Supplementary Information

Self-powered, ultrabroad band photodetector with large open circuit voltage using colloidal PbSe QDs

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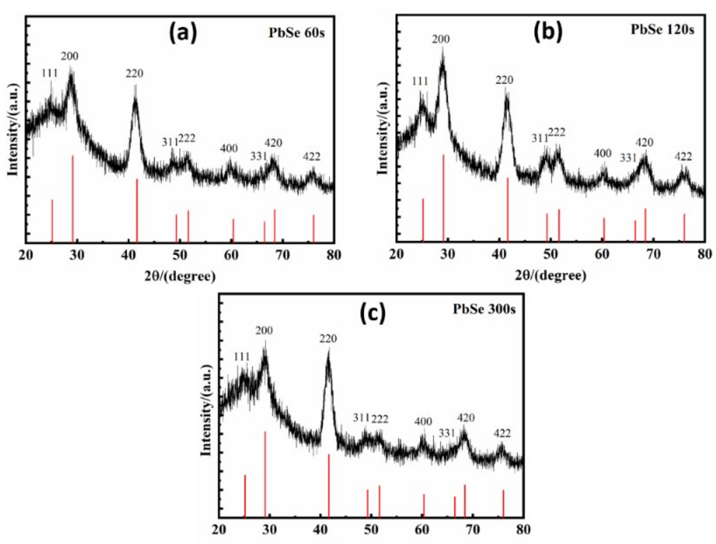


+ Contributed equally

Figure S1. The X-ray diffraction pattern of colloidal PbSe QDs synthesized for (a) 60 s; (b) 120 s; (c) 300 s.

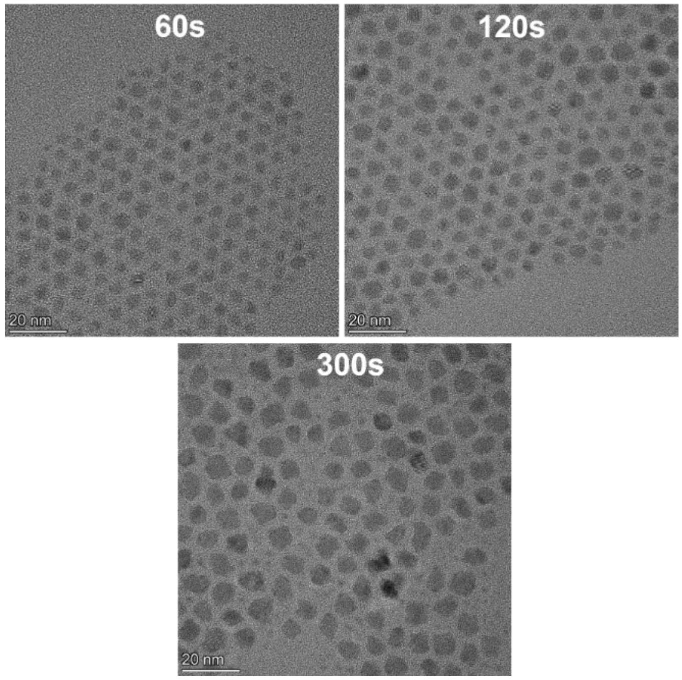
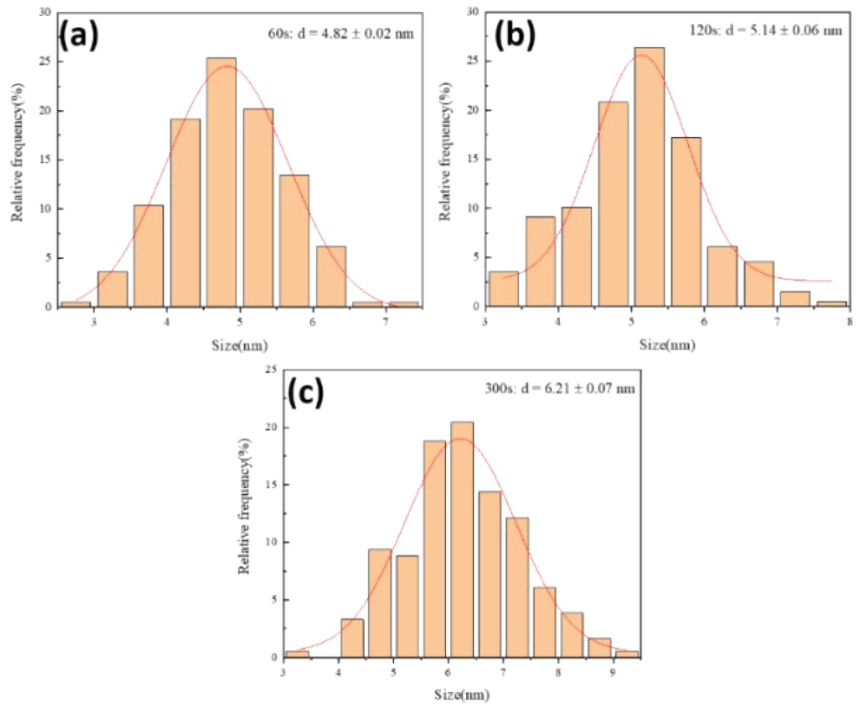


Figure S2. TEM pattern of PbSe colloidal QDs. The growth time of QD is (a) 60 s; (b) 120 s; (c) 300



s.

Figure S3. Statistical graph of particle size distribution of PbSe colloidal QDs. The growth time of QD is (a) 60 s; (b) 120 s; (c) 300 s.

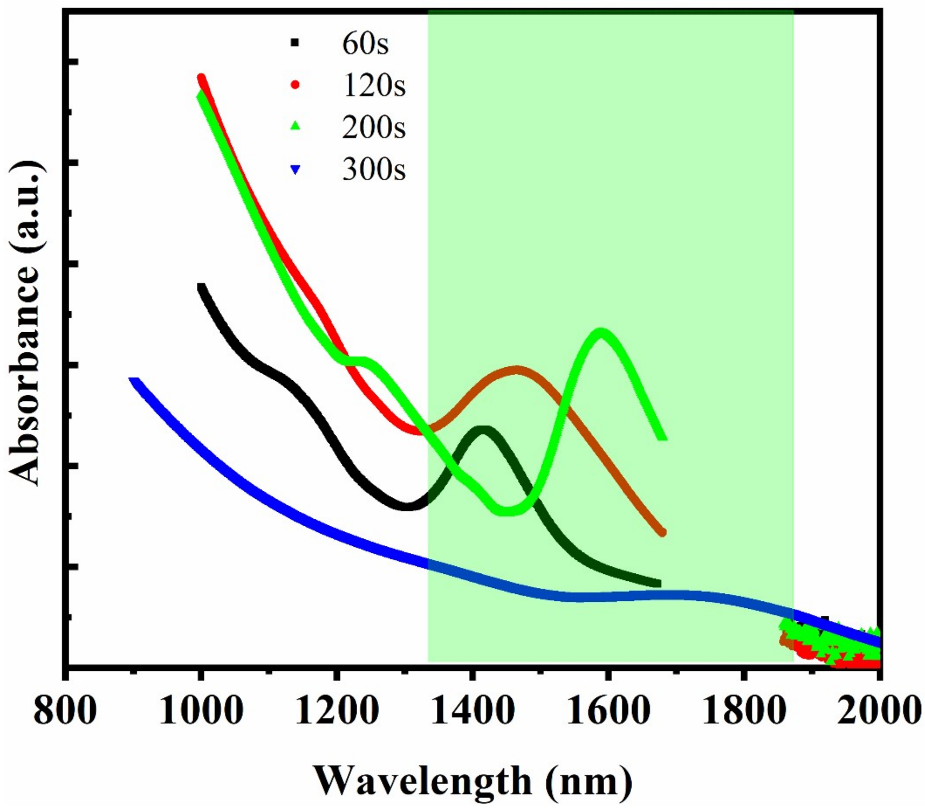


Figure S4. The absorption spectra of PbSe QDs synthesized for different growth time.

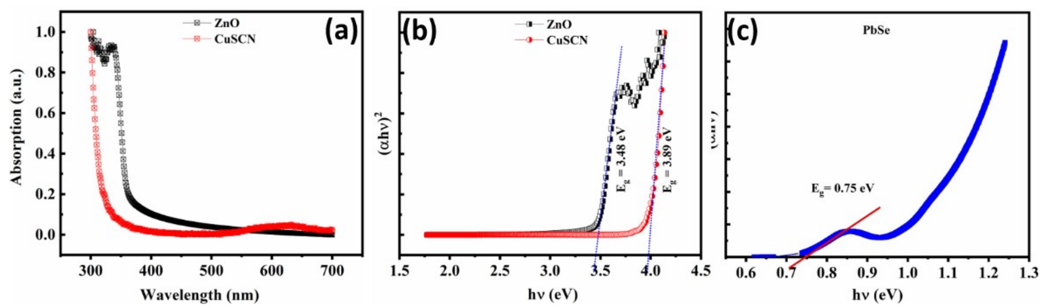


Figure S5. (a) The absorption spectra of ZnO and CuSCN layers; (b) corresponding Tauc plot; (a) Tauc plot of PbSe QDs synthesized for 200 s.

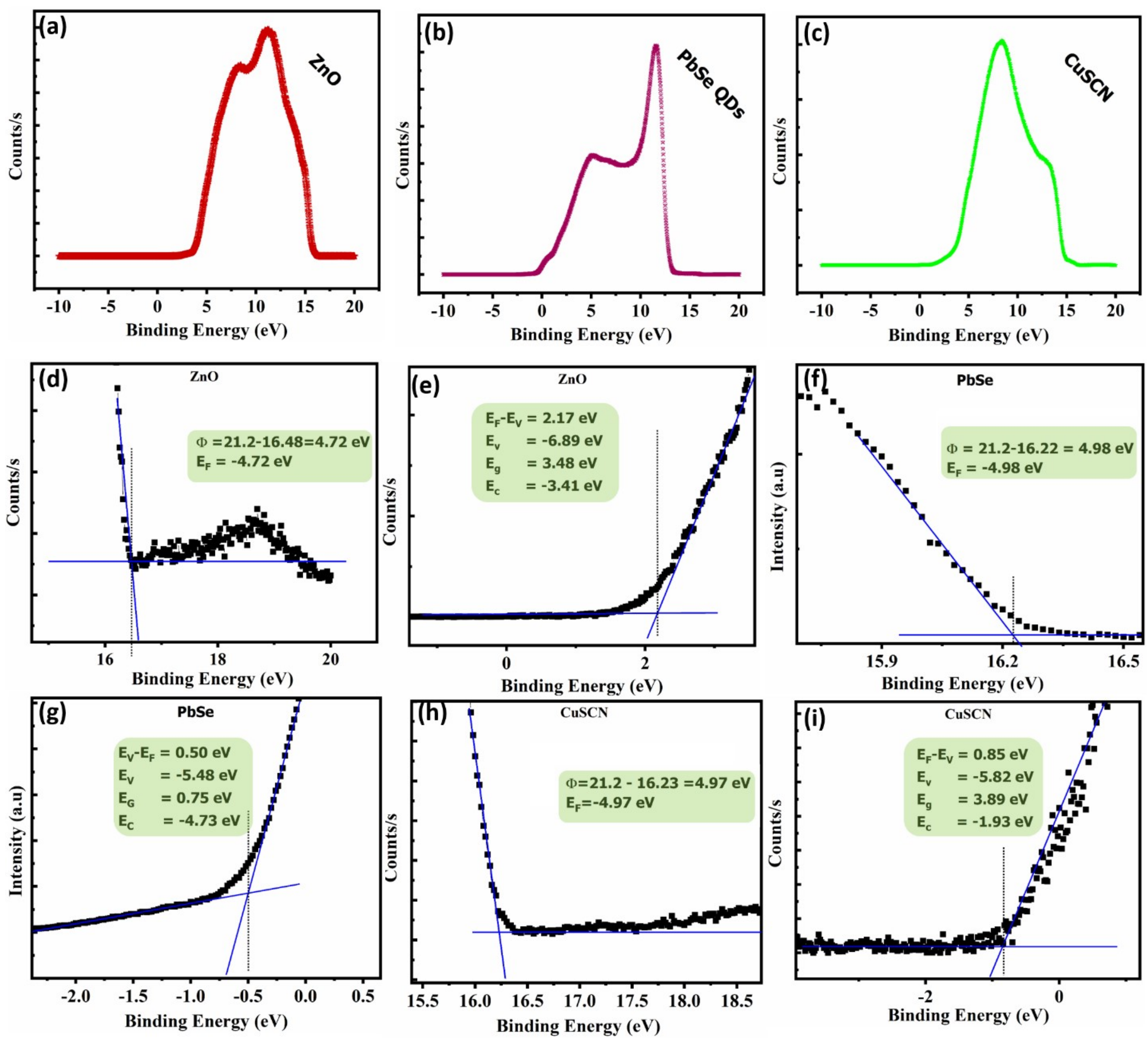


Figure S6. The ultraviolet photoelectron spectroscopy (UPS) study of functional layers. Full scan of (a) ZnO; (b) PbSe; (c) CUSCN; (d,f,h) High energy cutoff for (d) ZnO; (f) PbSe; (h) CuSCN; Low energy cutoff for (e) ZnO; (g) PbSe; (i) CuSCN.

Table S1. The Ideality factor at different wavelength

Wavelength	*n_{ID} (Ideality factor)*
405	*1.5*
650	*0.65*
780	*3.86*
850	*0.61*
980	*1.81*
1550	*1.89*

Calculation of Photoresponsivity

The photoresponsivity (*Rph*), which is a measure of the electrical output per optical input of a photodetector and is described as the change in current in the photodetector device after the illumination of photons of various power levels, is defined as

$$R = \frac{I_{Ph} - I_d}{P}$$ **--Equation 1**

where I_{ph} *and* I_d in Ampere is the photocurrent and dark current respectively. *P* in Watt is the total illumination power on the device active area. In our case, the active area of device the overlapping area of bottom electrode and top electrode *i.e.* 2 mm × 1 mm.

Calculation of Specific detectivity

Specific detectivity, which is one of the Figures of merits of a photodetector used to characterize the performance of the photodetector, determines the minimum illumination light power that can be used to permit a detector to distinguish from noise, and it can be defined as

$$D^* = R\sqrt{\frac{A}{2qI_d}}$$ ---**Equation 2**