Electronic Supplementary Material

Facile synthesis of hierarchical flower-like Ag/Cu_2O and Au/Cu_2O nanostructures and enhanced catalytic performance in electrochemical reduction of CO_2

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Products *FEs* calculation

After the quantification, the Faradaic efficiencies (*FE*s) toward each CO_2 reduction product were calculated as

$$i_{H_2 \text{ or } CO} = V_{H_2 \text{ or } CO} \times q \times \frac{2Fp_0}{RT}$$

$$FE_{H_2 \text{ or } CO} = \frac{i_{H_2 \text{ or } CO}}{i_{total}} \times 100$$

$$FE_{HCOOH} = \frac{znF}{Q} \times 100$$

where $V_{H2 \text{ or } CO}$ is volume concentration of H_2 or CO quantified by GC, q is flow rate of CO_2, i_{total} is measured average current, F is Faradaic constant (96485.3 C/mol), p_0 is pressure, T is room temperature and R is ideal gas constant(8.314J •mol^{-1} •K^{-1}), z is the amount of the product, n is the number of moles of electrons to participate in the Faradaic reaction quantified by NMR, and the Q is the total charge applied during the electrolysis process.

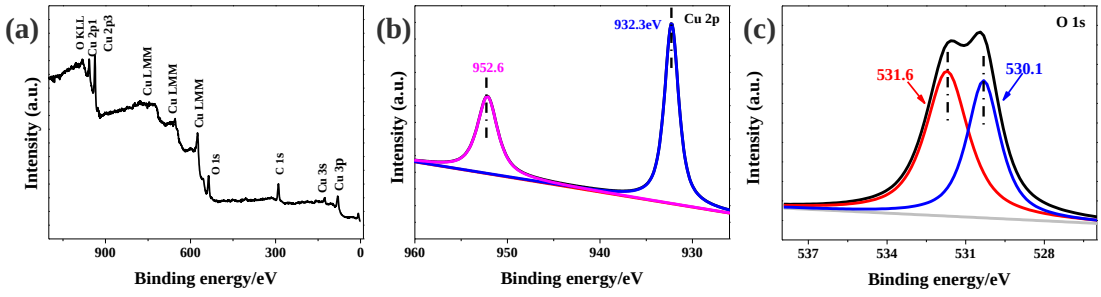

Fig. S1 XPS survey spectrum of Cu_2O (a), Cu 2p (b), and O 1s (c)

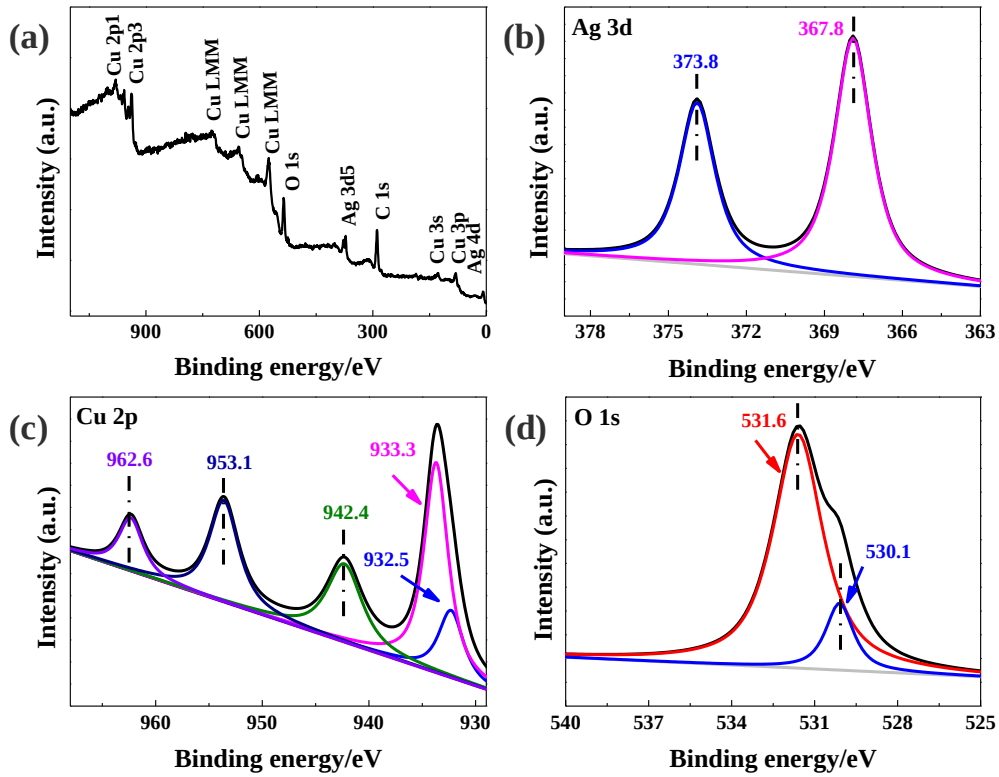

Fig. S2 XPS survey spectrum of $Ag_{0.25}/Cu_2O$ composite (a), Ag 3d (b), Cu 2p (c), and O 1s (d)

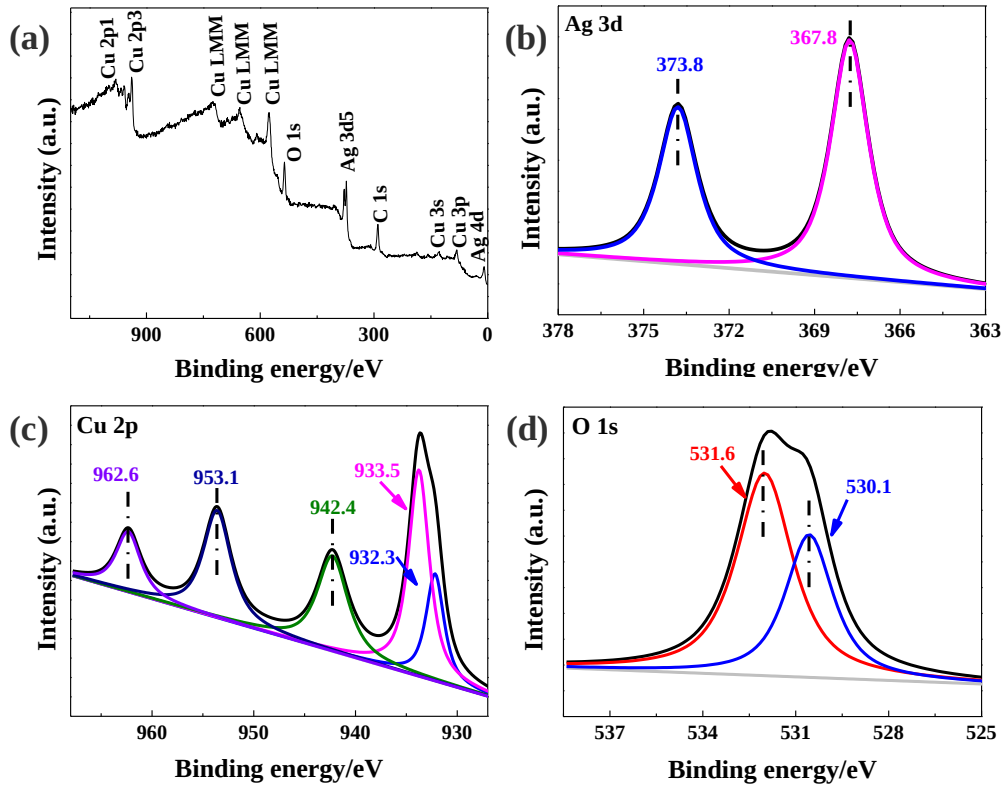

Fig. S3 XPS survey spectrum of $Ag_{0.5}/Cu_2O$ composite (a), Ag 3d (b), Cu 2p (c), and O 1s (d)

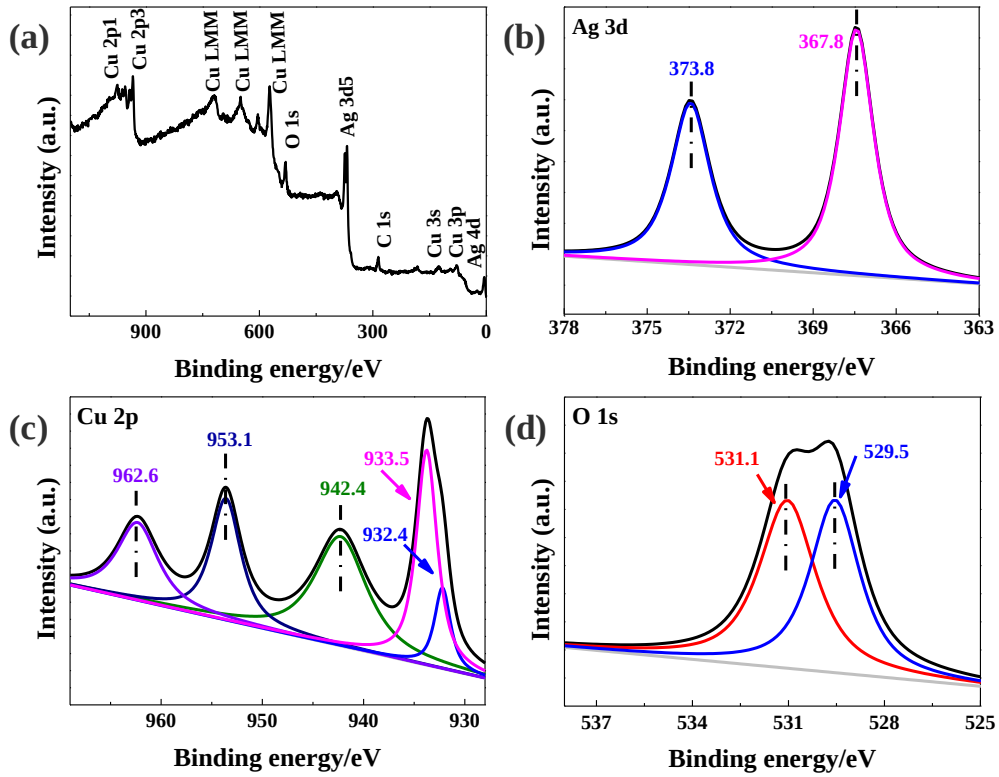

Fig. S4 XPS survey spectrum of Ag_1/Cu_2O composite (a), Ag 3d (b), Cu 2p (c), and O 1s (d)

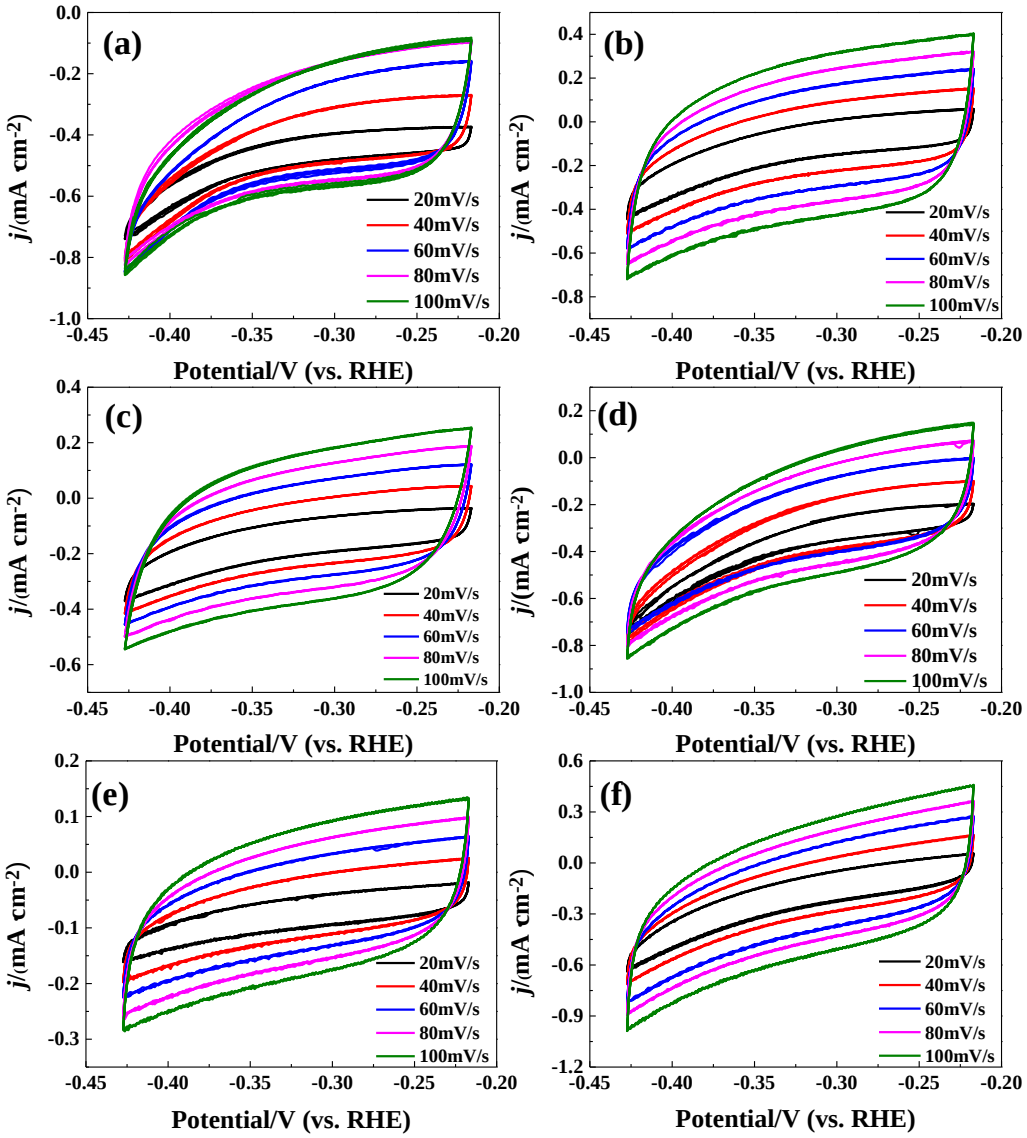

Fig. S5 Cyclic voltammograms at various scan rates for (a) Cu_2O, (b) $Ag_{0.125}/Cu_2O$, (c) $Ag_{0.25}/Cu_2O$, (d) $Ag_{0.5}/Cu_2O$, (e) Ag_1/Cu_2O, and (f) Au/Cu_2O

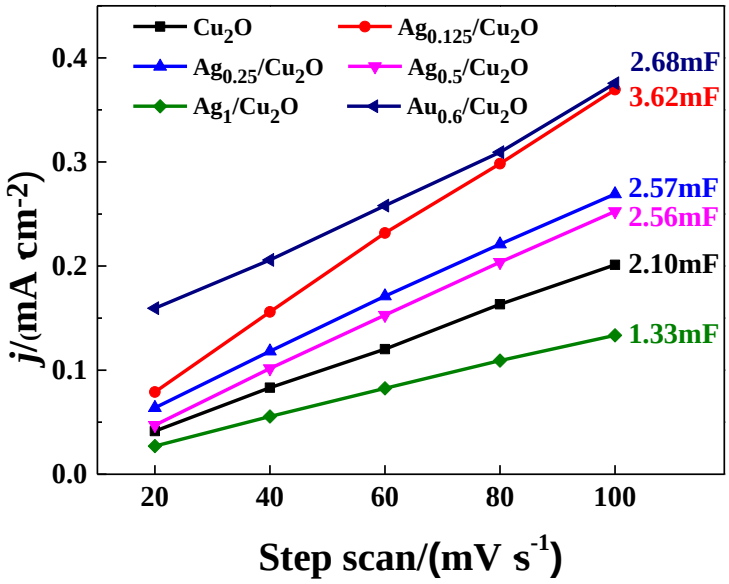

Fig. S6 The linear relationship between the current density and scan rate

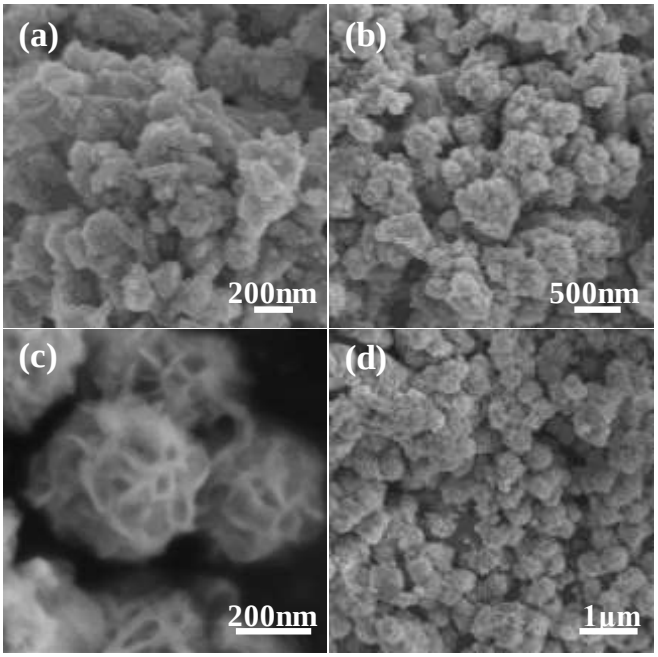

Fig. S7 SEM images of the used catalysts after 5 h reduction at -1.0V in CO_2-saturated 0.1 M $KHCO_3$ solution (a) and (b) for Cu_2O, (c) and (d) for $Ag_{0.125}/Cu_2O$

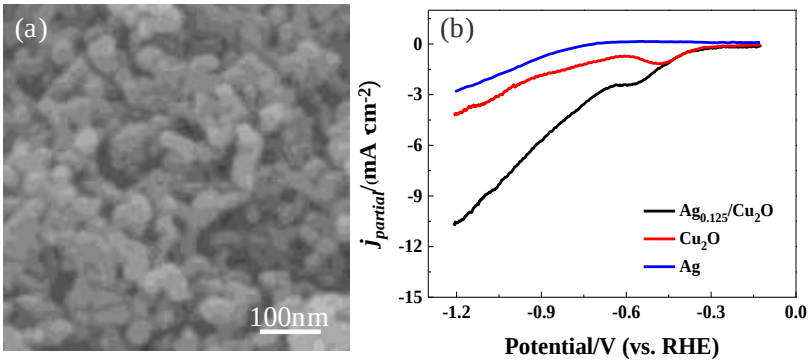

Fig. S8 (a) SEM image of as-prepared Ag nanoparticles, (b) Partial current density of CO_2 reduction on three samples

Table S1 Summary of compositions of Ag/Cu_2O composites based on XPS results

Sample	Cu	Ag	O	Atom Ratio
	Atom %			Ag/Cu
Cu_2O	38.2	/	61.8	/
$Ag_{0.125}/Cu_2O$	38.9	3.5	57.6	0.09
$Ag_{0.25}/Cu_2O$	29.0	6.3	64.7	0.22
$Ag_{0.5}/Cu_2O$	30.1	9.7	60.2	0.32
Ag_1/Cu_2O	27.6	11.8	60.6	0.43

Table S2 Summary of representative catalysts for electrochemical reduction of CO_2

Catalyst	Electrolyte	Experimental Conditions	Faradaic efficiency (%)				Ref.
			H_2	CO	HCOOH	Others	
Dendritic Ag_xCu_{100-x}	0.5 M $KHCO_3$	-1.3 V (vs. SCE)	28.6	43.9	--	--	[1]
Cubic Cu_2O@Au Nanocomposites	0.1 M $KHCO_3$	−1.0 V (vs. RHE)	51.3	30.1	--	CH_4 , C_2H_4	[2]
Au thin layers on polycrystalline Cu	0.1 M $KHCO_3$	−1.0 V (vs. RHE)	41	58	1	--	[3]
AuCu Nanoparticles	0.1 M $KHCO_3$	−0.77 V (vs. RHE)	42	52	5	--	[4]
Au_3Cu bimetallic nanoparticles	0.1 M $KHCO_3$	−0.7 V (vs. RHE)	35	62	3	--	[5]
Flower-like Ag/Cu_2O	0.1 M $KHCO_3$	−1.0 V (vs. RHE)	30	55	15	--	Our work
Flower-like Au/Cu_2O	0.1 M $KHCO_3$	−1.0 V (vs. RHE)	28	65	7	--	Our work

References:

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