Supporting Information

Growth of InZnP/ZnS Core/Shell Quantum Dots with Wide-range and Refined Tunable Photoluminescence Wavelength

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S1 Experiments section

S1.1 Materials.

Indium(III) chloride (99.99%), zinc(II) chloride (99.99%), zinc(II) acetate ($Zn(OAc)_2$, 99.99%), Dodecylamine (DDA, 98%), Oleylamine (OA, 85%), 1-octadecene(ODE, 95%), 1-Dodecanethiol (1-DDT, 98%), Tris(dimethylamino)phosphine ($(DMA)_3P$, 97%) were purchased from Aladdin. All the chemicals were used without further purification.

S1.2 Synthesis of InP /ZnS or InZnP/ZnS Core/shell QDs.

S1.2.1 Synthesis of InP Core QDs.

In a typical synthesis, 0.08847 g of $InCl_3$ (0.4mmol), 108 μl of $(DMA)_3P$, 3 ml of OA and 8 ml of Toluene were mixed in a teflon-lined autoclave with a capacity of 25 ml in a glove box filled with argon. The sealed autoclave was removed from the glove box and put into a vacuum drying oven of 180 °C, and the QDs were allowed to grow for 24 h. The crude solution was directly used for the growth of ZnS shell.

S1.2.2 Synthesis of InZnP Core QDs.

The same method as S1.1 but more 0.4 mmol of zinc chloride is added to the teflon-lined autoclave.

S1.2.3 Synthesis of InP /ZnS or InZnP/ZnS Core/shell QDs.

After autoclave cooling to room temperature, 0.272 g of $ZnCl_2$ (2 mmol), 0.96 ml of n-DDT (4 mmol), 2 ml of Toluene, 1 ml of OA was add to the InP or InZnP crude solution in teflon-lined autoclave in a glove box filled with argon. The sealed autoclave was removed from the glove box and put into a vacuum drying oven of 180 °C, and the QDs were allowed to grow for 24 h. After cooling to room temperature, The by-products was collected by centrifugation and discarded. InP/ZnS or InZnP/ZnS QDs are then precipitated and purified in ethanol and dispersed in Toluene, finally stored in a glovebox filled with argon.

S1.3 Synthesis of InZnP/ZnS Core/shell QDs with different Zn/In ratio in the growth of the InZnP core QDs.

Similar to the S1.2, 0.0442 g of $InCl_3$, 152 μl of $(DMA)_3P$, 2 ml of OA, 1 ml TOP and 5 ml of Toluene were mixed in core growth, in ZnS shell coating process, 0.1363 g of $ZnCl_2$, 0.48 ml of n-DDT, 1 ml of Toluene were add to the InP or InZnP crude solution.

S1.4 Synthesis of InP /ZnS or InZnP/ZnS Core/shell QDs with different P/In ratio.

Similar to the S1.2, but the P/In ratio is 0.5 - 3 mmol with the dosage of $InCl_3$ is 0.4 mmol.

S1.5 Synthesis of InP /ZnS Core/shell QDs with different Zn/In ratio in shell coating porcess.

Similar to the S1.3, but the Zn/In ratio is 0.5 – 6 mmol with the dosage of $InCl_3$ is 0.4 mmol.

S1.6 Synthesis of InZnP/ZnS Core/shell QDs using ODE and DDA as solvents.

Similar to the S1.2, but in all steps, OA and toluene are replaced by DDA and ODE, respectively. Zinc acetate was used as the Zn precursor. During the size-sorted process, the QDs with different PL emission wavelengths can be obtained by continuously adding ethanol and centrifugation.

S2 XRD patterns and peak positions of InP, InZnP, InP/ZnS and InZnP/ZnS QDs

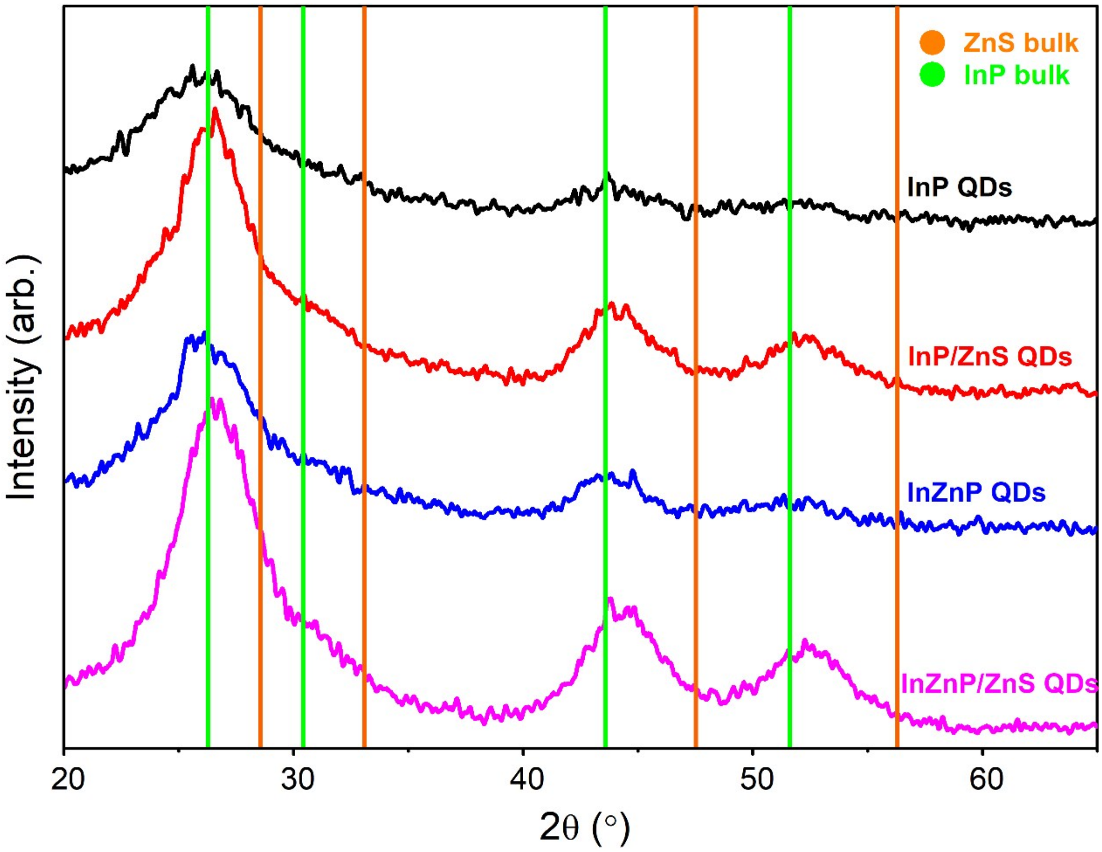

Fig. S2 XRD patterns of InP, InZnP, InP/ZnS and InZnP/ZnS QDs. The corresponding bulk reflections of zinc blende InP (green, PDF#32-0452) and inc blende ZnS (orange, PDF#05-0566) are compared with InP-based QDs.

Table S2. Peak positions of InP , ZnS bulk and InP-based QDs

	Peak Position (°)			
	1	2	3	4
InP Bulk	26.28	30.43	43.6	51.62
ZnS Bulk	28.56	33.09	47.52	56.29
InP QDs	26.23		43.64	51.78
InZnP QDs	26.57		43.89	51.98
InP/ZnS QDs	26.58		44.08	52.13
InZnP/ZnS QDs	26.9		44.14	52.27

S3 Extended data for Zn addiction by varying P/In precursors ratio.

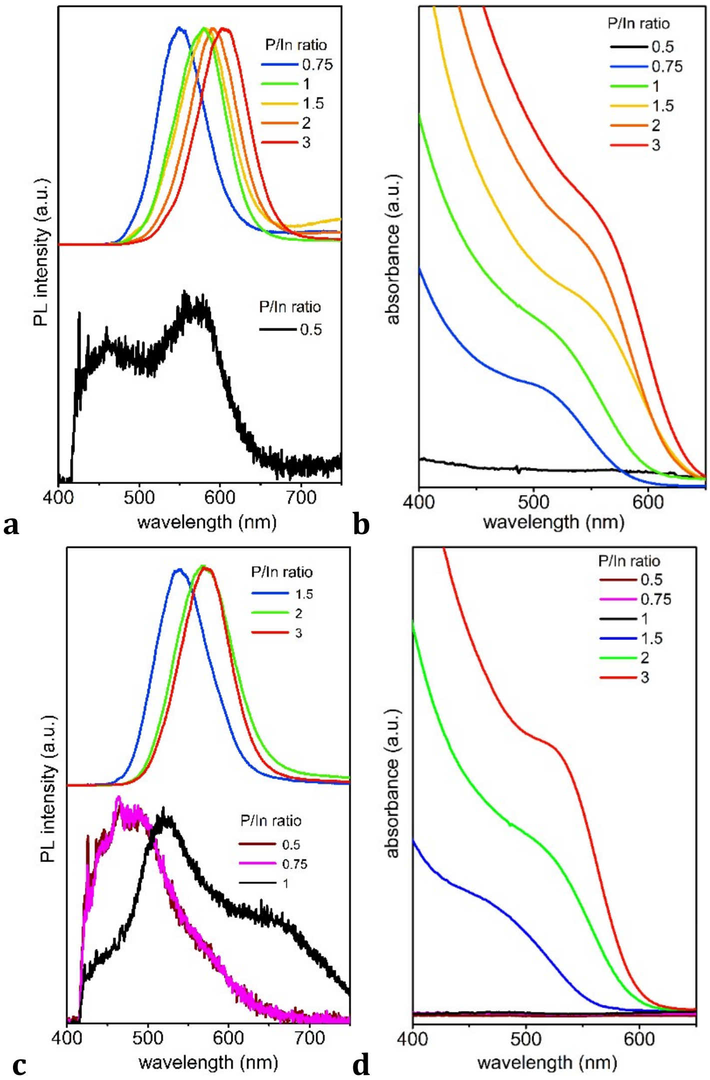

Fig. S3 PL (a) and absorption spectrums (b) of InP/ZnS QDs without Zn precursor addiction, the PL wavelengths range from 549 nm to 602 nm. When the P/In ratio is 0.5, the InP/ZnS QDs can't be synthesized. PL (c) and absorption (d) spectrums of InZnP/ZnS QDs without Zn precursor addiction, the PL wavelengths range from 539 nm to 573 nm. When the P/In ratio is below 1, the InZnP/ZnS QDs can't be synthesized.

S4 Absorption and emission spectra of InZnP/ZnS QDs with high PLQY

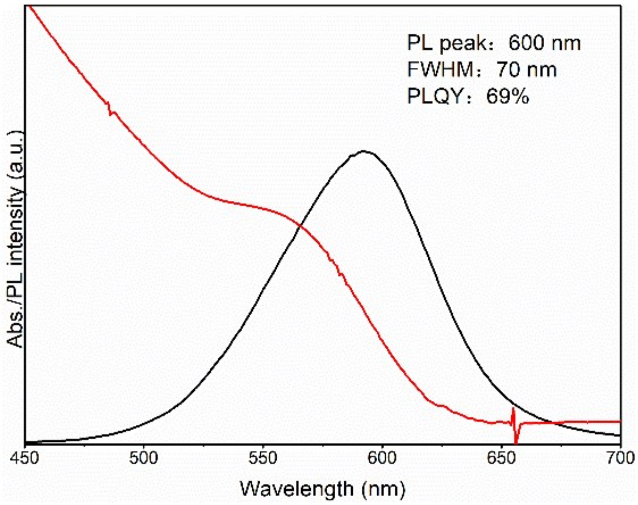

Fig. S4 Absorption (red lines) and PL spectra (black line) of InZnP/ZnS QDs with high PLQY.

S5 Performances of the InZnP/ZnS QDs

QDs	In, Zn precursors	P precursors	S precursors	PL peak (nm)	PL FWHM (nm)	PLQY (%)	Reference
InZnP/ZnS	$InCl_3$, $ZnCl_2$	$(DMA)_3P$	t-DDT	600	75	69	This work
			n-DDT	580	65	57	
		$(DEA)_3P$	t-DDT	585	67	67	
			n-DDT	561	63	64	
		$(DMA)_3P/2 + (DEA)_3P/2$	t-DDT	595	74	57	
			n-DDT	571	68	50	
	$InBr_3$, $ZnBr_2$	$(DMA)_3P$	t-DDT	533	70	35	
			n-DDT	524	64	33	
		$(DEA)_3P$	t-DDT	528	71	37	
			n-DDT	519	61	33	
	InI_3, ZnI_2	$(DMA)_3P$	t-DDT	512	63	-	
			n-DDT	498	70	-	
		$(DEA)_3P$	t-DDT	503	68	-	
			n-DDT	484	75	-	
InZnP/InGaP/GaP/ZnSeS	$In(OAc)_3$, $Zn(OAc)_2$	$(TMS)_3P$	TOP-S*	565	52	75	Ref. 1[1]
InP/ZnSe/ZnS	$In(OAc)_3$, zinc stearate	$(TMS)_3P$	TOP-S	607	48	73	Ref. 3[2]
InP/GaP/ZnS	$In(OAc)_3$, $Zn(OAc)_2$	$(TMS)_3P$	DDT	red	60	65	Ref. 4[3]
InP/ZnSe/ZnS	$In(OAc)_3$, $Zn(OAc)_2$	$(TMS)_3P$	TOP-S	630	35	100	Ref. 5[4]
InP/ZnSe/ZnS	$In(OAc)_3$, $Zn(OAc)_2$	$(TMS)_3P$	TOP-S	528	36	95	Ref. 6[5]

*: Top-S: Sulfur powder dissolve in trioctylphosphine.

Reference

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