Electronic Supplementary Information

Mn^{2+}-Doped Zn-In-S Quantum Dots with Tunable Bandgaps and High Photoluminescence Properties

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Table S1. Optical Properties of typical Mn^{2+}-doped QDs in the reported works

QDs	PL QY/(%)	Peak/(nm)	Lifetime/(ms)	Band gap/(eV)	Ref.
Mn:ZnS	> 50	590	1.71	~3.7	1
Mn:ZnS	> 50	585	0.37	~3.7	2
Mn:CdS	not mentioned	580-620, tunable	not mentioned	~2.7	3
Mn:ZnSe	35	590	0.38	~2.7	4
Mn:ZnSSe	~60	~595	not mentioned	~2.9	5
MnS/ZnS/CdS	68	580	0.68	2.6-3.1, tunable	6
Mn:ZnCdS	30	580	not mentioned	2.7-3.9, tunable	7
Mn:CuInZnS	45	600	2.12	~2.7	8
Mn:CdInS	17	630	1.1	2.8-3.7, tunable	9
Mn:CdZnSe	~25	580	~0.6	~3.1	10
Mn:CuInS/ZnS	66	610	3.78	~2.7	11
Mn:Zn-In-S	**56**	**600**	**4.2**	**2.88-3.68, tunable**	**The present work**

Table S2. Fitting parameters of PL dynamics of Mn^{2+} doped Zn-In-S QDs with different Zn precursor injection times

Zn precursor injection times	A_1	τ_1/(ms)	A_2	τ_2/(ms)	τ_{ave}/(ms)	PL QY(%)
0	0.57	0.08	0.41	0.31	0.25	5
1	0.82	0.52	0.17	2.44	1.45	21
2	0.77	0.65	0.23	3.82	2.66	45
3	0.52	0.72	0.44	4.89	4.27	56

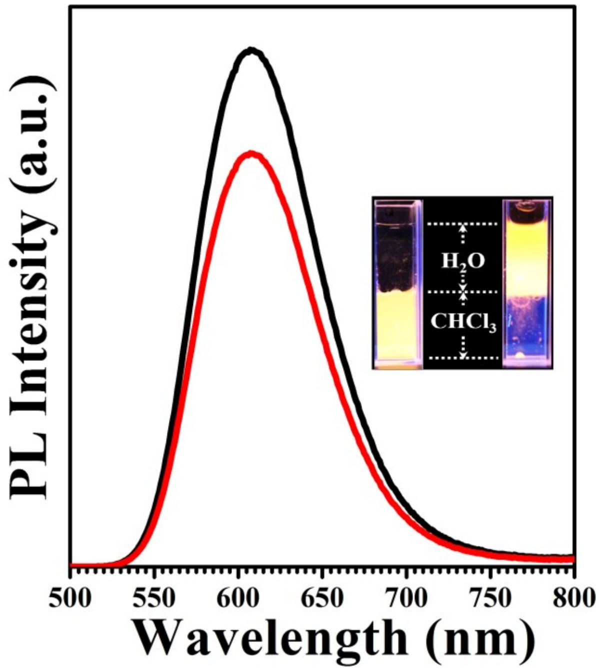

Figure S1. Typical PL spectra of Mn^{2+} doped Zn-In-S QDs before (black line, $CHCl_3$ dispersions) and after (red line, aqueous dispersions) ligand exchange. The inset shows the digital photographs of the Mn^{2+} doped Zn-In-S QDs dissolved in $CHCl_3$ (left) and water (right) excited at 365 nm.

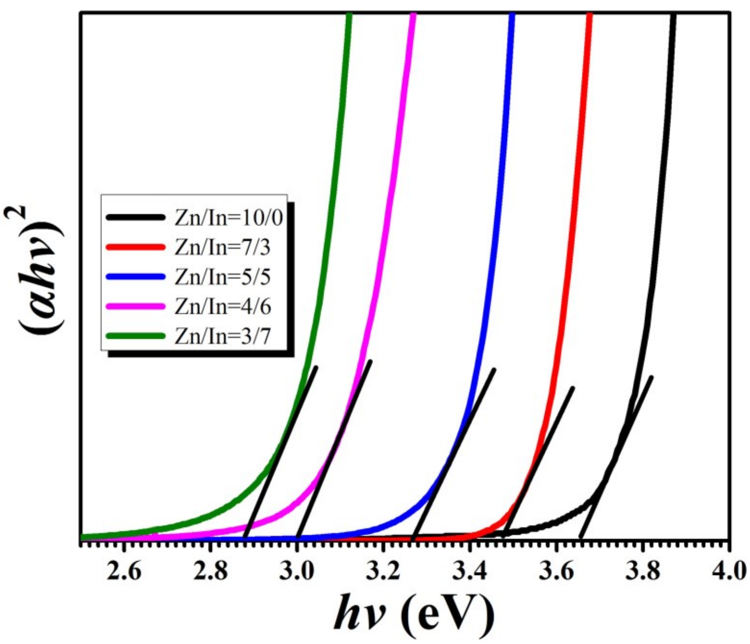

Figure S2. The linear extrapolation of $(\alpha hv)^2$ *vs* photon energy of Mn^{2+} doped Zn-In-S QDs under different nominal Zn/In precursor ratios.

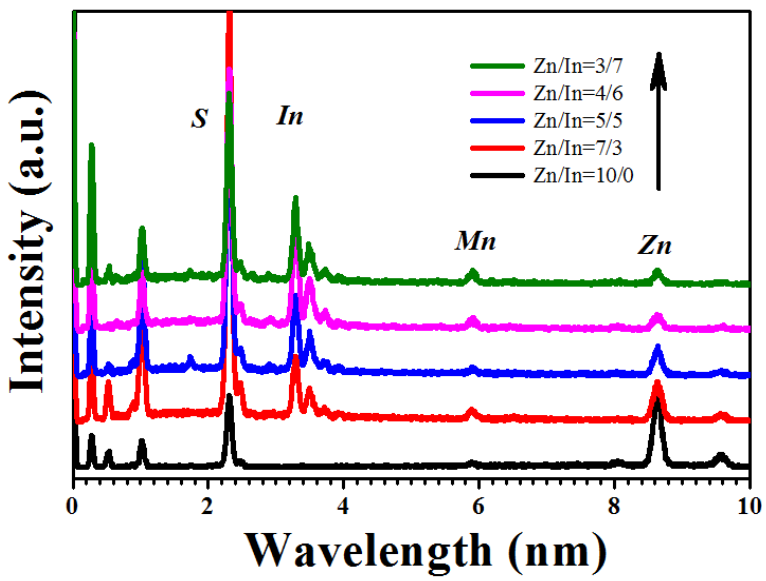

Figure S3. Typical EDX spectra of Mn^{2+} doped Zn-In-S QDs under different nominal Zn/In precursor ratios

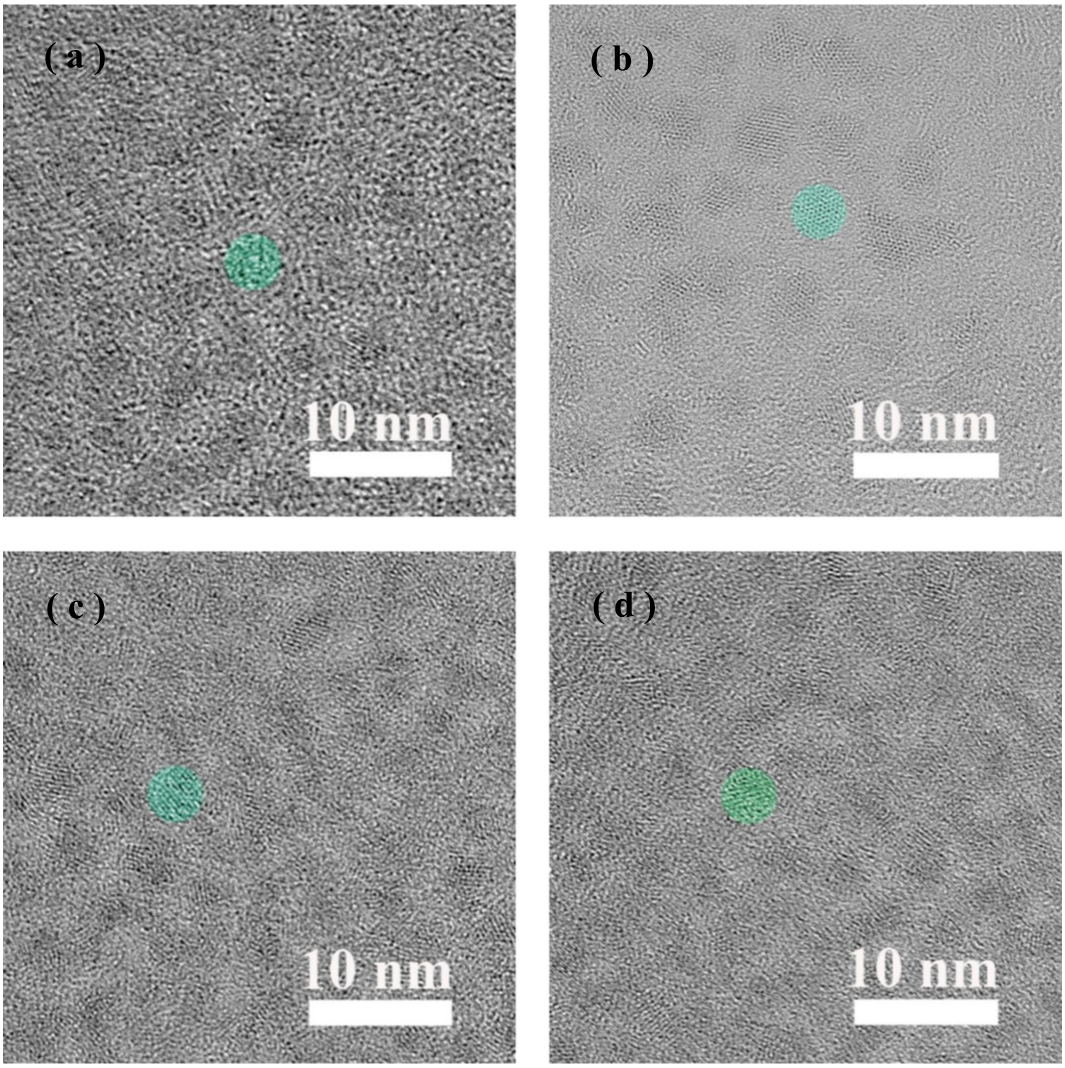

Figure S4. Typical TEM images of the Mn doped Zn-In-S QDs with nominal Zn/In precursor molar ratios of 7/3 (a,), 5/5 (b,), 4/6 (c,), and 3/7(d), indicating that the particle sizes are almost kept a constant regardless of various Zn/In precursor ratios introduced.

Table S3. Chemical Compositions of Mn^{2+} doped Zn-In-S QDs under different nominal Zn/In precursor ratios

Nominal Zn/In Ratios for Mn:ZnInS cores	Nominal Zn/In Ratios for Mn^{2+}-doped QDs	Real Zn/In Ratios	S /atom.%	Zn /atom.%	In /atom.%	Mn /atom.%	Mn^{2+} doping Concentration/ %
10/0	10/0		60.84	37.55	0	1.61	4.1
7/3	88/12=7.3	3.5	60.81	28.86	8.21	2.12	5.4
5/5	80/20=4	1.25	57.26	22.55	17.95	2.24	5.2
4/6	76/24=3.2	0.89	54.03	20.4	22.83	2.74	5.9
3/7	72/28=2.6	0.68	58.91	14.20	22.97	2.92	7.1

Table S4. Chemical Compositions of Mn^{2+} doped Zn-In-S QDs under different nominal Mn^{2+} doping concentrations.

Nominal Mn^{2+} Doping Concentration / %	S /atom.%	Zn /atom.%	In /atom.%	Mn /atom.%	Real Mn^{2+} doping Concentration / %
1.5	75.23	19.31	4.72	0.74	3.1
3	83.97	11.24	4	0.79	5.2
4.5	77.05	15.25	6.48	1.22	5.6
6.5	74.03	18.32	6.12	1.53	6.3
7.5	80.92	12.34	5.32	1.42	8.1
9	70.55	19.62	7.32	2.51	9.3

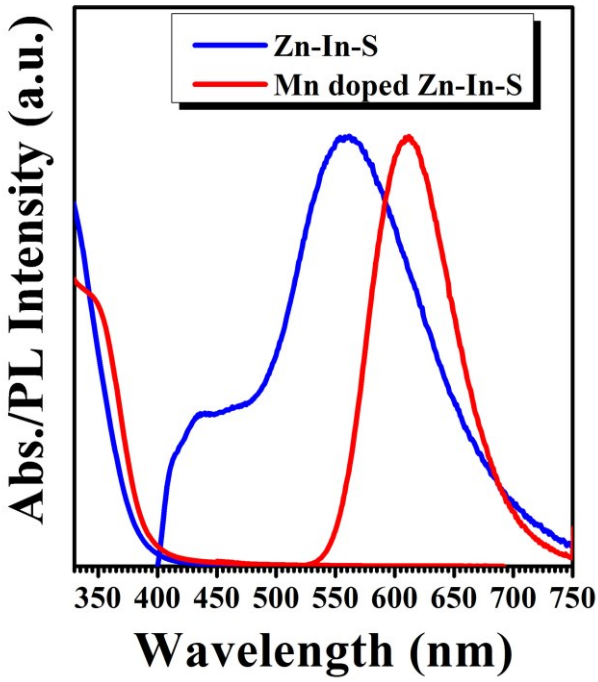

Figure S5. Typical absorption and PL spectra of Mn^{2+}-doped Zn-In-S (red lines) and undoped Zn-In-S QDs (blue lines).

References

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