Electronic Supplementary Material (ESI) for RSC Advances.

Electronic Supplementary Information

Surface plasmon-driven catalytic reactions on patterned Co_3O_4/Au inverse catalyst

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KEYWORDS: Inverse catalyst, LSPR, hot electron, NSL, cobalt oxide, CO oxidation

1. X-ray diffraction (XRD) patterns of the Au nanostructure before and after annealing

Figure S1 shows XRD patterns of the crystalline phase of the Au nanostructure before and after heat treatment at 553 K for 2 h 30 min. The many diffraction peaks indicate that the Au nanostructure was polycrystalline before and after annealing at 553 K.

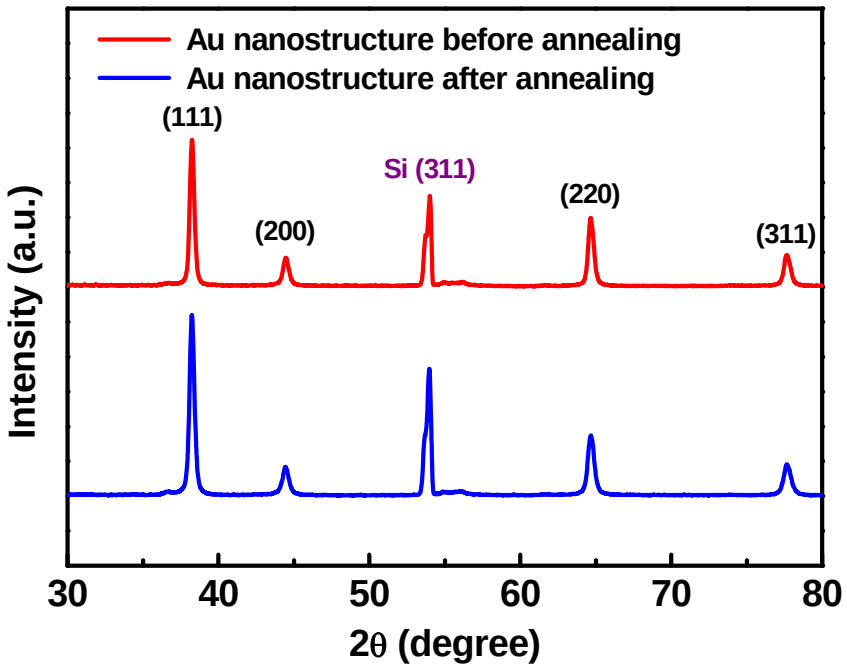

Figure S1. XRD patterns of the Au nanostructure before and after heat treatment at 553 K for 2 h 30 min.

2. Sonication process for removal of SiO_2 nanospheres

Figure S2 shows a SEM image of the patterned Au nanostructure after removing the 300-nm SiO_2 nanospheres by sonication for 1 minute with deionized water. All the Au cones remained and there were no SiO_2 nanospheres after sonication. Furthermore, there were some defects in the Au nanostructures caused by misalignment or by the size distribution of the nanospheres.

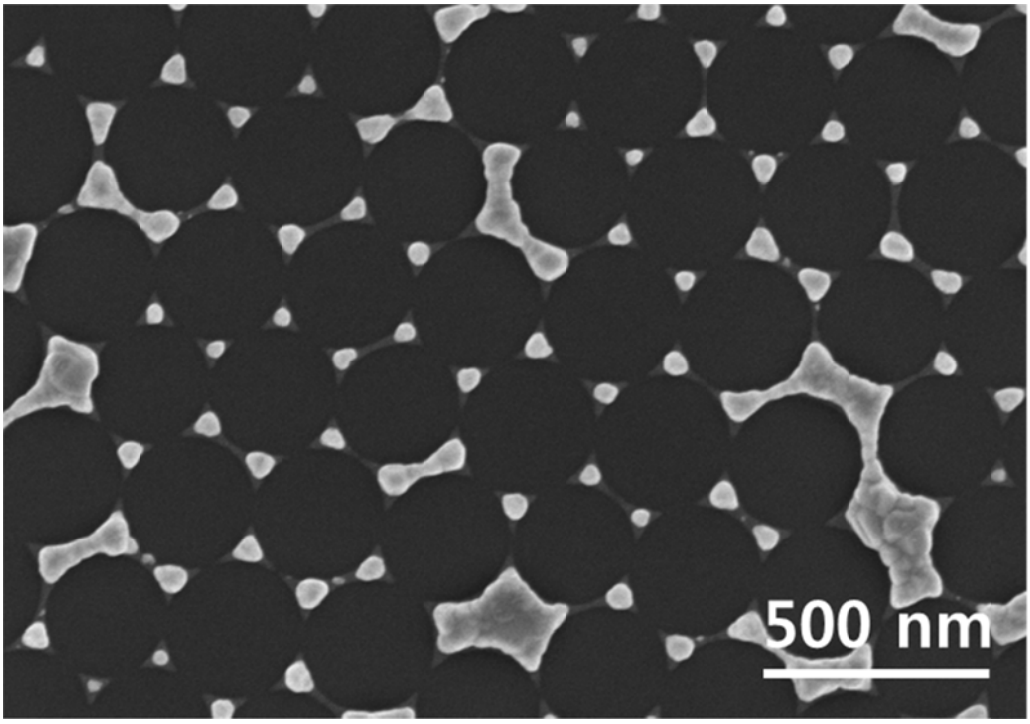

Figure S2. SEM image of the patterned Au nanostructure after removal of the 300-nm SiO_2 nanospheres by sonication for 1 minute.

3. Sample temperature with and without light at 523 K

Figure S3 shows the sample temperature measured from the temperature controller with and without light at 523 K under 40 Torr CO, 100 Torr O_2, and 620 Torr He. There was no change in the sample temperature when light was irradiated on the sample. Therefore, we can ignore the thermal effect of light irradiation in our experiments.

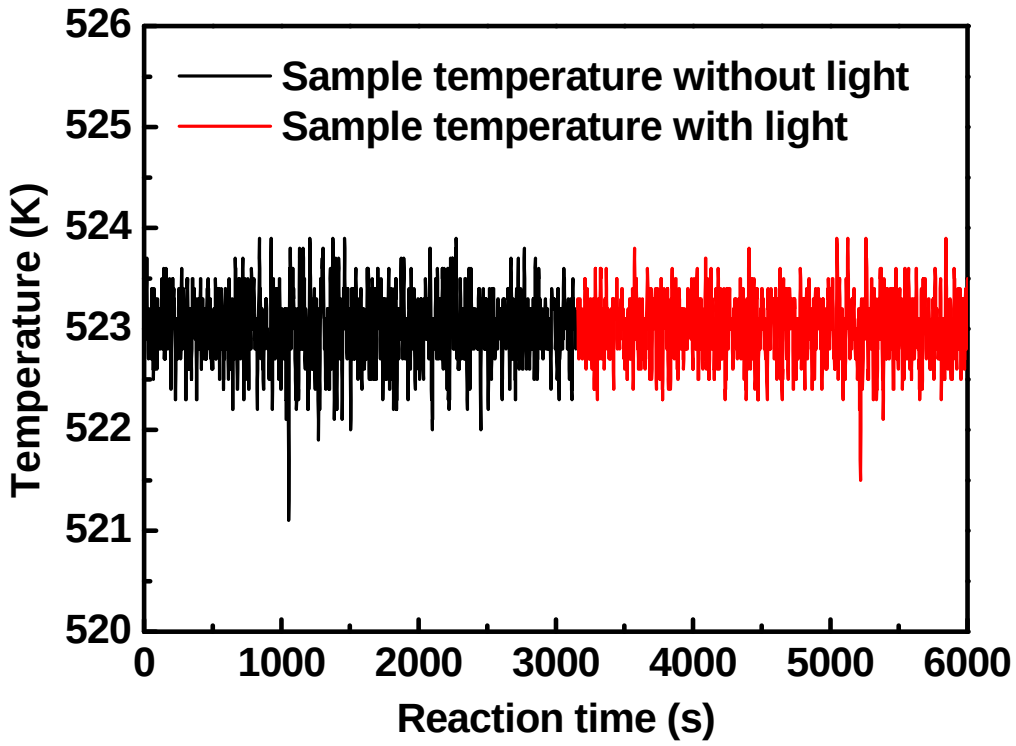

Figure S3. Sample temperature with and without light at 523 K under 40 Torr CO, 100 Torr O_2, and 620 Torr He.

4. Structures of the patterned Co_3O_4/Au nanostructure

The morphology of the patterned Co_3O_4/Au nanostructure was characterized using scanning electron microscopy (SEM, Magellan 400). The SEM images before and after CO oxidation show that some portions had minor changes, but there were no significant morphology changes to the patterned Co_3O_4/Au inverse catalyst.

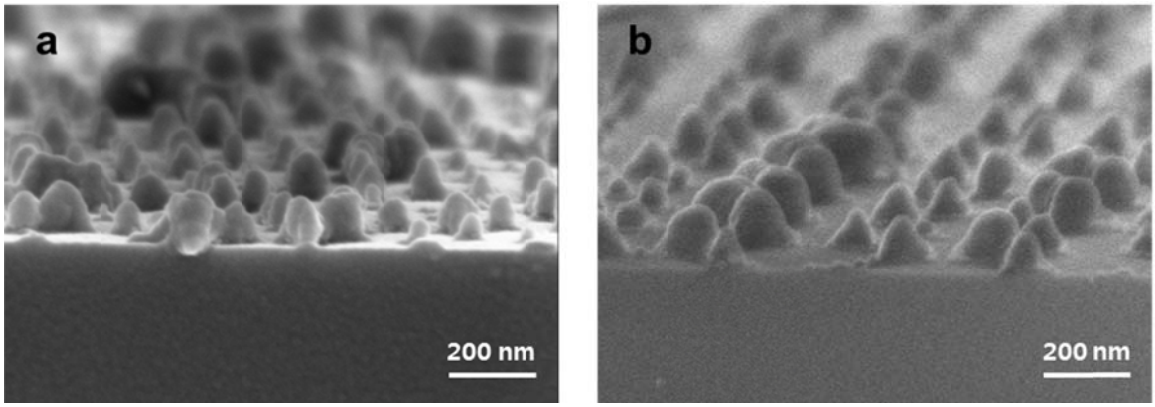

Figure S4. SEM image (cross section) of the patterned Co_3O_4/Au nanostructure (a) before and (b) after CO oxidation.

5. X-ray photoelectron spectroscopy (XPS) spectra of the patterned Co_3O_4/Au nanostructure

Figure S5 shows the chemical state of the cobalt oxide (Co 2p) taken using X-ray photoelectron spectroscopy (XPS, Thermo VG Scientific Sigma Probe system with an Al Kα X-ray source (1486.3 eV)) before and after CO oxidation. After CO oxidation, there is a slight change in the oxidation states of the cobalt oxide.

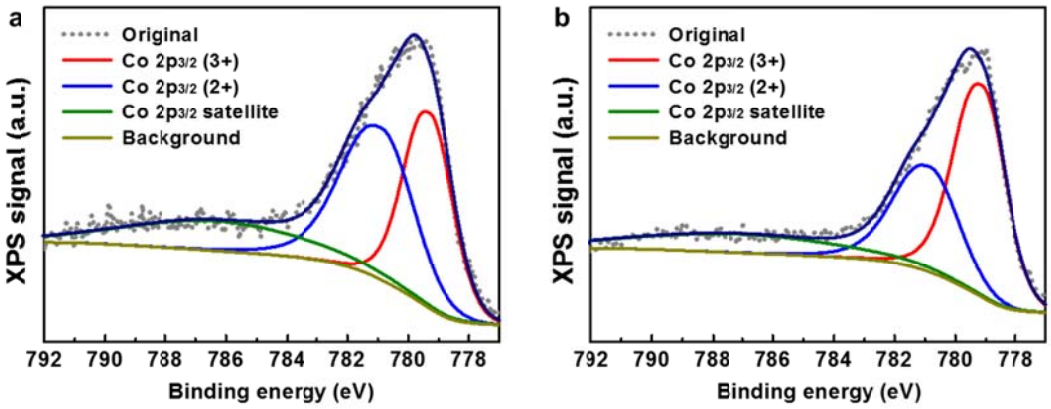

Figure S5. XPS spectra of Co 2p on the patterned Co_3O_4/Au nanostructure (a) before and (b) after CO oxidation.

6. Finite-difference time domain (FDTD) simulations on the patterned Au nanostructure

Figure S6 shows the electric field distribution indicating the enhancement of light absorption for the cross-sectional view of the nanostructure using LSPR around the patterned Au nanostructure without Co_3O_4 using two-dimensional FDTD simulation analysis. The electric field was only formed along the gold edge between two adjacent Au triangles.

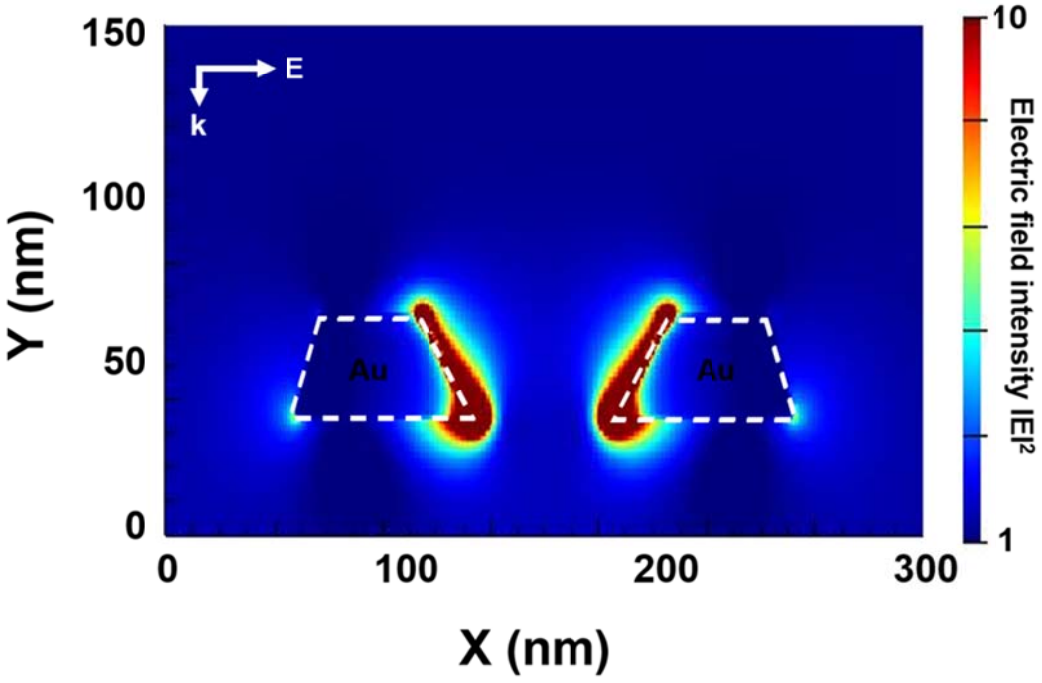

Figure S6. Cross-sectional view of the FDTD calculation of electric field intensity by LSPR on the patterned Au nanostructure without Co_3O_4.