Supporting Information

Effective Driving of Ag-loaded Al-doped $SrTiO_3$ under irradiation at λ >300 nm for the photocatalytic conversion of CO_2 by H_2O

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Table S1. BET surface area, FWHM of the {110} diffraction peak, Molar ratio, determined by ICP-OES

Various kinds of catalyst	BET/m^2 g^{-1}	FMHW	Al / Ti*100 (experiment) (%)	Al/(Al+Ti)*100 (ICP-OES) (%)
Pristine $SrTiO_3$	3.7	0.105		0.63
0 mol % $SrTiO_3$-Y	1.1	0.057	0	0.68
0 mol % Al-$SrTiO_3$	1.8	0.053	0	1.50
2 mol% Al-$SrTiO_3$	4.1	0.087	2	1.68
4 mol% Al-$SrTiO_3$	4.5	0.087	4	2.16
16 mol% Al-$SrTiO_3$	4.1	0.087	16	4.59

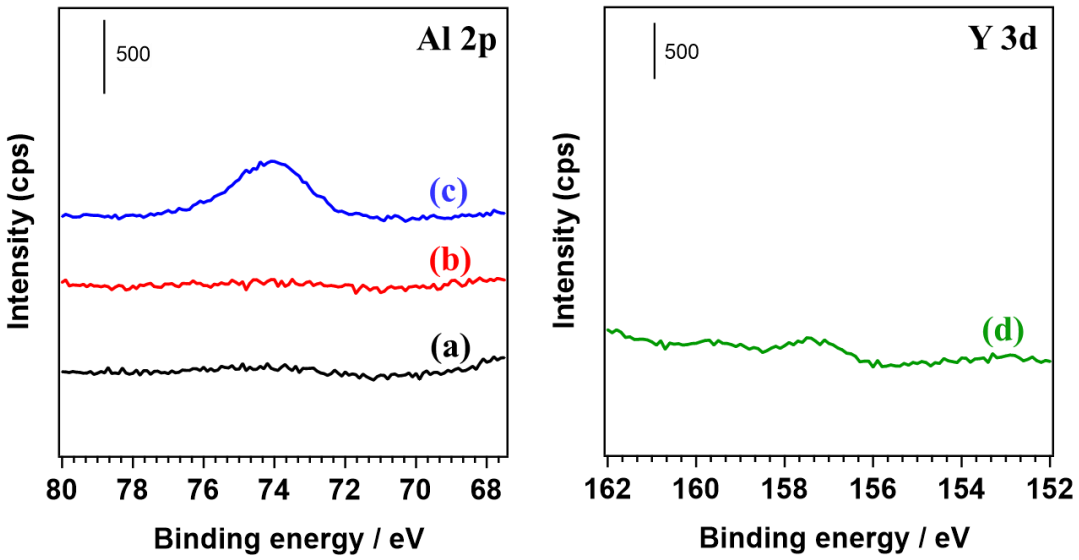

Figure S1. XPS Al 2p for (a) pristine $SrTiO_3$; (b) 0 mol% $SrTiO_3$-Y; (c) 0 mol% Al-$SrTiO_3$; (d) the XPS Y3d for the 0 mol% $SrTiO_3$-Y.

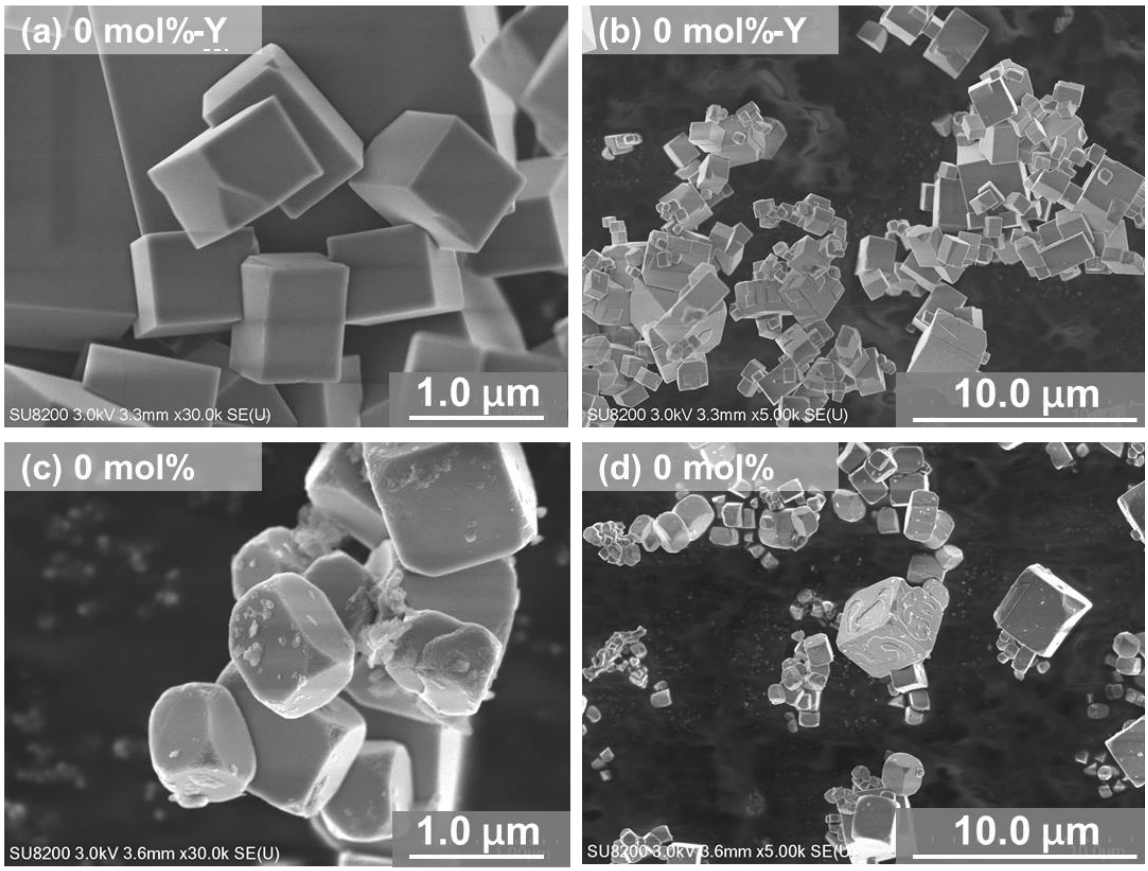

Figure S2. SEM images of (a) and (b) 0 mol% $SrTiO_3$-Y; (c) and (d) 0 mol% Al-$SrTiO_3$.

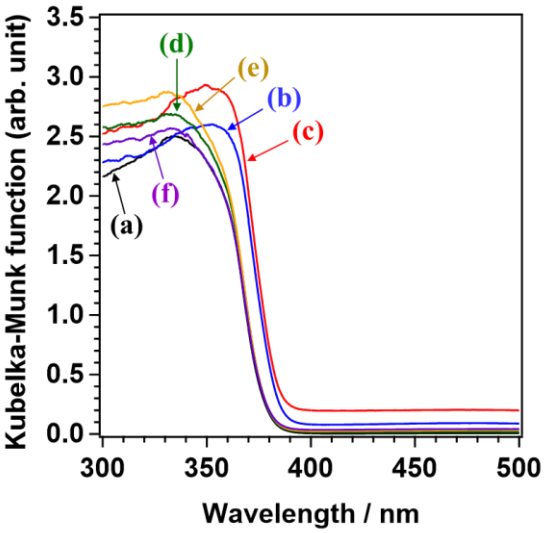

Figure S3. UV-Vis DR spectra of various kinds of $SrTiO_3$: (a) pristine $SrTiO_3$; (b) 0 mol% $SrTiO_3$-Y; (c) 0 mol% Al-$SrTiO_3$; (d) 2 mol% Al-$SrTiO_3$; (e) 4 mol% Al-$SrTiO_3$; and (f) 16 mol% Al-$SrTiO_3$.

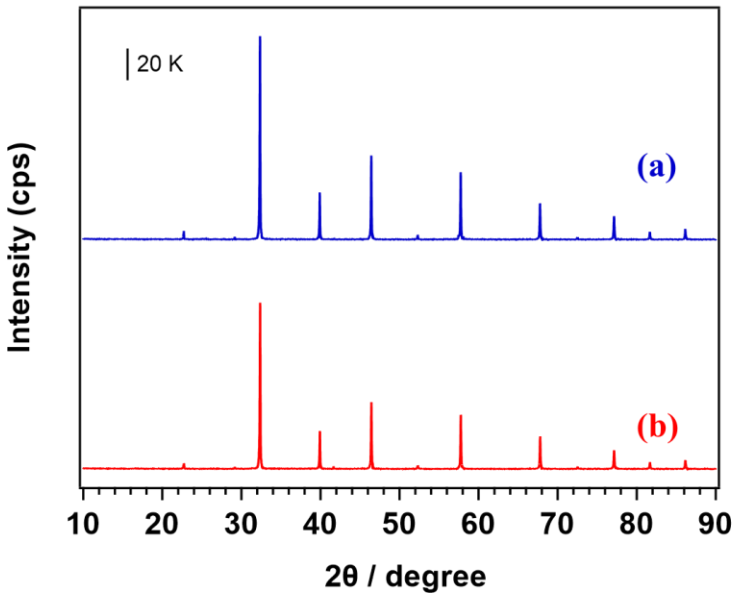

Figure S4. XRD patterns of Ag/Al-$SrTiO_3$ (a) as-prepared, (b) after 5 hours photoreaction.

Table S2. Comparison of Ag/Al-$SrTiO_3$ photocatalyst with other CO_2 reduction photocatalysts in aqueous solution under irradiation.

Catalyst	Formation rates of products (μmol h^{-1})			Selec. toward CO (%)	e^-/h^+	Weight of sample (g)	Solution	Light source Wavelength	Ref.
	H_2	O_2	CO						
$Ag/SrTiO_3$	0.05	0.17	0.24	83.9	0.85	0.5	1.0 L, 0.1M $NaHCO_3$ aq.	λ > 300 nm	This work
$Ag/Al\text{-}SrTiO_3$	0.15	3.58	7.19	98.02	1.03	0.5	1.0 L, 0.1M $NaHCO_3$ aq.	λ > 300 nm	This work
$Ag/BaLa_4Ti_4O_{15}$	10	16	22	67.3	1.02	0.3	0.36 L, aq.	λ > 254 nm	1
$Ag\text{-}Cr/Ga_2O_3$	92.9	281	480	83.8	1.02	0.5	1.0 L, 0.1M $NaHCO_3$ aq.	λ > 254 nm	2
$Ag\text{-}Cr/Ga_2O_3$: Rh	10.3	6.5	3.9	27.6	1.09	0.5	1.0 L, 0.1M $NaHCO_3$ aq.	λ > 300 nm	3
$Ag/K_2YTa_5O_{15}$	16.3	43.2	91.9	84.9	1.25	1.0	1.0 L, 0.1M $NaHCO_3$ aq.	λ > 254 nm	4
$Ag/SrNb_2O_6$	1.1	24.8	51.2	97.9	1.05	0.5	1.0 L, 0.1M $NaHCO_3$ aq.	λ > 254 nm	5
$Ag\text{-}Mn/K_2Ti_6O_{13}$	0.20	4.39	10.1	98	1.17	0.3	0.4 L, 0.5 M $NaHCO_3$ aq.	λ > 254 ± 10 nm	6
$Ag/CaTiO_3$	0.45	0.56	0.35	44	1.5	0.2	0.01 L, 1.1 M $NaHCO_3$ aq.	λ > 254 ± 10 nm	7
$Ag/CaTiO_3$	3.1	25	54	94	1.14	0.3	0.36 L, 1.0 M $NaHCO_3$ aq.	λ > 254 ± 10 nm	8
$Ag/Sr\text{-}NaTaO_3$	28	102	176	86	1.0	0.2-0.5	0.36 L 0.1 M $NaHCO_3$ aq.	λ > 254 nm	9
$Ag/Ca\text{-}NaTaO_3$	15	84	148	91	0.97	0.2-0.5	0.36 L 0.1 M $NaHCO_3$ aq.	λ > 254 nm	

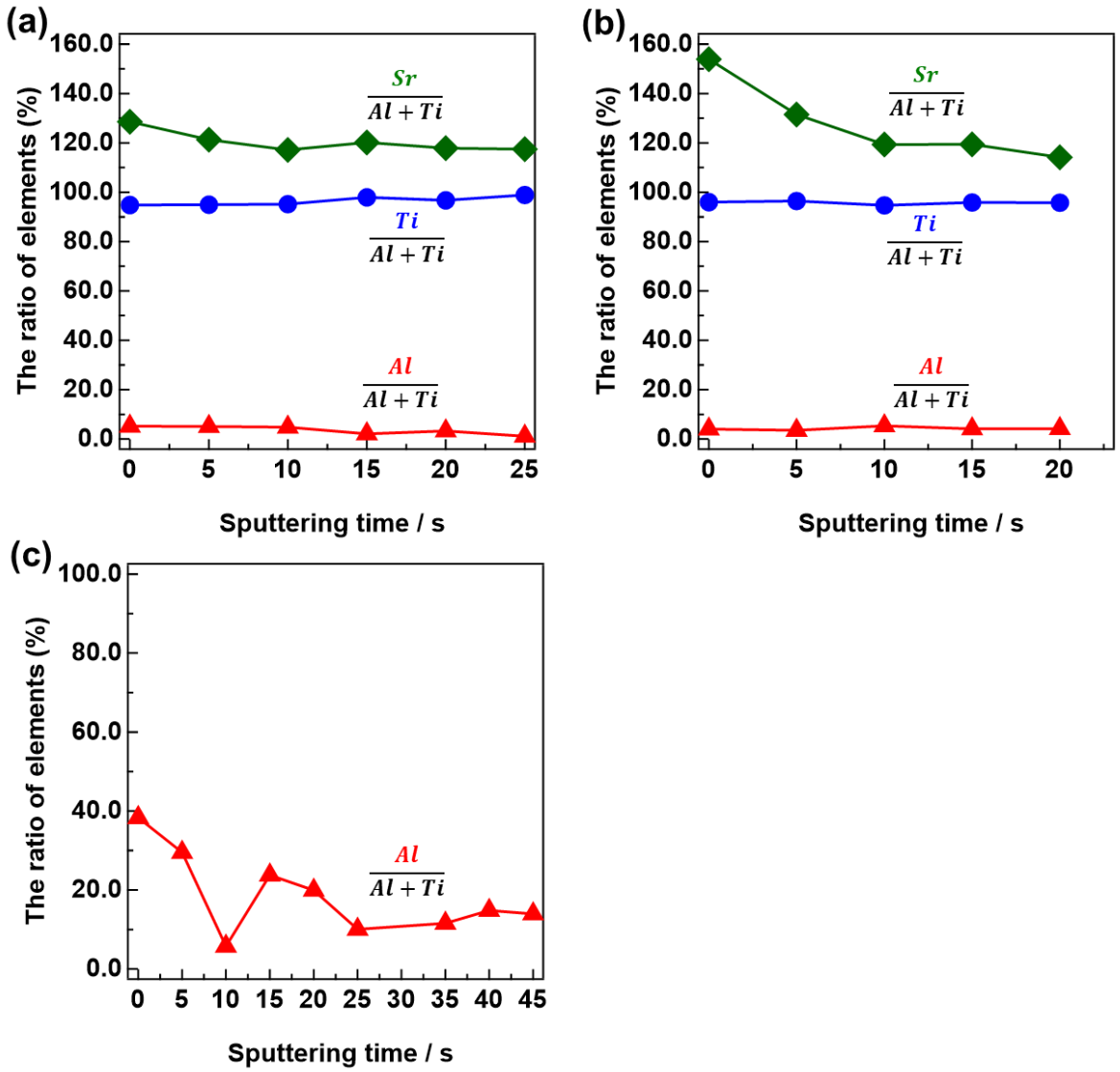

Figure S5. Atom ratio of Al, Sr, Ti elements to the total of Ti and Al; Sr/(Al+Ti), Ti/(Al+Ti), Al/(Al+Ti)

(a) pristine $SrTiO_3$; (b) 0 mol% $SrTiO_3$-Y; (c) 0 mol% Al- $SrTiO_3$

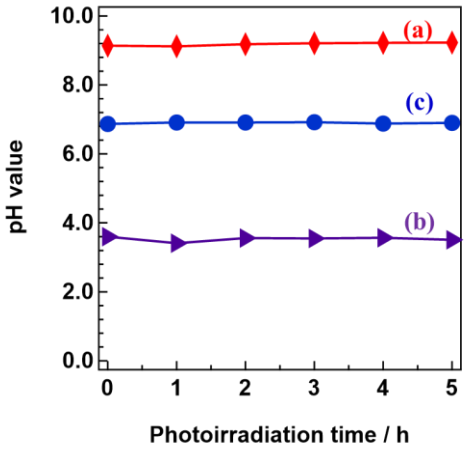

Figure S6. pH value of the suspension solution during the photocatalytic reaction; (a) flowing Ar gas, without a CO_2 gas flow; (b) without the $NaHCO_3$ additive; (c) typical conditions

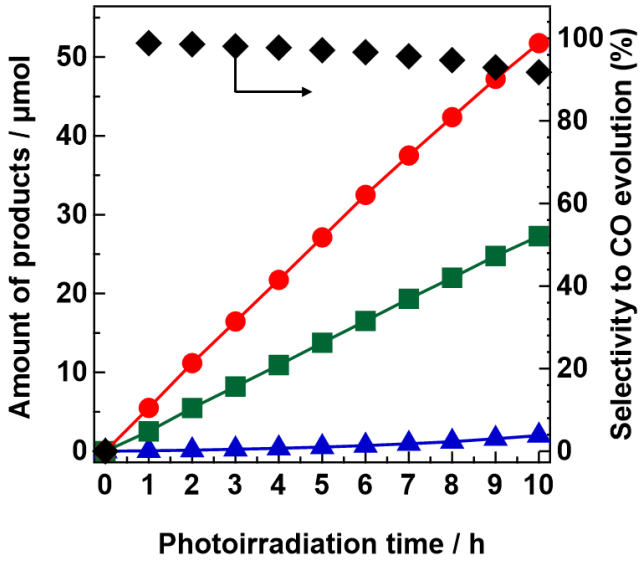

Figure S7. Time-dependent evolution of H_2 (blue triangle), O_2 (green square), CO (red circle), and selectivity to CO evolution (black rhombus) over Ag-loaded Al-SrTiO3 for 10 h without a break.

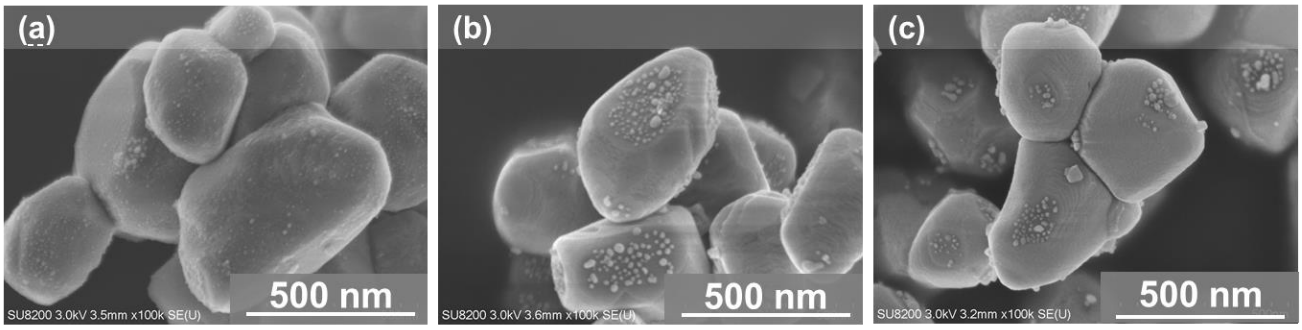

Figure S8 the SEM images of Ag/Al-$SrTiO_3$; (a) before reaction; (b) after 5 h photocatalytic reaction; (c) after 15 h photocatalytic reaction

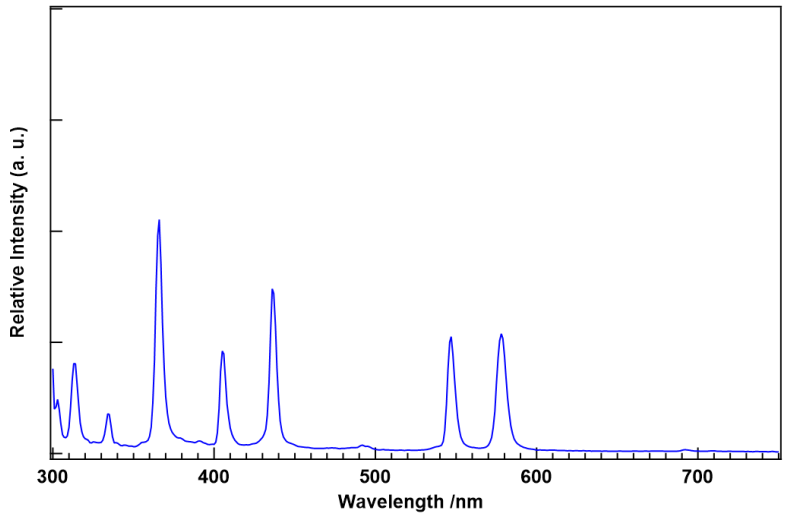

Figure S9. The emission spectrum of high-pressure Hg lamp after Pyrex® cooling jacket.

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