Supporting information for

Laser synthesis of gold/oxide nanocomposites

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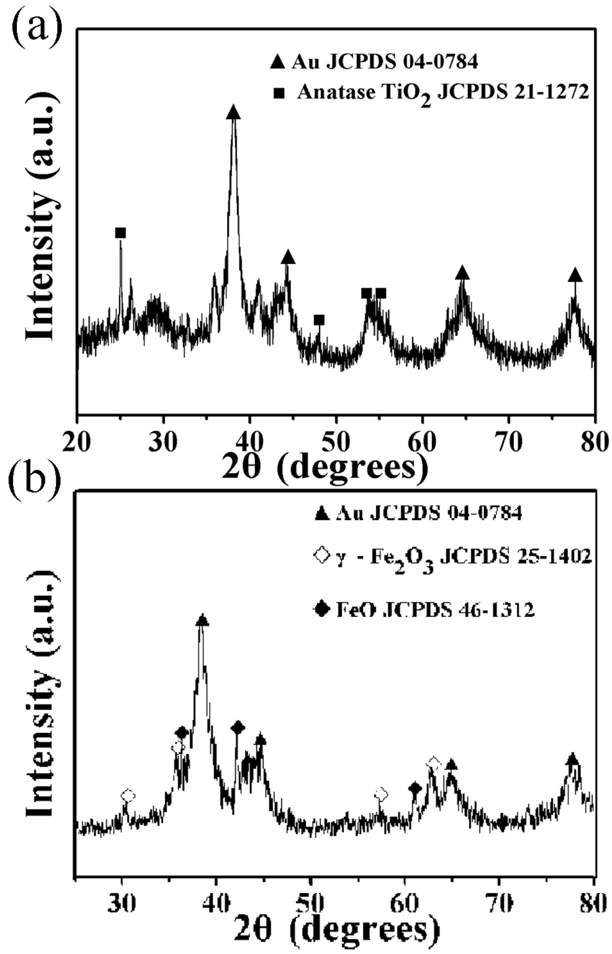

Figure S1 XRD patterns of as-prepared GONs,(a) Au/TiO_2 (b) Au/Fe_xO_y.

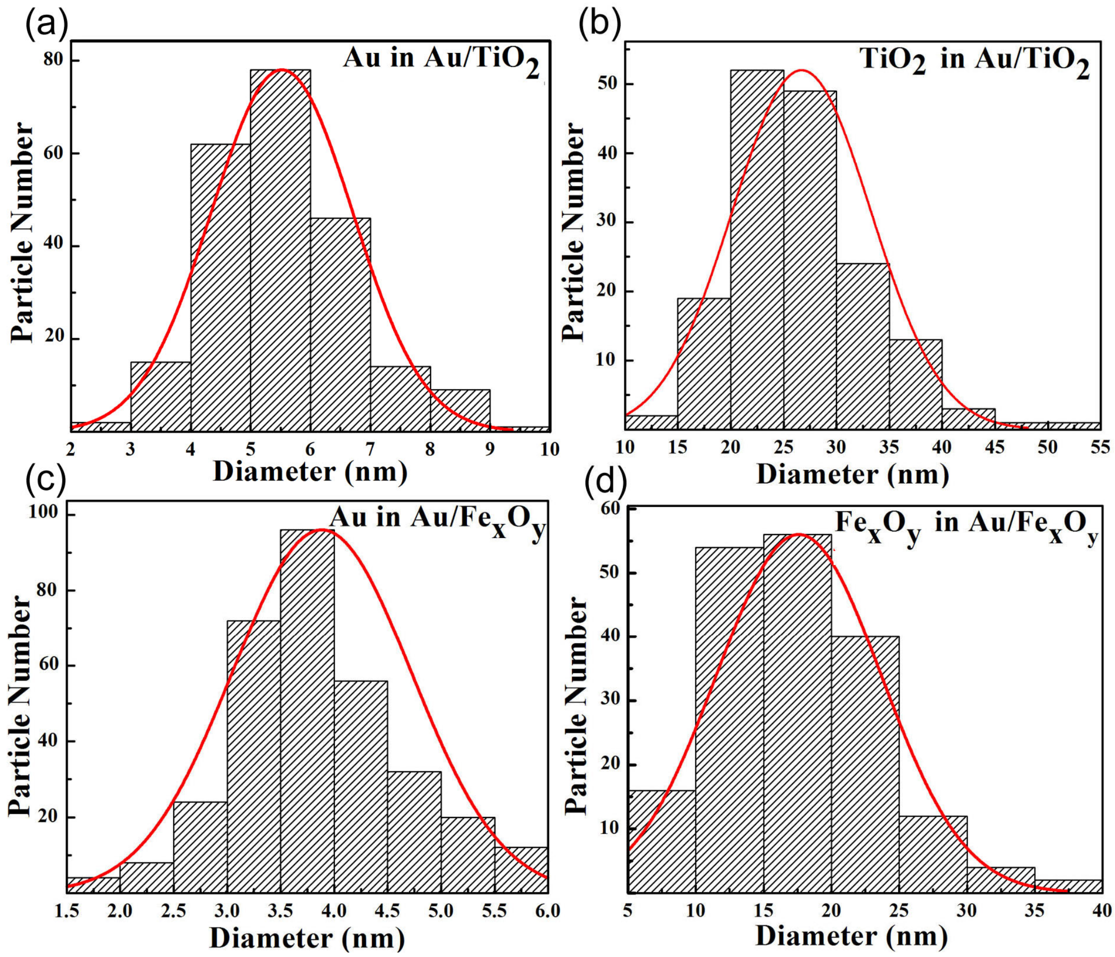

Figure S2 Size distribution of nanoparticles in GONs. (a) Au nanoparticles in Au/TiO_2 nanocomposite, (b) TiO_2 nanoparticles in Au/TiO_2 nanocomposite, (c) Au nanoparticles in Au/ Fe_xO_y nanocomposite, (d) Fe_xO_y nanoparticles in Au/ Fe_xO_y nanocomposite

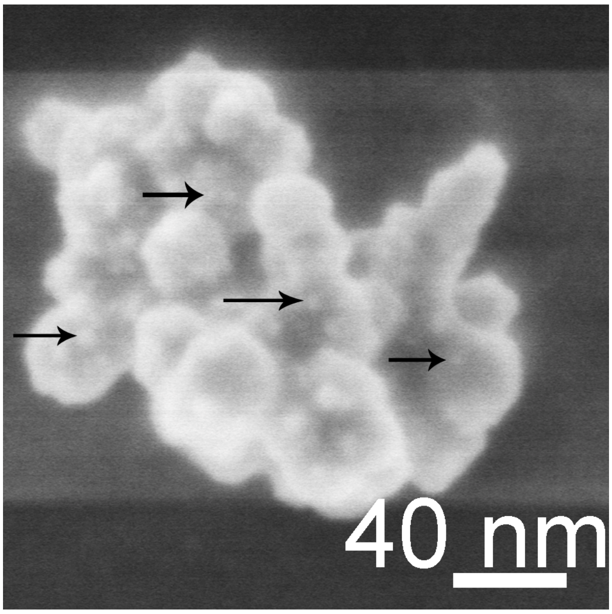

Figure S3 SEM image of as-prepared Au/TiO_2 nanocomposite, where Au nanoparticles are marked by arrows.

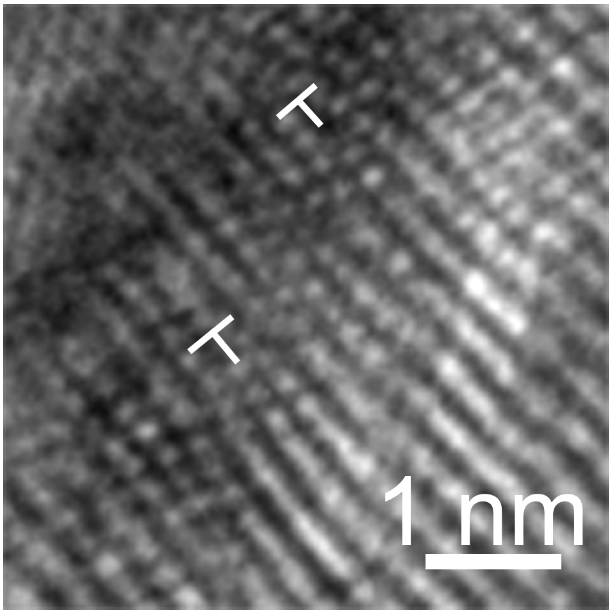

Figure S4 High resolution TEM image corresponding to the inset of Figure 1b, where "T" indicates an edge dislocation

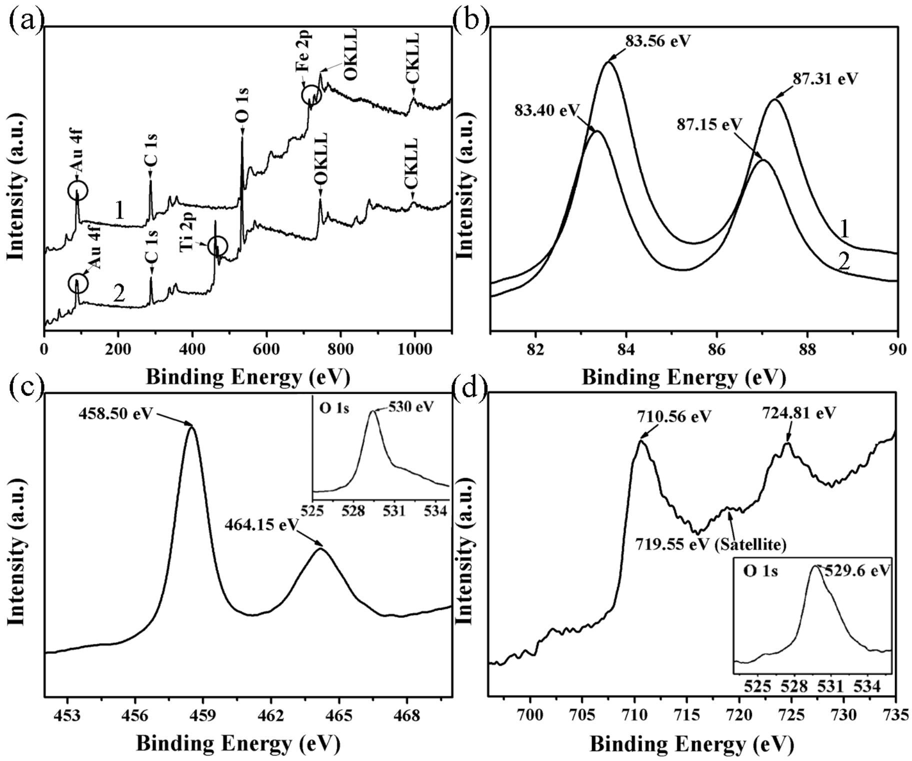

Figure S5 XPS spectra of as-prepared Au/oxide nanocomposites. (a) Extended spectra of Au/Fe_xO_y (curve 1) and Au/TiO_2 (curve 2). (b) Au 4f spectra of Au/Fe_xO_y (curve 1) and Au/TiO_2 (curve 2). (c) Ti 2p spectrum of Au/TiO_2 and (d) Fe 2p spectrum of Au/Fe_xO_y.

Detailed analysis on XPS spectra. Quantified XPS results reveal that the atomic contents of Au are 2.7% and 3.0% for samples A and sample B, respectively. Cl 2p or Na 1s peak does not appear in Figure S4a,[1] thus the washing procedure is an effective way to remove chloride ions which can lead to catalyst poisoning and agglomeration of Au nanocrystals.[2]

For as-prepared Au/TiO_2 nanocomposite, the binding energies of Au $4f_{7/2}$ and Au $4f_{5/2}$ are 83.40 eV and 87.15 eV, respectively, while those for used Au/TiO_2 are 83.10 eV and 86.59 eV, respectively. Therefore, we conclude that Au atoms are in metallic state, and the reason why the binding energy of Au $4f_{7/2}$ is lower than that for bulk gold (84.0 eV) should be attributed to surface core level shift and charge transfer from TiO_2 to Au nanoparticles.[3] Moreover, XPS results show that the binding energy of O

1s in Au/TiO_2 is 530 eV, thereby, Ti atoms are fully oxidized into TiO_2.[4]

For Au/Fe_xO_y nanocomposite, the binding energies of Au $4f_{7/2}$ and Au $4f_{5/2}$ are 83.56 eV and 87.31 eV, respectively, and the binding energies of Fe $2p_{1/2}$ and Fe $2p_{3/2}$ are 724.81 eV and 710.56 eV, respectively. Particularly, a satellite line is found situated at 719.55 eV, which is the characteristic of Fe^{3+} in γ-Fe_2O_3,[5,6] Hence, the surface of Fe_xO_y nanoparticles is composed of γ-Fe_2O_3.

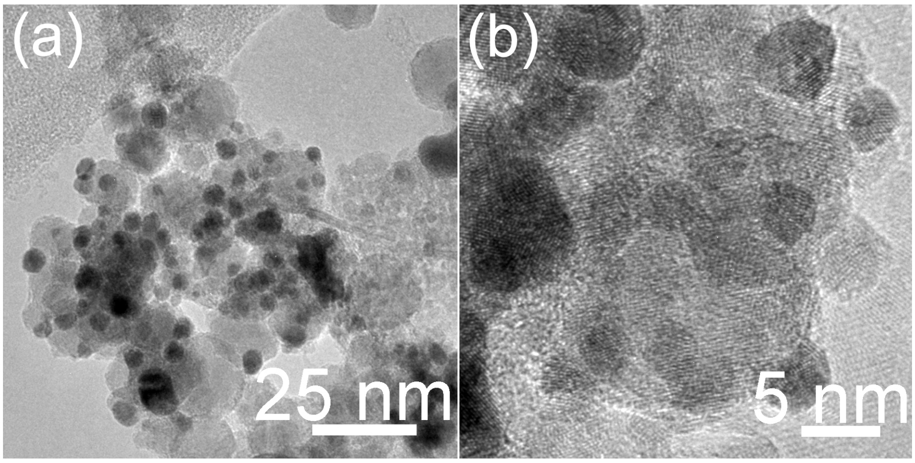

Figure S6 TEM images of Au/TiO_2 nanocomposite after three catalytic cycles. (a) Low magnification image and (b) high magnification image.

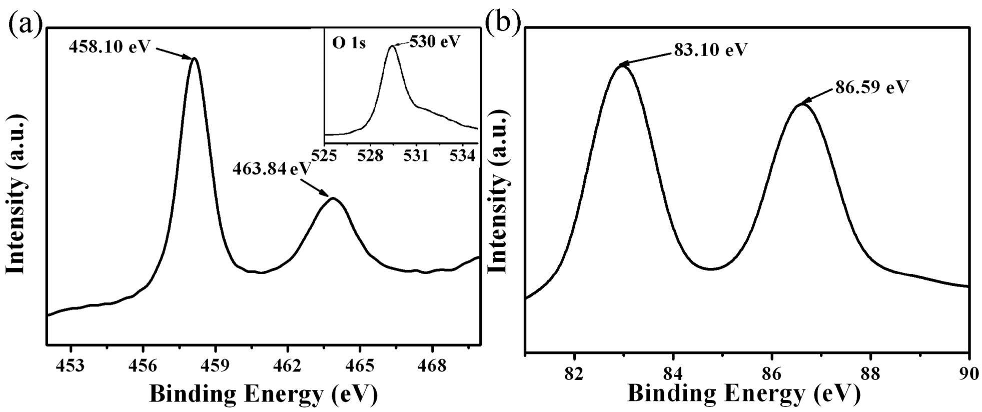

Figure S7 XPS spectra of Au/TiO_2 nanocomposites after three catalytic cycles. (a) Ti 2p spectrum. (b) Au 4f spectrum.

References

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