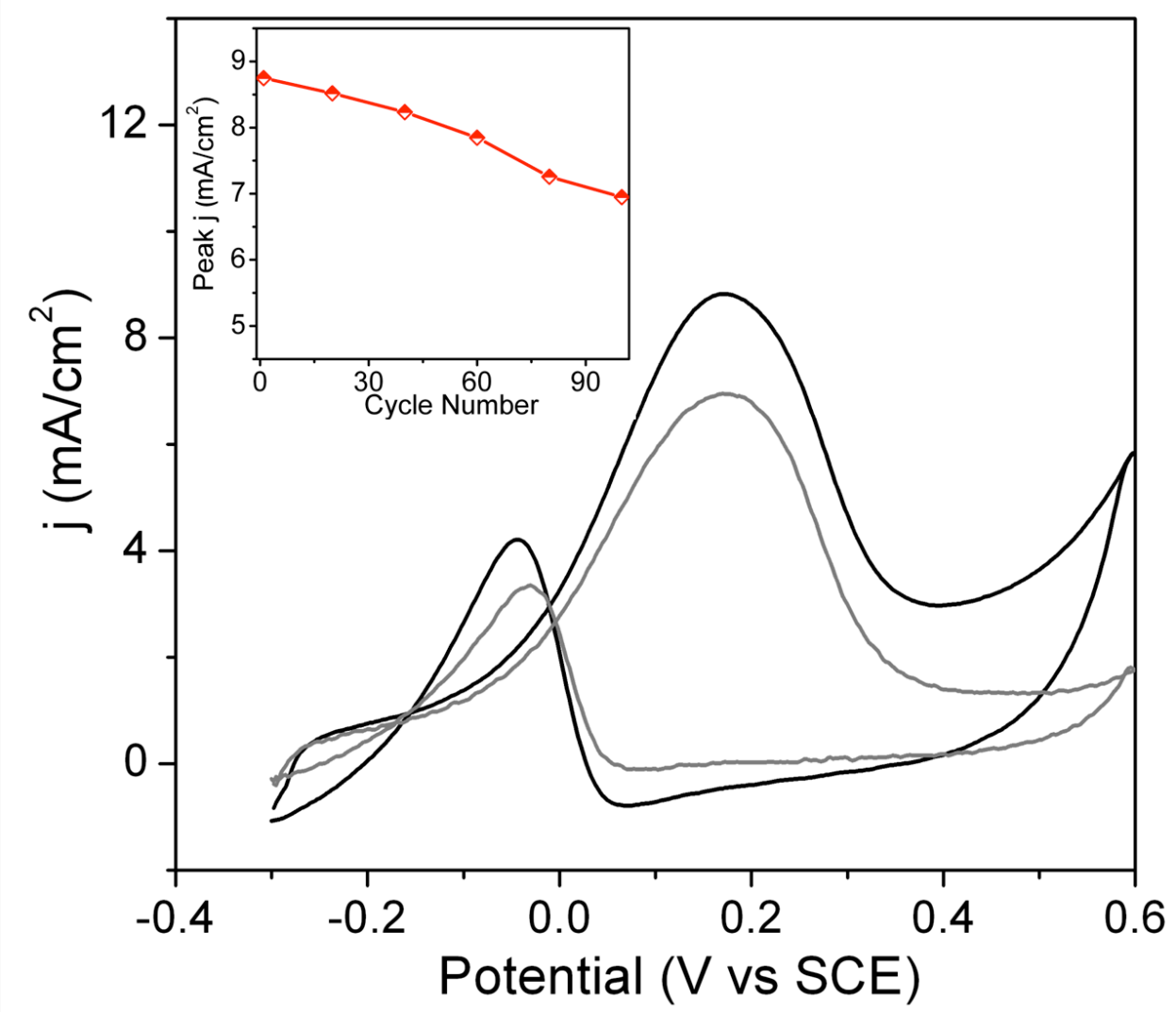

Fig. S12 CV stability test of rGO/TiO_2/AuNW, in 1 M NaOH aqueous solution containing 1.5 M ethanol, 1st and 100th cycle, inset displays peak current density versus cycle number at a scan rate 40 mV/s.

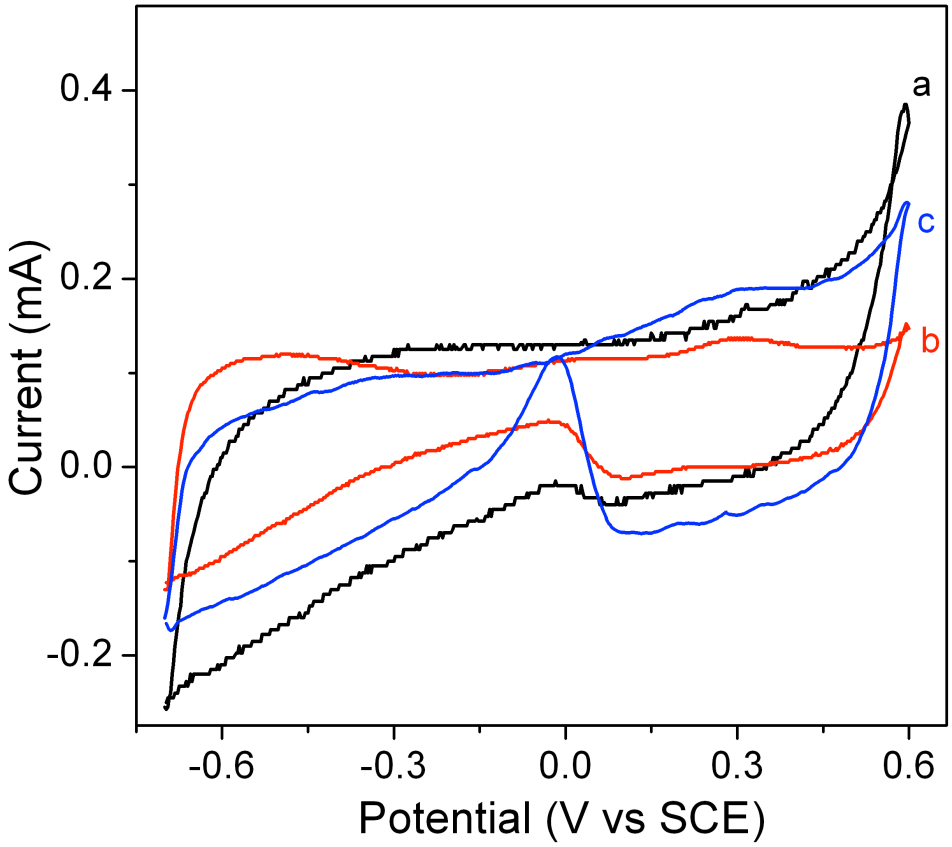

Fig. S13 CVs for CO oxidation obtained in CO saturated 1M NaOH on (a) TiO_2/AuNW, (b) rGO/AuNW and (c) rGO/TiO_2/AuNW.

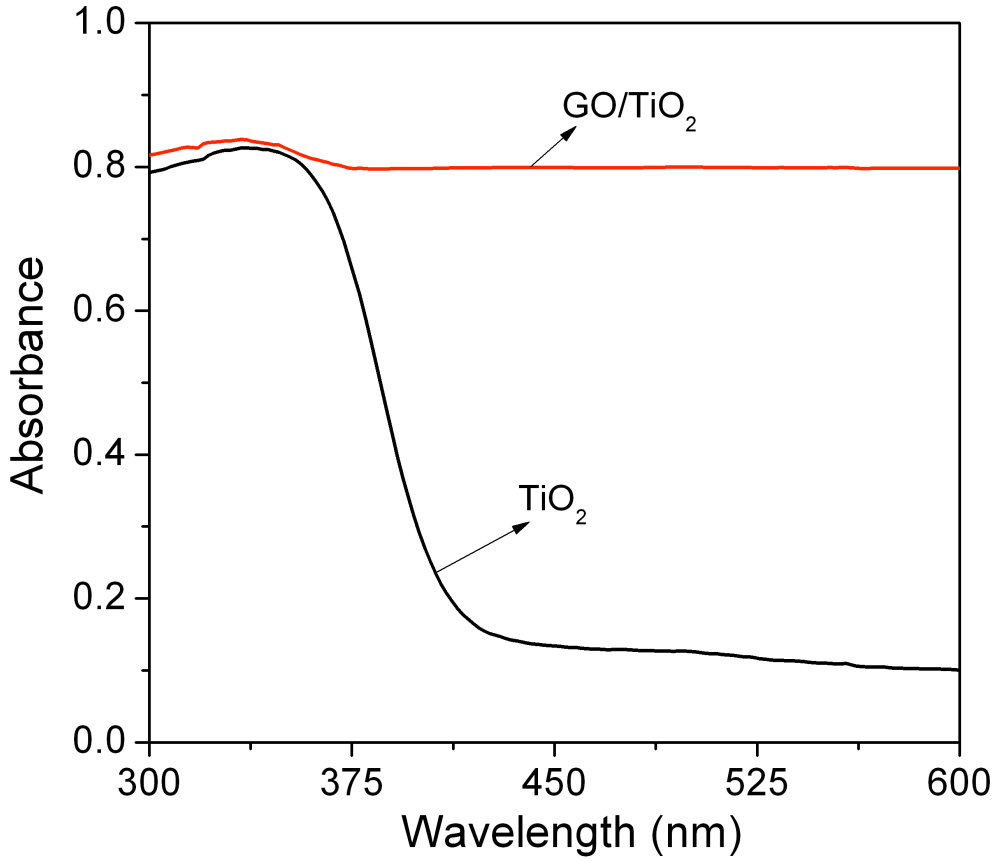

Fig. S14 Diffuse reflectance spectra of TiO_2 and GO/TiO_2. Enhanced absorption in the visible region is attributed to the presence of GO. Expected to boost the utilizing efficiency of solar light.

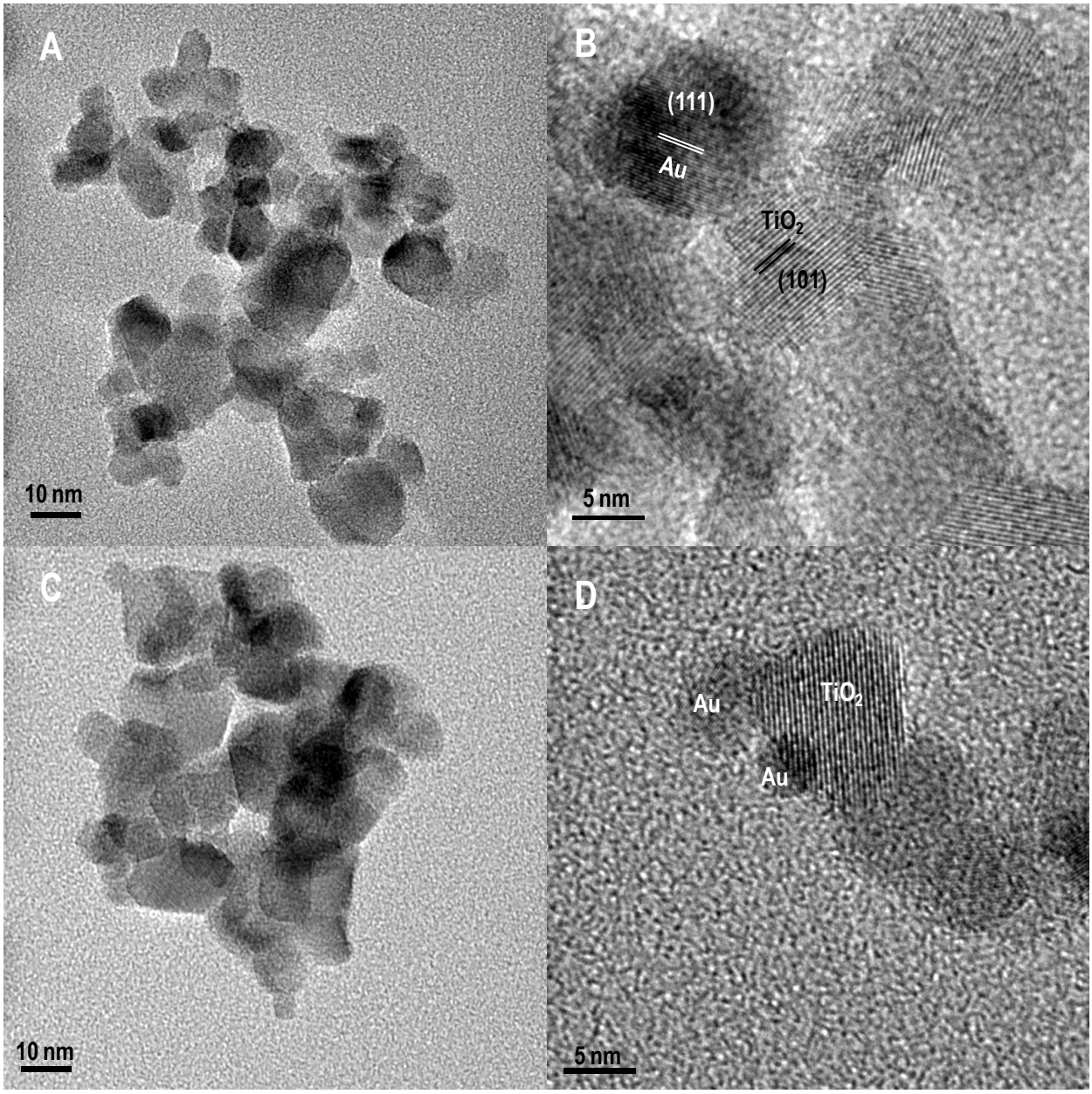

Fig. S15 TEM micrographs (A, B) and (C, D) corresponds to Au nanoparticles nucleated on unmodified and amine modified TiO_2, respectively. Marked d-spacing represents the (101) plane of TiO_2 and (111) plane of Au.

References

1. I. K. Moon, J. Lee, R. S. Ruoff and H. Lee, *Nat. Commun.*, 2010, **1**, 73.
2. T. Ohsaka, F. Izumi and Y. Fujiki, *J. Raman Spectrosc.*, 1978, **7**, 321-324.