Supplementary Information

A MPB intensified tube microreactor system for continuous synthesis of Ag^+ doped CdS quantum dots

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Reaction conditions:

(1) Solution A: TBP dissolved in toluene (0.033 mL/L, **0.067 mol/L** or 0.134 mol/mL, 6 mL).

(2) Solution B: As-prepared Ag_2S QDs (3 mL), $Cd(NO_3)_2 \cdot 4H_2O$ methanol solution (0.1 $g \cdot mL^{-1}$, 1mL), toluene (2 mL), OA (0.2 mL) and OAm (0.1 mL).

(3) Flow rate of Solution A (Q_A) and Solution B (Q_B): **0.2 mL/min**, 0.4 mL/min, 0.7 mL/min, 1.0 mL/min, 2.0 mL/min, or 2.5 mL/min.

(4) Internal particle size of MPB: 1.2 mm, **2.0 mm**, 2.5 mm or 3.0 mm.

(5) Length of MPB: 13 cm or **18 cm**.

(6) Reaction temperature: 40 °C, 50 °C, 60 °C or **70 °C**.

Figure. S1
The structural photo of the 13 cm long MPB.

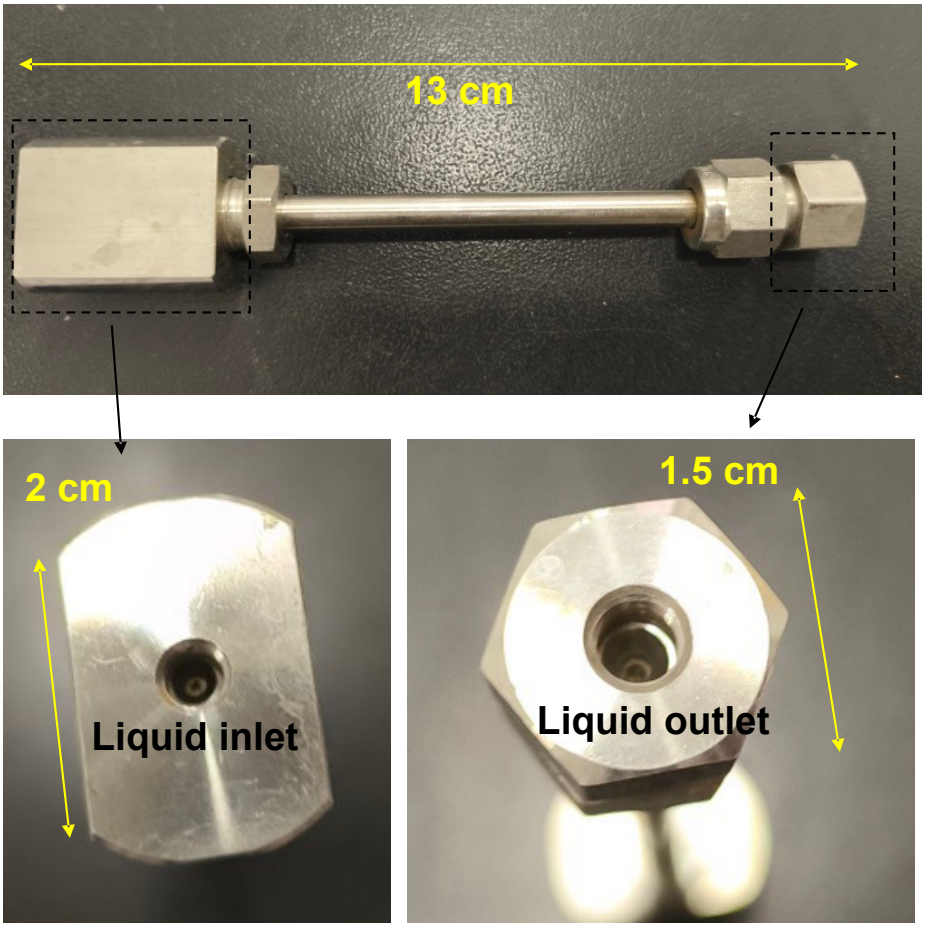
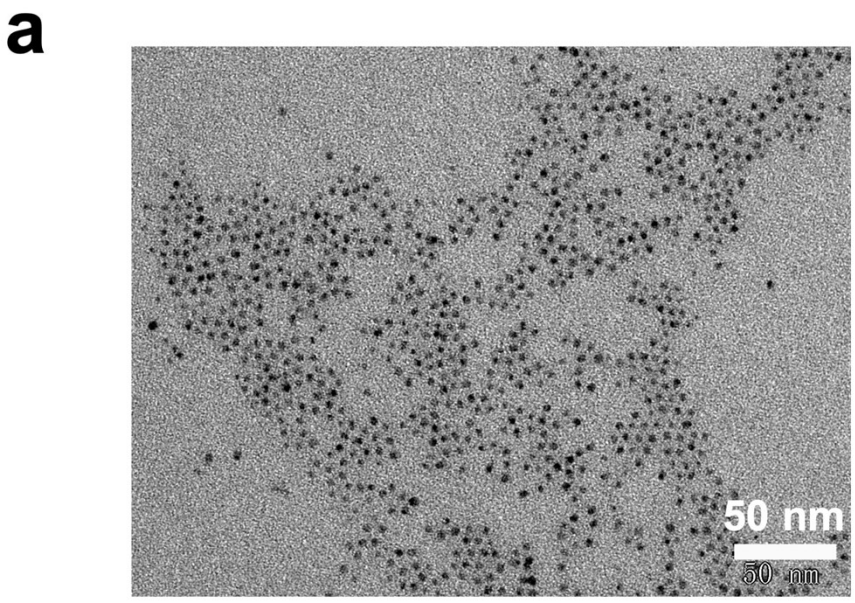


Figure. S2

(a) TEM image of CdS:Ag^{+} doped-QDs synthesized by batch flask method. (b) Particle size analysis of CdS:Ag^{+} doped-QDs synthesized by batch flask method.



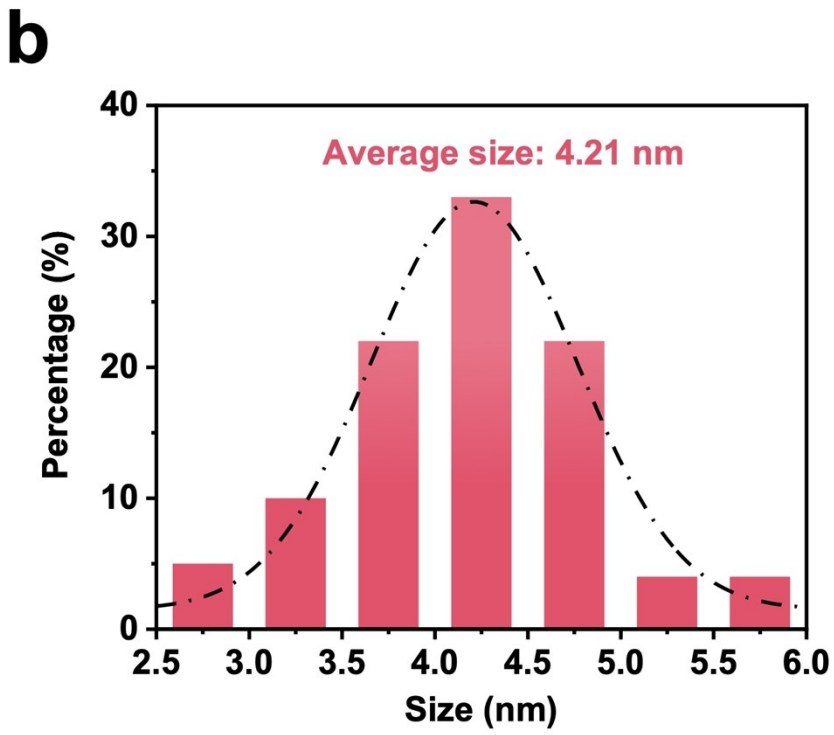


Figure. S3

HRTEM image of CdS:Ag^{+} doped-QDs synthesized by MPB system.

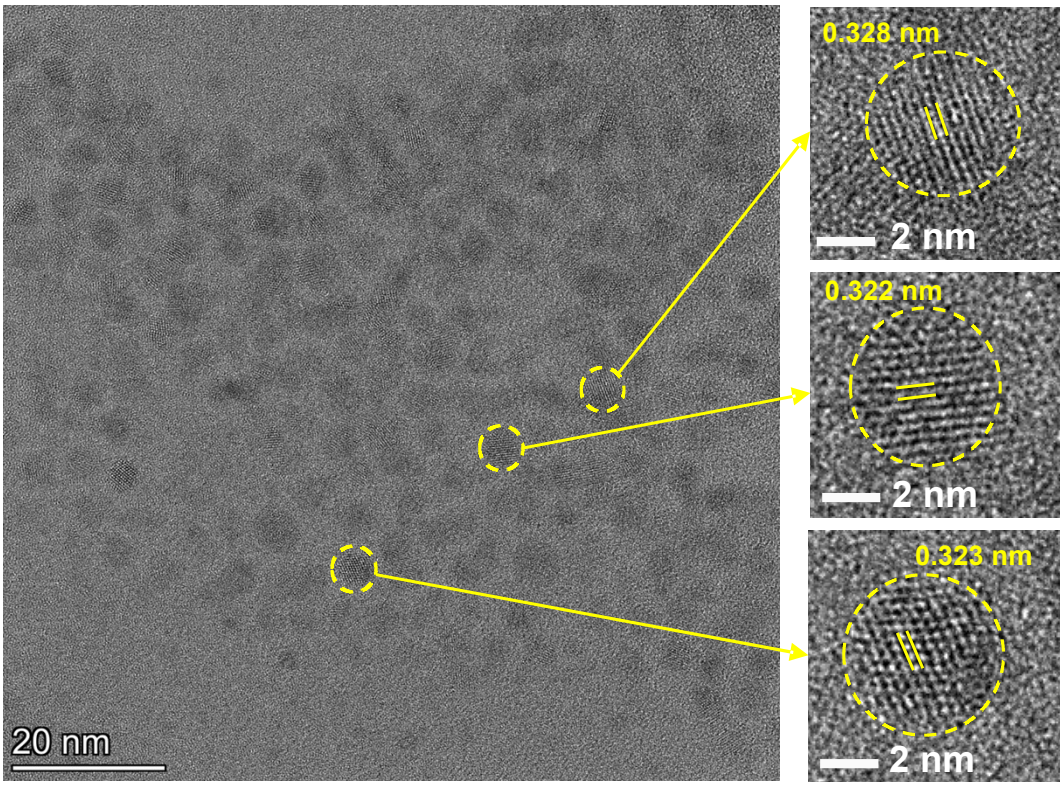


Table. S1

The EDS elemental content of CdS:Ag^{+} doped-QDs synthesized by MPB system.

Element	Family	Atomic Fraction (%)	Atomic Error (%)	Mass Fraction (%)	Mass Error (%)	Fit error (%)
S	K	58.03	34.47	28.30	12.91	36.17
Ag	L	1.06	10.18	1.74	16.70	975.80
Cd	L	40.91	22.45	69.96	27.66	26.04

Table. S2

The ICP-OES result of CdS:Ag^{+} doped-QDs synthesized by MPB system.

Element	Content (mg/L)	RSD (%)	Mass ratio (%)
Ag	19.76	1.69	3.33
Cd	578.43	2.16	96.67

Figure. S4

The XRD pattern of CdS:Ag^{+} doped-QDs synthesized by MPB and batch flask method.

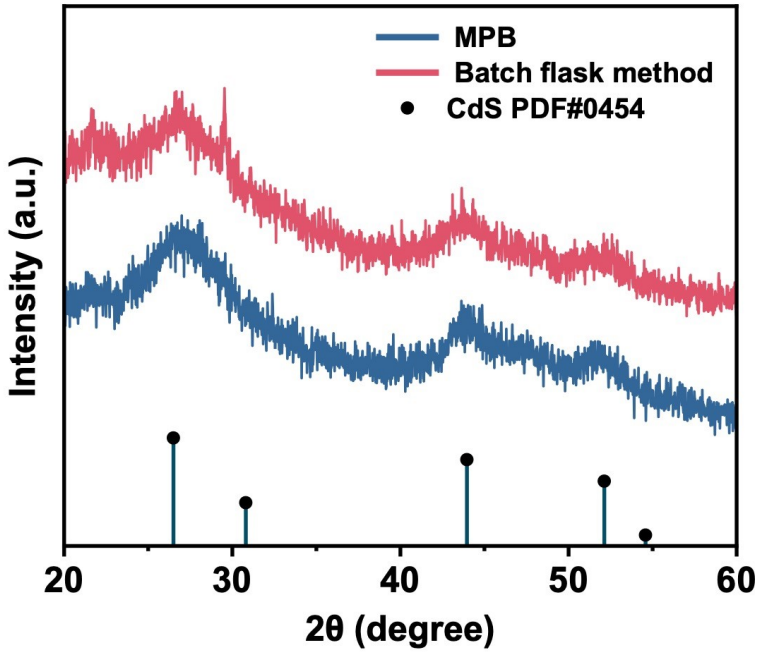


Figure. S5

XPS spectra of CdS:Ag^{+} doped-QDs prepared by MPB intensified tube microreactor and batch-flask method.

(a) XPS spectra of Ag 3d. (b) XPS spectra of Cd 3d. (c) XPS spectra of S 2p. (d) XPS survey.

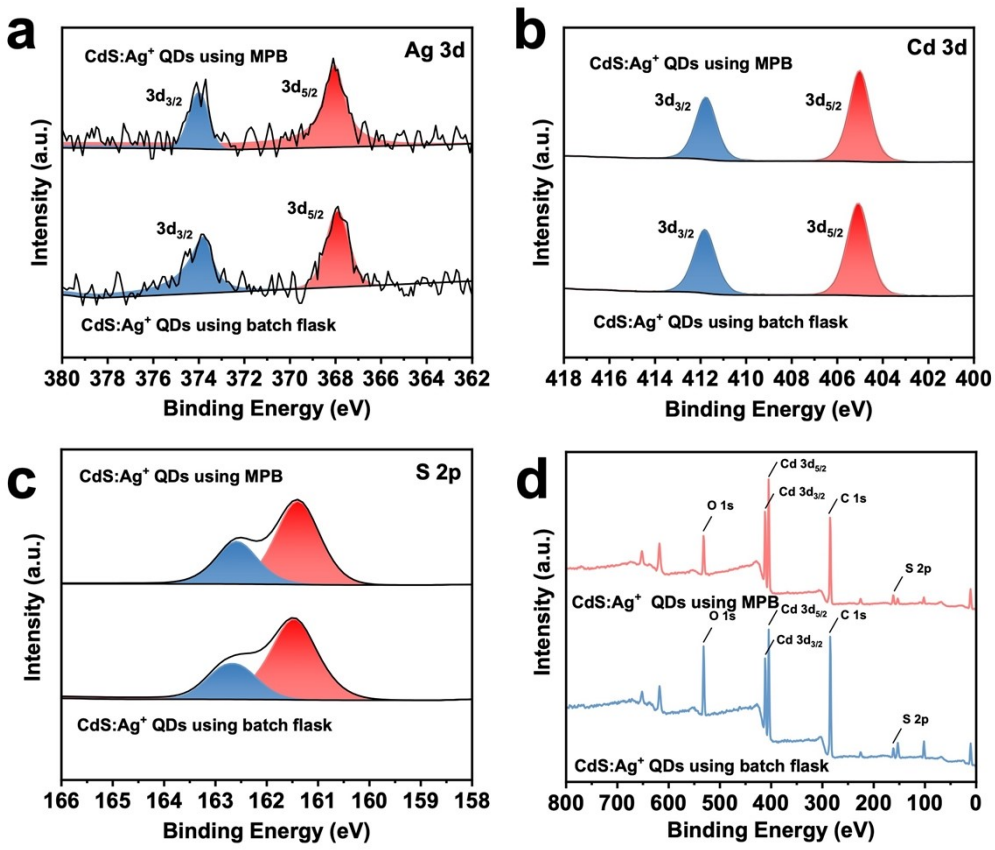


Figure. S6

(a) The fluorescence decay curve of CdS:Ag^+ doped-QDs synthesized at 0.033 mol/L TBP, 60 °C and 0.4 mL/min (Q_A=Q_B). (b) The fluorescence decay curve of CdS:Ag^+ doped-QDs synthesized at 0.134 mol/L TBP, 60 °C and 0.4 mL/min (Q_A=Q_B). (c) Excitation light on reference toluene (λ_{ex} = 365 nm) and PL spectrum of CdS:Ag^+ QDs synthesized at 0.033 mol/L TBP for PLQY measurements. (d) Excitation light on reference toluene (λ_{ex} = 365 nm) and PL spectrum of CdS:Ag^+ QDs synthesized at 0.134 mol/L TBP for PLQY measurements.

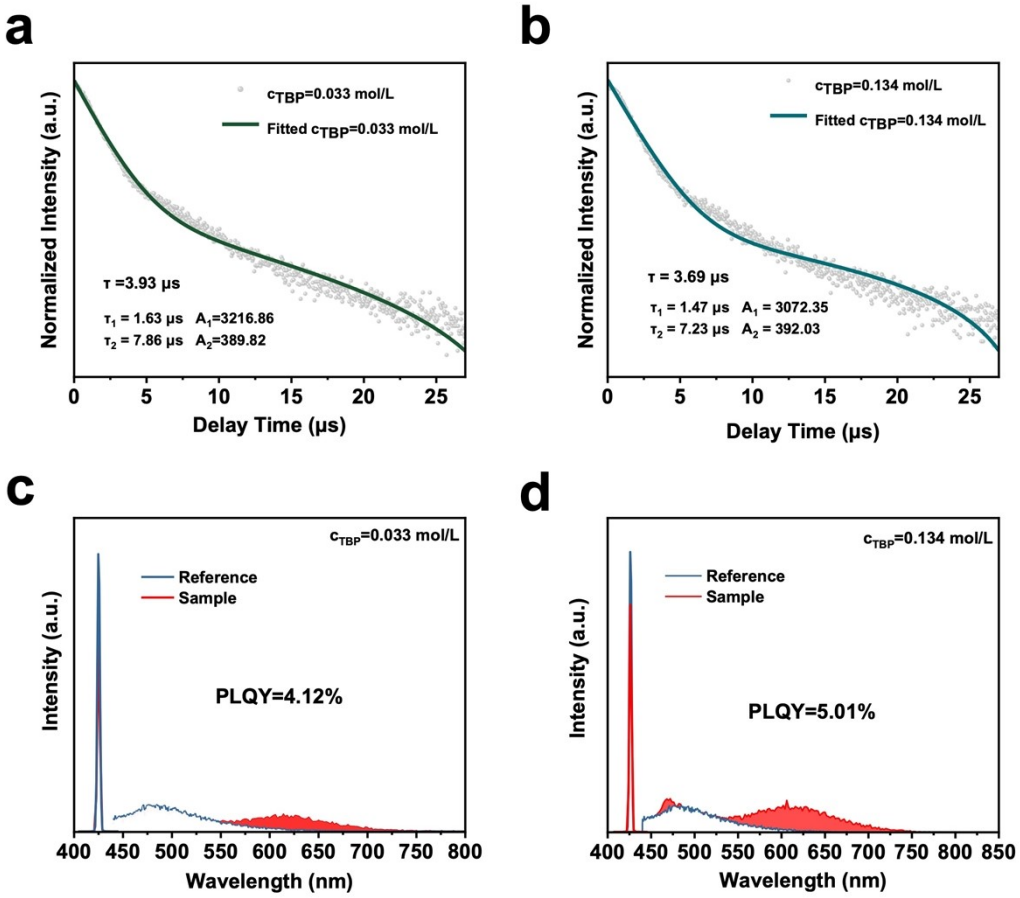


Figure. S7

Excitation light on reference toluene (λ_{ex} = 365 nm) and PL spectrum of CdS:Ag^{+} QDs synthesized at different temperature and flow velocity.

(a) Temperature is 60 °C and the flow rate is 0.2 mL/min. (b) Temperature is 70 °C and the flow rate is 0.2 mL/min. (c) Temperature is 60 °C and the flow rate is 0.3 mL/min. (d) Temperature is 70 °C and the flow rate is 0.3 mL/min. (e) Temperature is 60 °C and the flow rate is 0.4 mL/min. (f) Temperature is 70 °C and the flow rate is 0.4 mL/min.

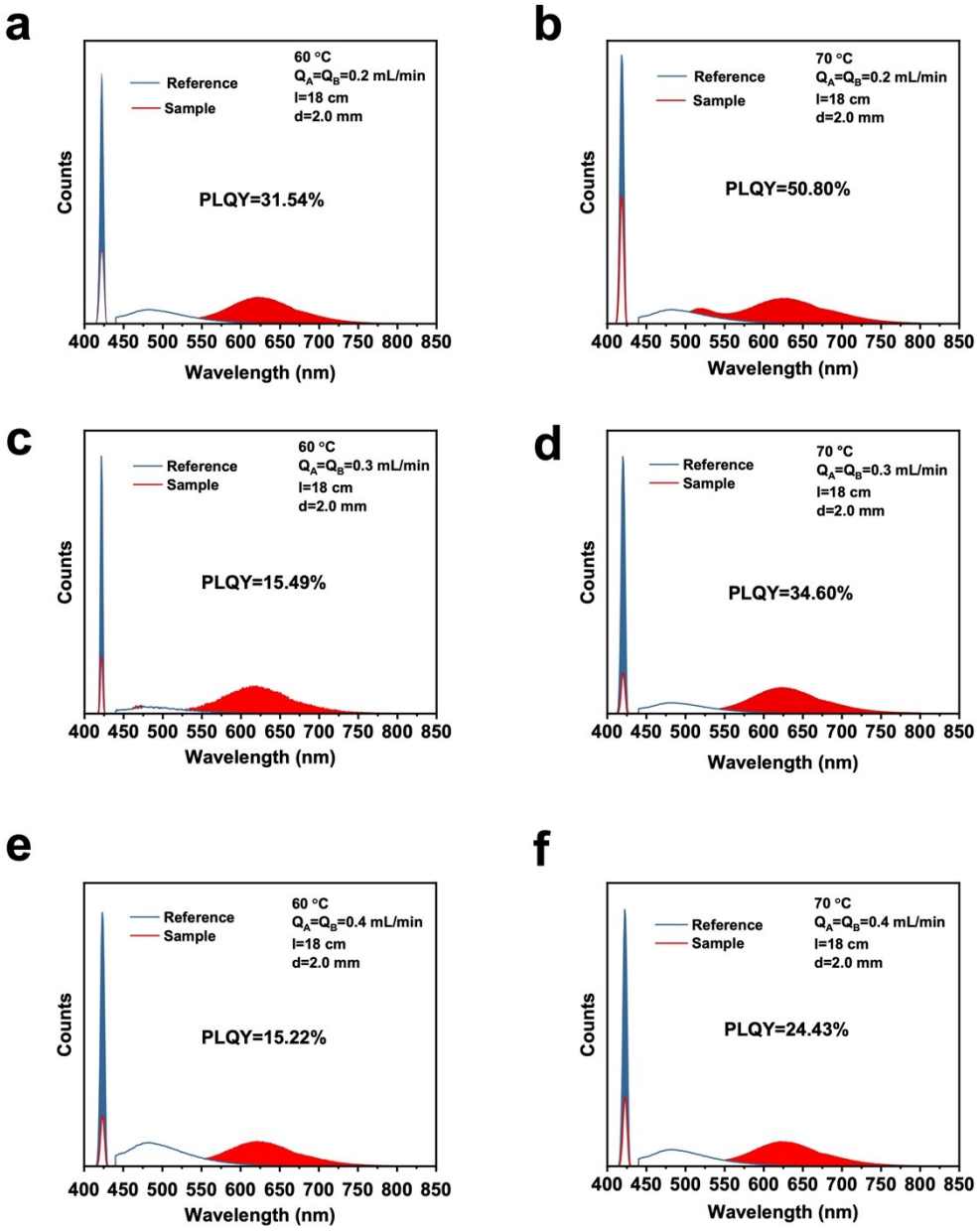


Figure S8

PL spectra of CdS:Ag^{+} doped-QDs synthesized using batch flask method, MPB and tube microreactor without MPB.