Supporting information

Calculation of conversion and TOF to determine the catalytic efficiency

Conversion of CO=$[CO]_{inlet}$-$[CO]_{outlet}$ /$[CO]_{inlet}$ x 100, where, [CO] represents the CO concentration in the gas flow.

The dispersion of Ag (D) was estimated from the Ag particle size derived from STEM images as presented in Table 1. The turnover frequency (TOF) was calculated according to single surface Ag site on Ag/TiO_2 catalysts as shown below:

D (dispersion)= 6 x (V_m/a_m) /$d_{STEM,}$ where, V_m=volume of an Ag atom in the bulk of Ag metal, a_m=surface area occupied by an atom on a polycrystalline surface of Ag, $d_{STEM,}$=particle size calculated from STEM image.

TOF= V x Conversion of CO/m_{Ag} x D, where V is the molar flow rate of the reactants, and m_{Ag} is the molar amount of Ag metals on the catalysts. [1]

Reference

1. L. Ma, C. Y. Seo, X. Chen, J. Li, J. W. Schwank, *Chem. Eng. J.* **2018**, *350*, 419-428.

Fig. S1: Enlarged UV-vis. Spectra of Ag/TiO_2 with different Ag content in the region of 190-360 nm recorded at room temperature.

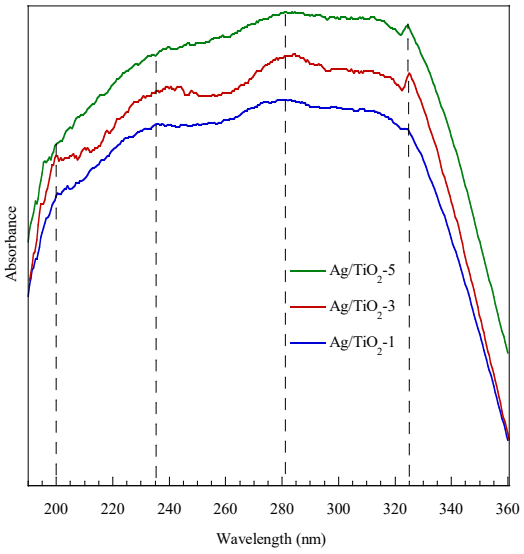


Fig. S2: A representative high-resolution XPS survey scan of Ag/TiO_2 catalysts.

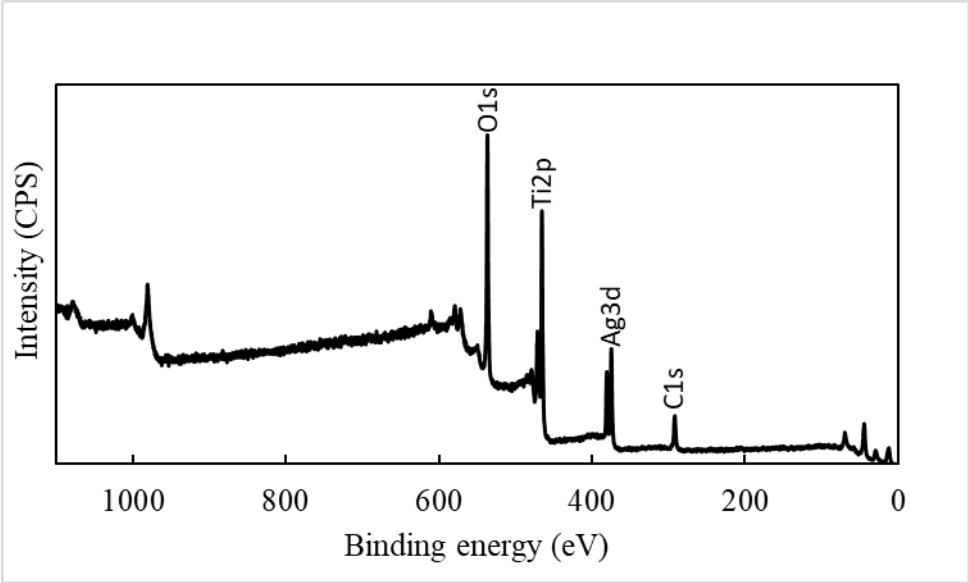
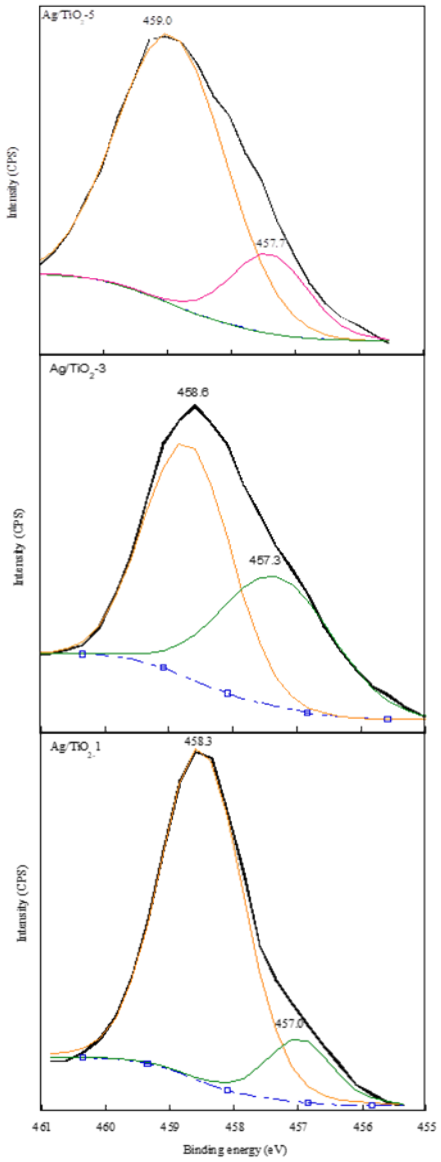


Fig. S3: The deconvoluted XPS spectra of (a) Ag3d of fresh and spent catalysts. (b) Ti 2p.

(a)



(b)

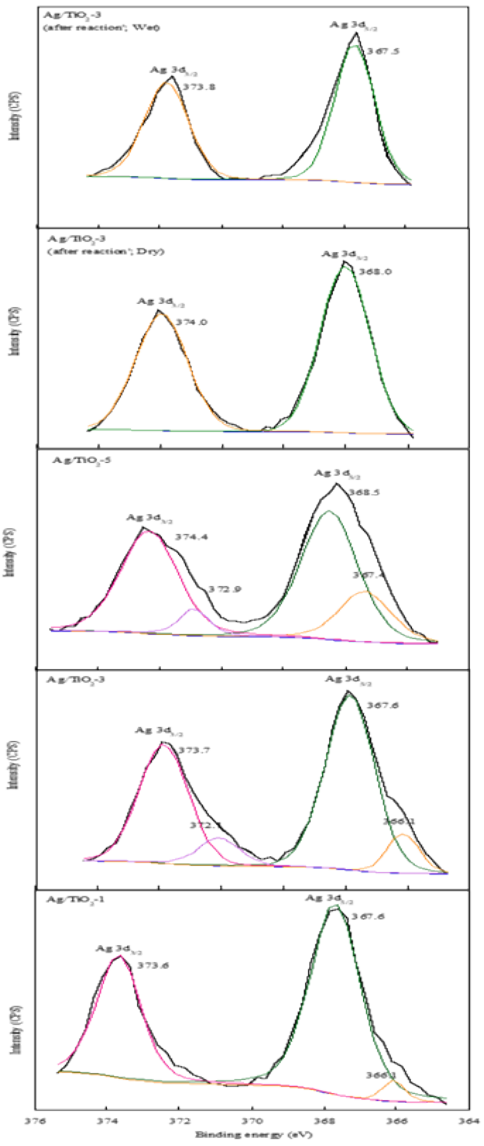
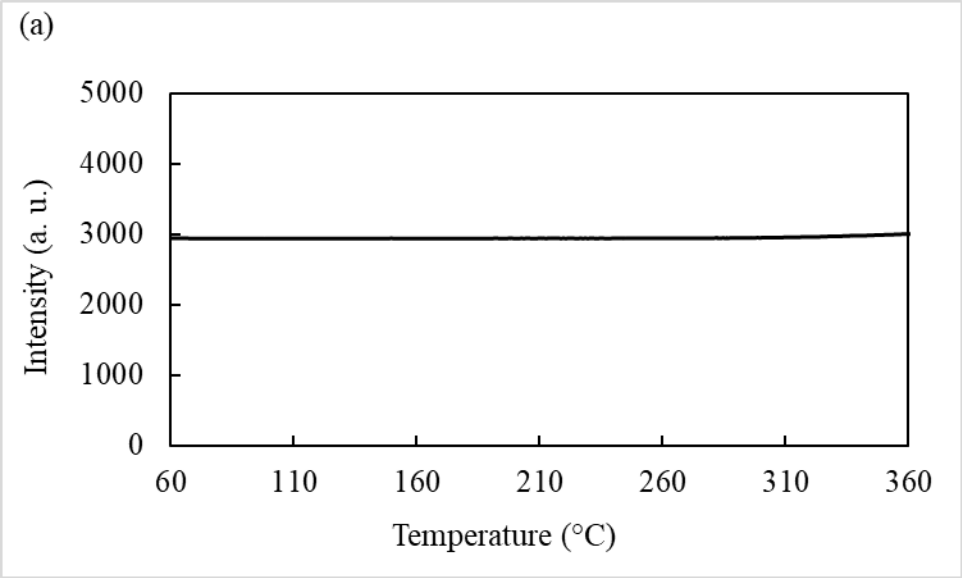


Fig. S4: H_2-TPR profile of (a) bare TiO_2 and (b) pure Ag_2O powder.



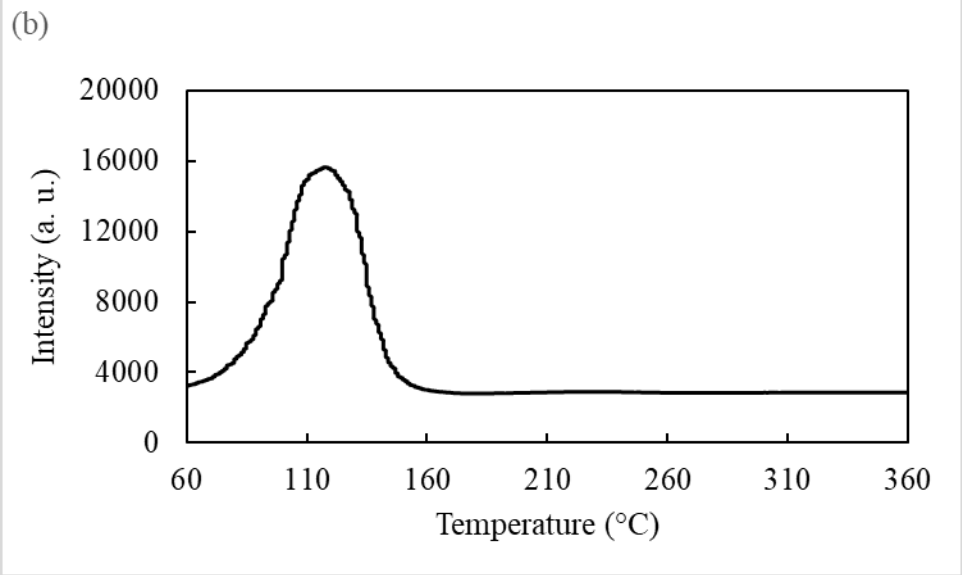


Fig. S5: Catalytic activity of as-synthesized Ag/TiO_2 with different Ag loadings.

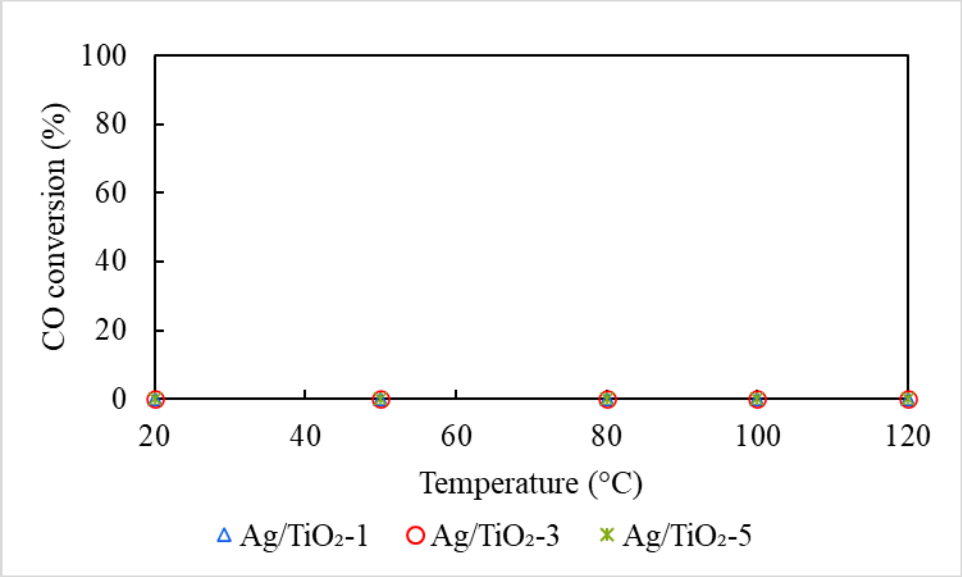


Fig. S6: Effect of calcination temperature on the structure of Ag/TiO_2-3.

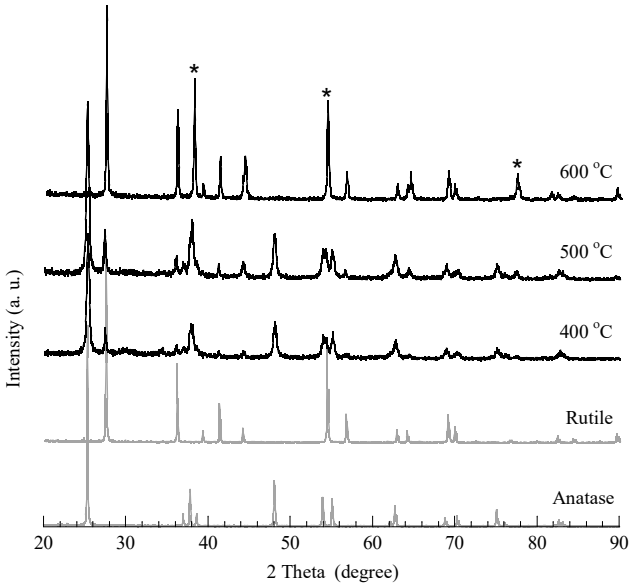


Fig. S7: Enlarged UV-vis. Spectra of Ag/TiO_2-3 under the wet (violet) and dry (red) conditions in the region of 190-360 nm recorded at room temperature.

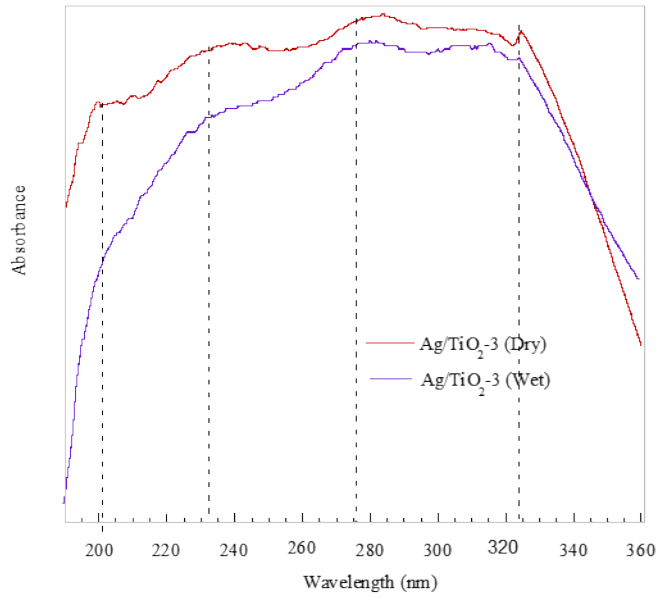


Fig. S8: Time on stream profile of CO oxidation at 70 % conversion over Ag/TiO_2 under (a) dry and (b) wet conditions.

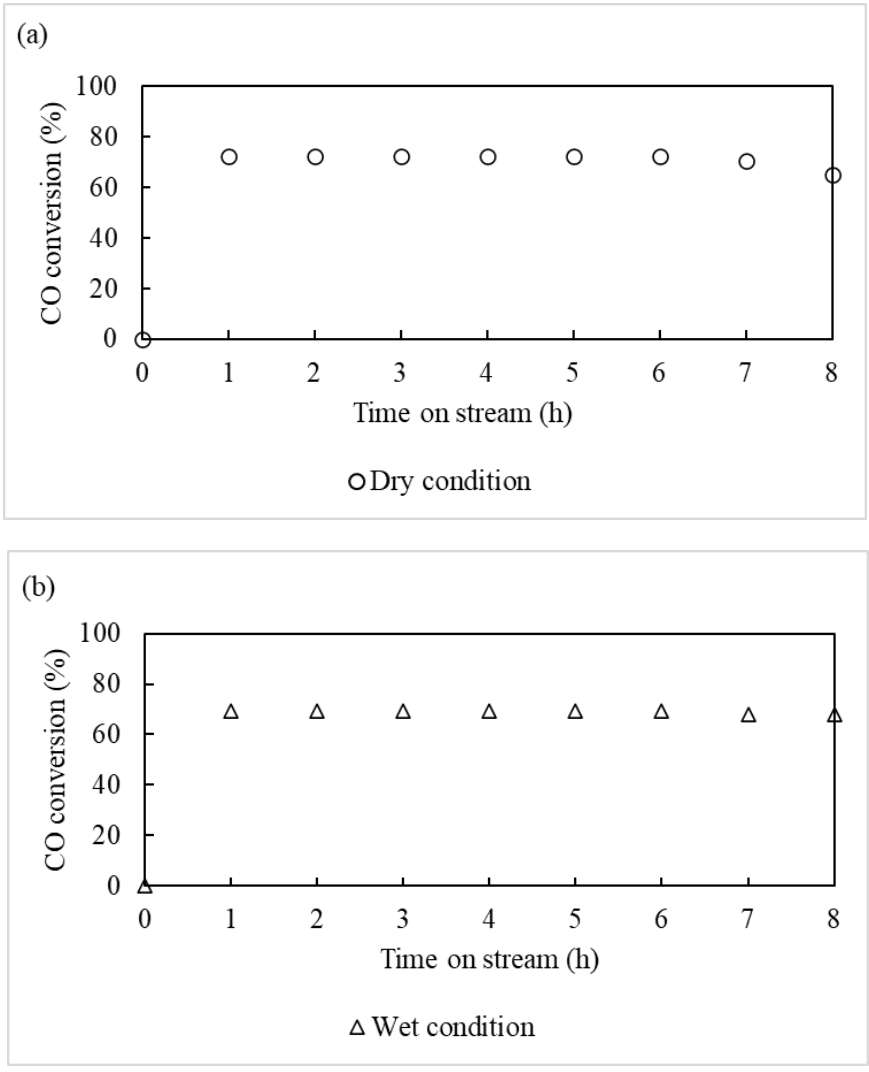


Fig. S9: Time on stream profile of CO oxidation on pure Ag_2O powder under the applied reaction conditions (Amount of Ag_2O= 0.013g; reactant gas (1% CO balance with air) flow rate=33 ml/min.; temperature=80 °C).

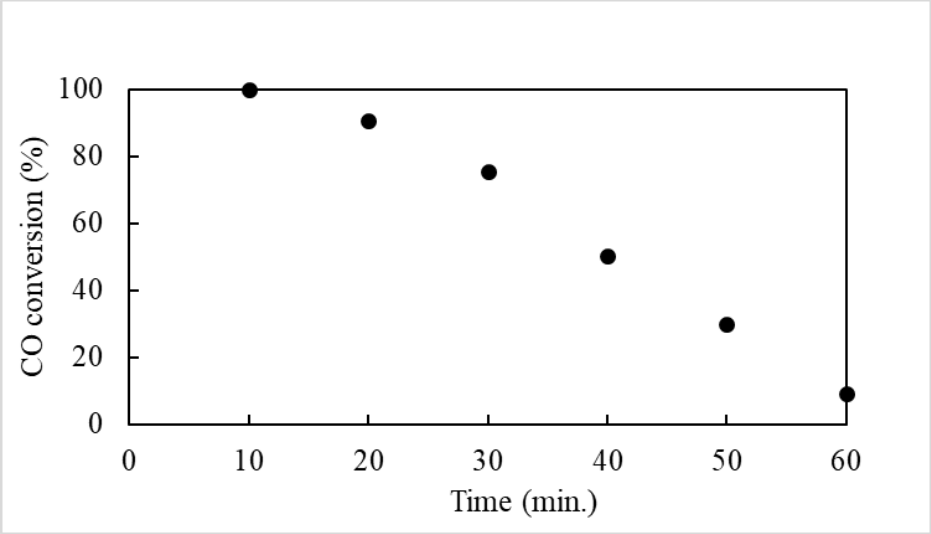


Fig. S10: XRD pattern of 3 wt.% Ag supported on (a) SiO_2, (b) Al_2O_3, (c) ZrO_2 and (d) CeO_2. Inset shows the Ag (1 1 1) peak at 2Θ= ≈38° of different support materials.

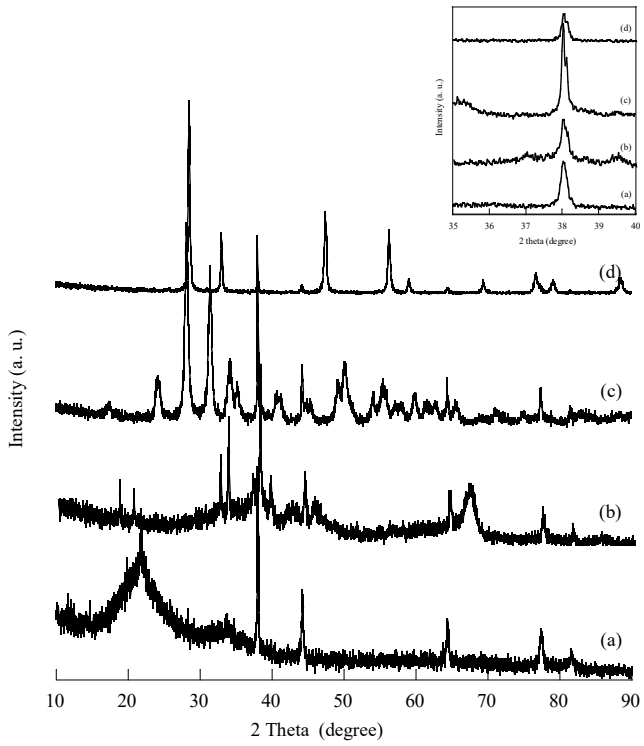


Table S1: Oxidation of CO on Ag catalysts supported on various oxide materials.

Entry	Catalyst	Particle size (nm)[a]	$T_{50\%}$ (°C)	$T_{100\%}$ (°C)
1[b]	Ag/TiO_2	-	34.6	80
2	Ag/SiO_2	8.8	41.5	100
3	Ag/Al_2O_3	7.1	81.3	120
4	Ag/ZrO_2	13.1	69.3	120
5	Ag/CeO_2	7.6	119.5	-

Reaction conditions: Catalyst=0.2g, Ag content=3 wt.%, reactant gas flow rate=33 ml/min. $T_{50\%}$ and $T_{100\%}$= temperature of 50% and 100% conversion, respectively. All the catalysts were prepared by wetness impregnation method as described in the experimental section. [a] Particle sizes were calculated from XRD using Scherrer equation based on the Ag (1 1 1) peak at $2\theta=38°$. [b] Particle size from XRD cannot be determined due to the overlapped peak of TiO_2.