Supporting Information

$Cs_2AgInCl_6$ Double Perovskite Quantum Dots Decorated with Ag Nanoparticles for Photocatalytic CO_2 Reduction

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Table and Figures

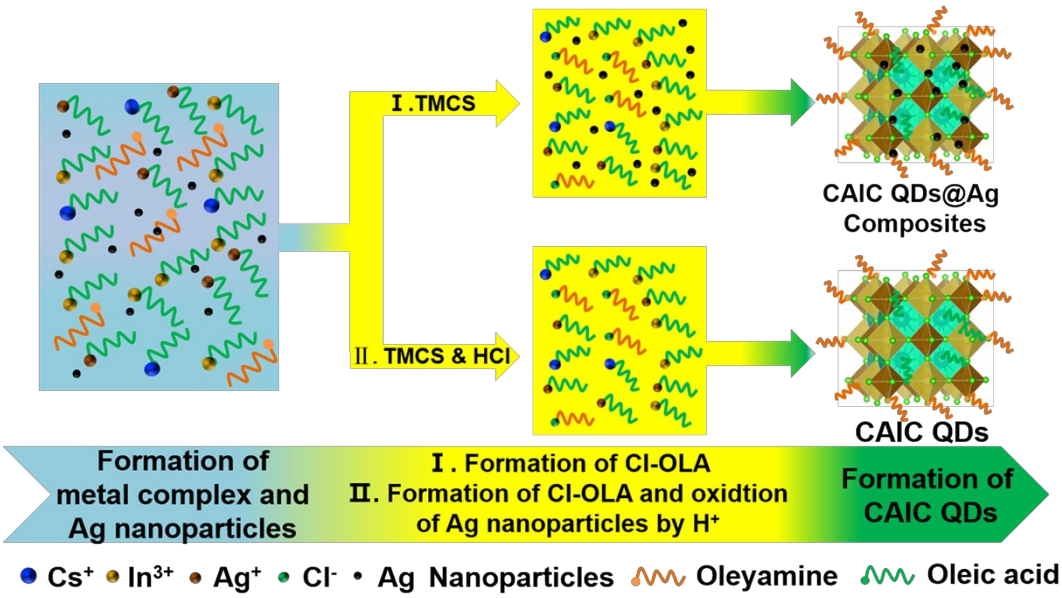

Figure S1. The reaction schematic of CAIC QDs and CAIC QDs@Ag composite during the process of synthesis.

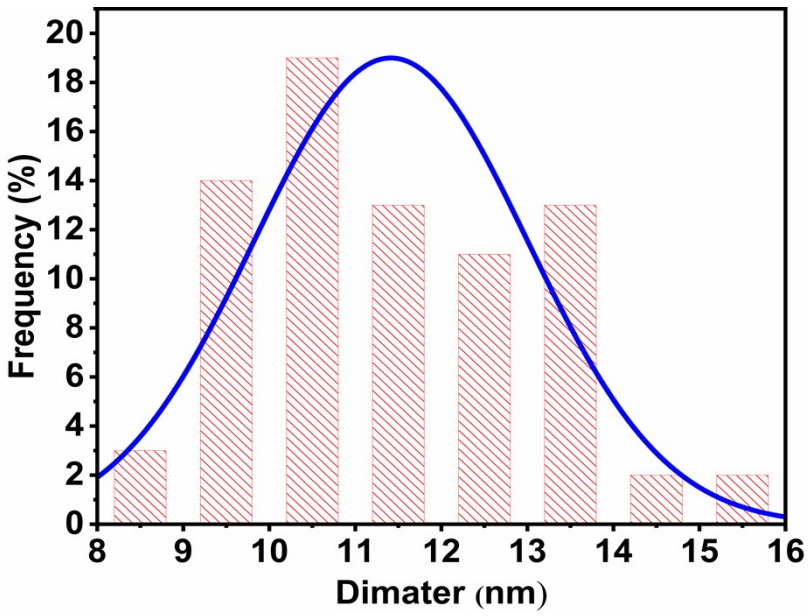

Figure S2. The Particle size distribution of CAIC QDs.

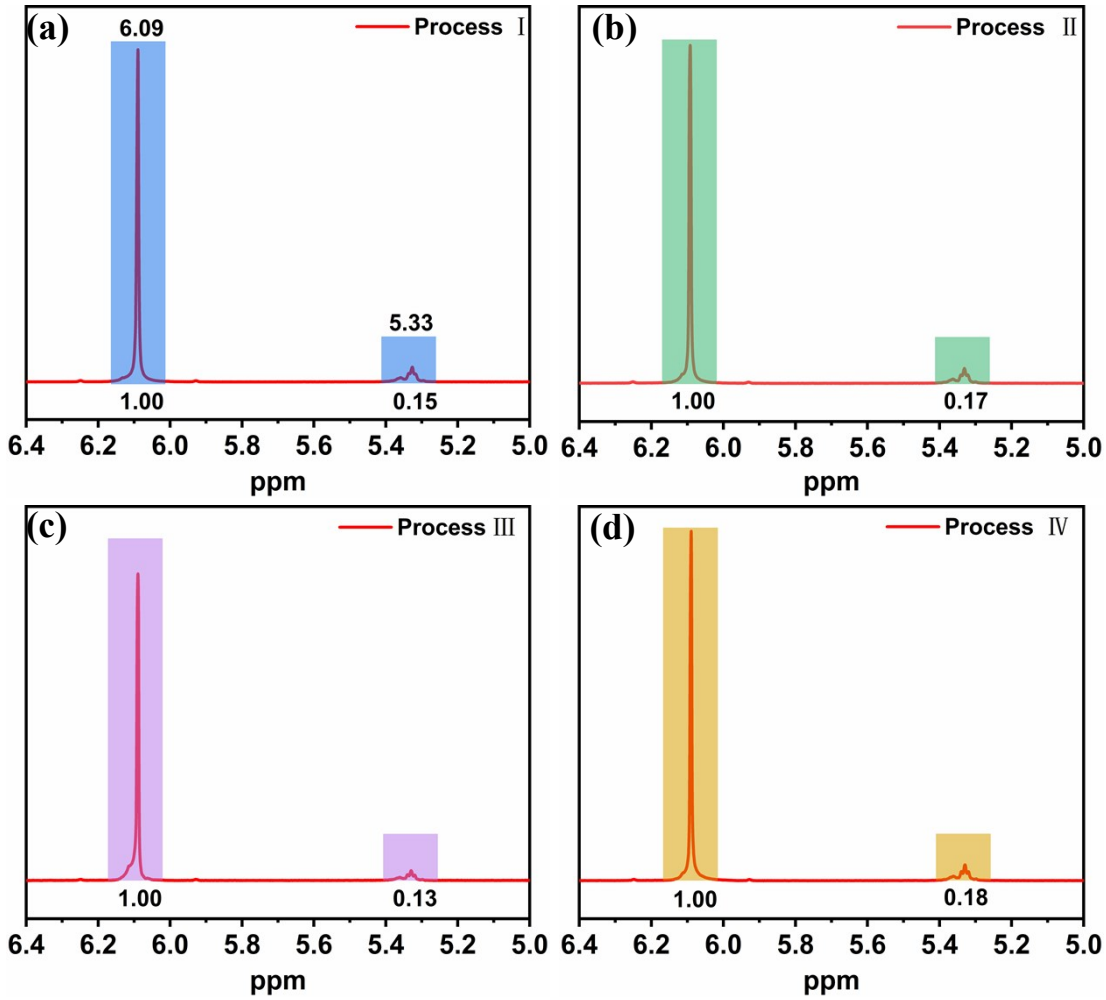

Figure S3. ^{1}H NMR spectrums of CAIC QDs@Ag-2 composite purified with various processes: (a) process Ⅰ, (b) process Ⅱ, (c) process Ⅲ, and (d) process Ⅳ (deuterated DMSO as solvent).

The peak position and the integral peak area are marked in the spectra. The peaks at 5.33 ppm and 6.09 ppm correspond to the signals of H on C=C bond from the ligands (OA and OLA) and H from the benzene ring in 1.3.5-trimethoxybenzene. The ratio of the peak area between 1.3.5-trimethoxybenzene and C=C bond is 3:2 when their molar amount are the same. The molar amount of 1.3.5-trimethoxybenzene and samples is calculated through their weight ratio. Based the above condition, the molar amount and relative molar content of C=C bond in the sample are calculated, as shown in Table S2.

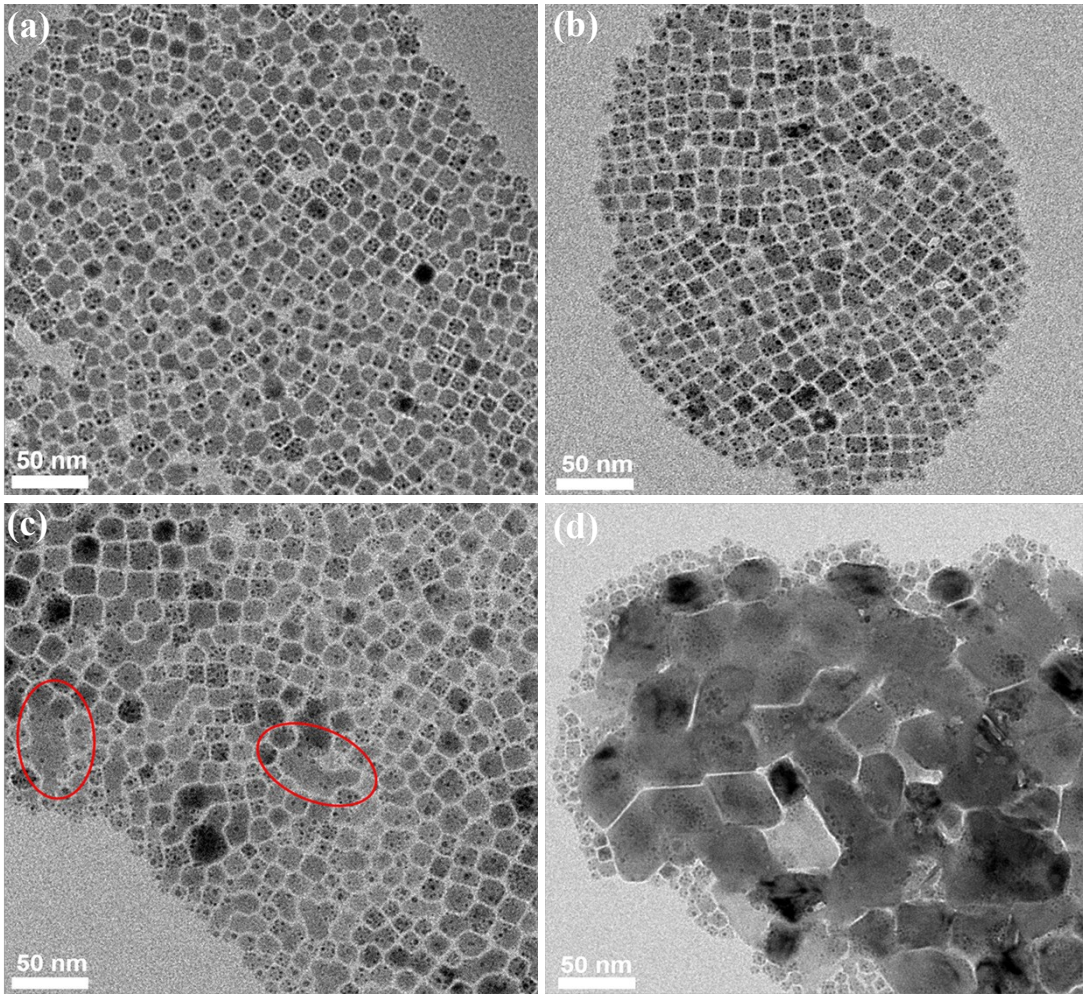

Figure S4. TEM images of CAIC QDs@Ag-2 composite after purified with various processes: (a) process Ⅰ, (b) process Ⅱ, (c) process Ⅲ, and (d) process Ⅳ.

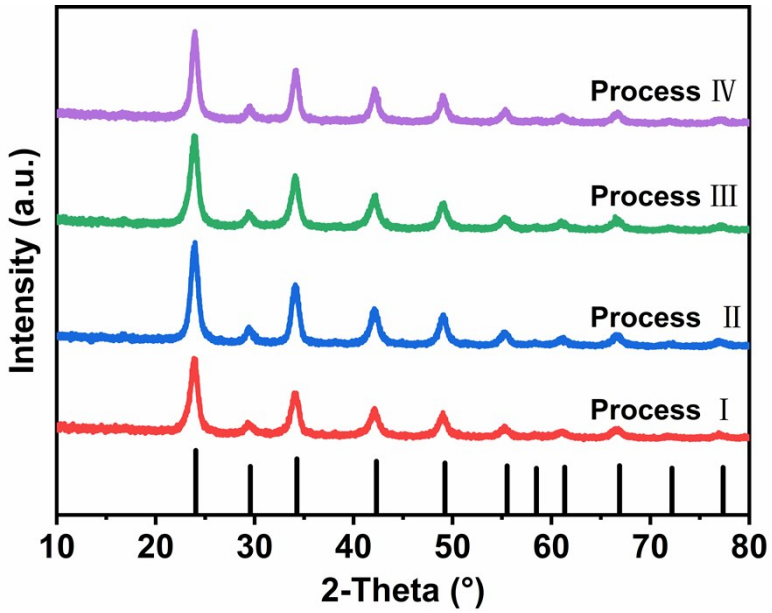

Figure S5. XRD patterns of CAIC QDs@Ag-2 composite after purified with various processes.

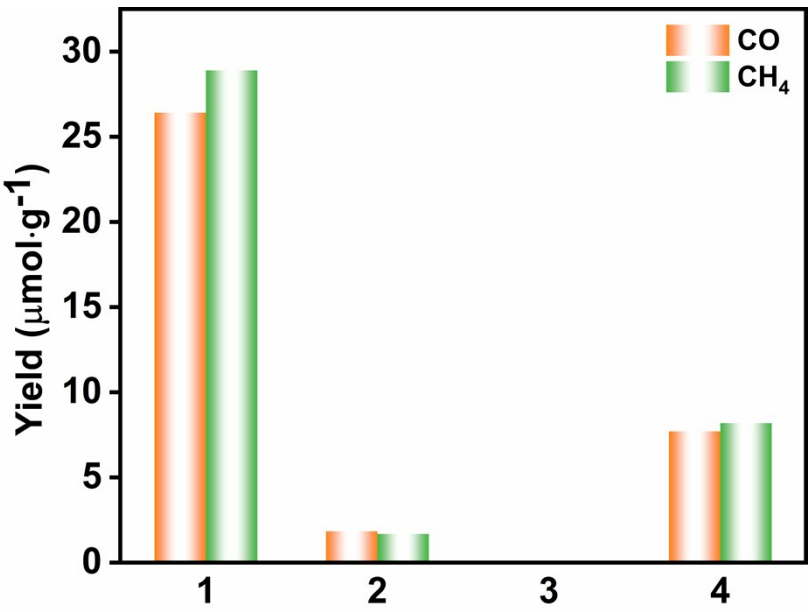

Figure S6. Photocatalytic CO_2 reduction performance under different conductions: CAIC QDs@Ag-2 composite purified with process Ⅱ is dispersed in EC under CO_2 (1) and Ar (2) atmosphere after irradiation of 3h, CAIC QDs@Ag-2 composite purified with process Ⅱ is dispersed in tert-butanol (3) under Ar atmosphere, TiO_2 is dispersed in EC under Ar atmosphere (4) after irradiation of 3h.

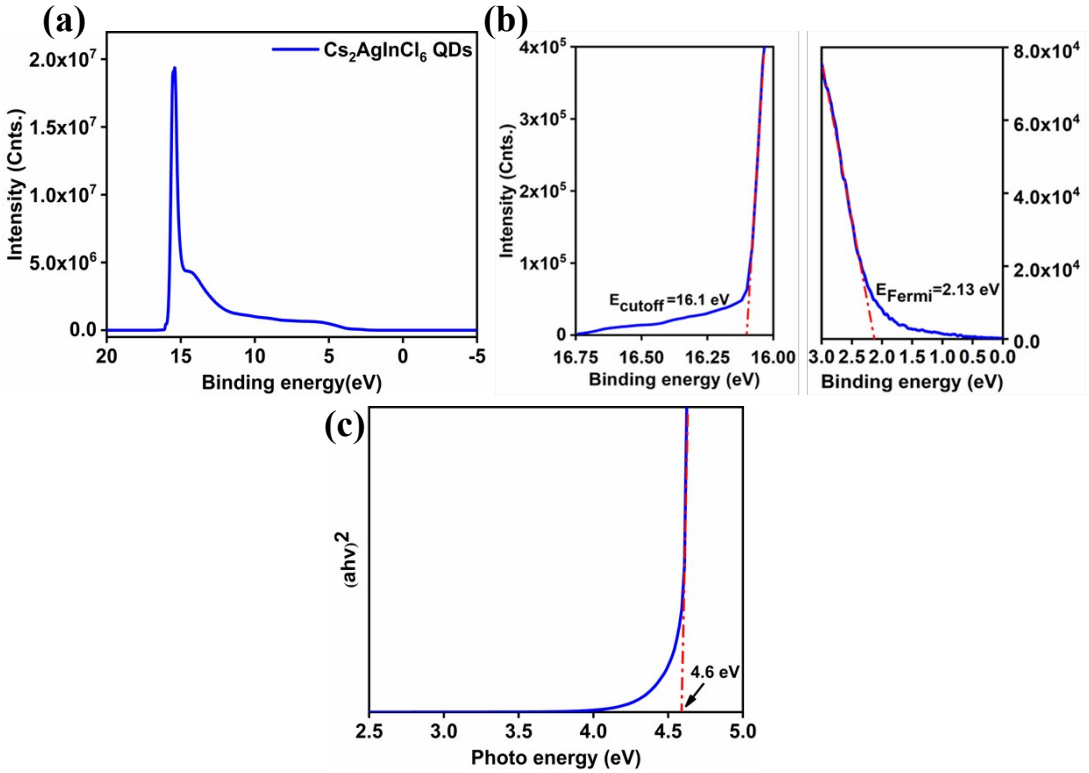

Figure S7. (a) The full scan UPS spectra, (b) Secondary electron cut-off energy (left) and low binding energy region (right), and (c) Tauc plots of CAIC QDs@Ag composite.

Table S1. Elements content (mol %) of CAIC QDs@Ag composites with various Ag loading amounts from EDS test.

Element	CAIC QDs@Ag-1	CAIC QDs@Ag-2	CAIC QDs@Ag-3
Cs	21.00	21.00	21.00
Ag	8.40	9.20	9.80
In	9.60	8.80	9.20
Cl	61.00	61.00	60.00

Table S2. Calculation results of molar amount and relative molar content of C=C bond for the CAIC QDs@Ag-2 composite purified with various processes.

Sample	1,3,5-Trimethoxybenzene (mol)	C=C bond (mol)	CAIC QDs@Ag-2 composite (mol)	Content of ligands (%)
Process Ⅰ	2.98×10^{-3}	6.25×10^{-4}	7.99×10^{-3}	7.81
Process Ⅱ	1.60×10^{-3}	4.10×10^{-4}	7.27×10^{-3}	5.64
Process Ⅲ	7.74×10^{-3}	1.51×10^{-4}	3.91×10^{-3}	3.86
Process Ⅳ	7.14×10^{-3}	1.93×10^{-4}	5.60×10^{-3}	3.45

Table S3. Fitted TRPL parameters of CAIC QDs@Ag-2 composite purified with various processes.

Sample	τ_1 (ns)	A_1 (%)	τ_2 (ns)	A_2 (%)	τ_{ave} (ns)
Process Ⅰ	1.15	78.00	7.71	22.00	2.59
Process Ⅱ	0.70	67.89	4.64	32.11	1.97
Process Ⅲ	0.99	67.12	5.33	32.88	2.42
Process Ⅳ	1.06	71.26	6.07	28.74	2.50