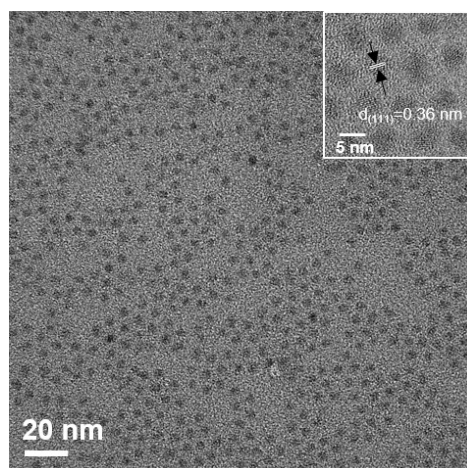
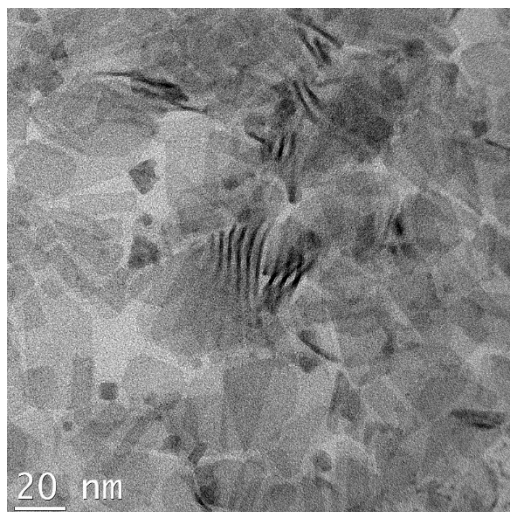


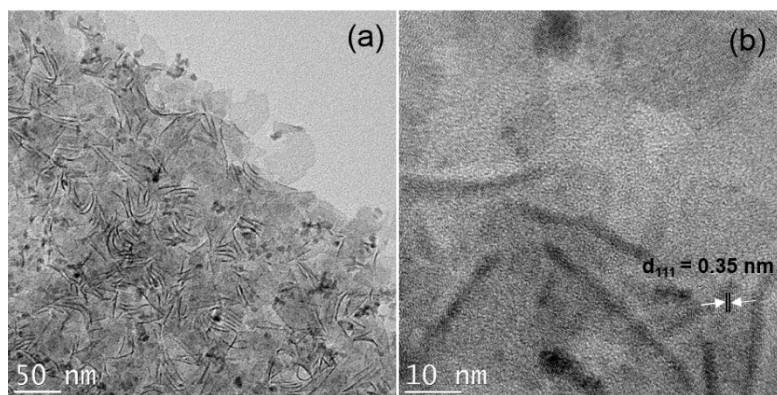
### Supporting figures and tables



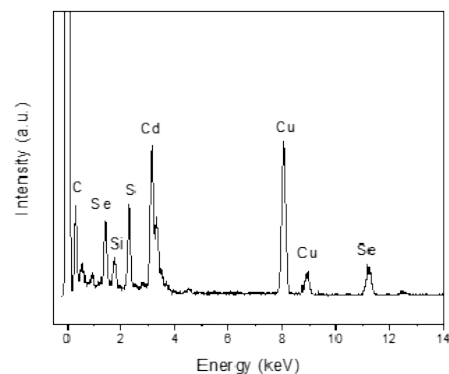
**Figure S1** TEM and HRTEM (inset) images of CdSe QDs.



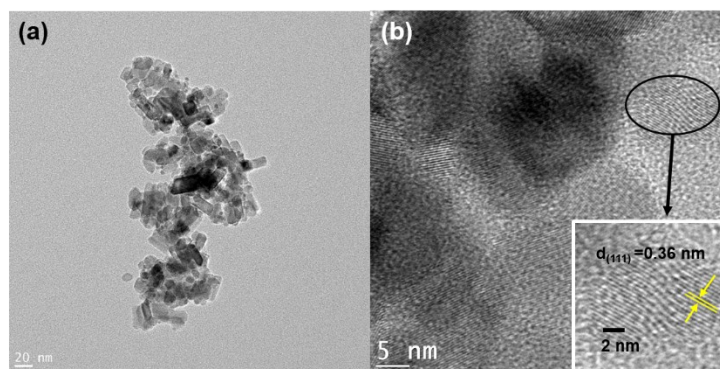
**Figure S2** TEM image of CdSeS NPLs. Se/S = 1:1.



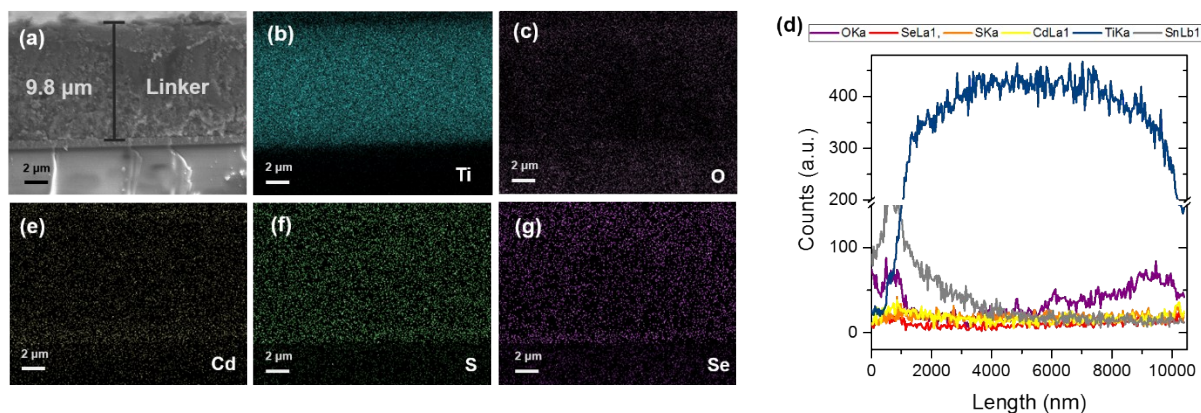
**Figure S3** TEM and HRTEM images of CdSe NPLs.



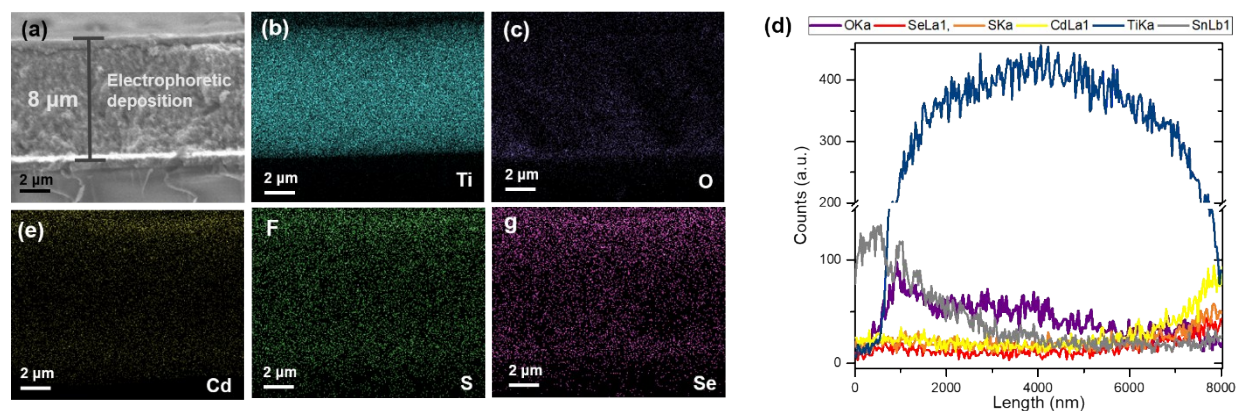
**Figure S4** EDS spectrum of heterostructures alloyed CdSeS NPLs/TiO<sub>2</sub> NPs formed via electrophoretic deposition. The data is collected from the area shown in Figure 1e.



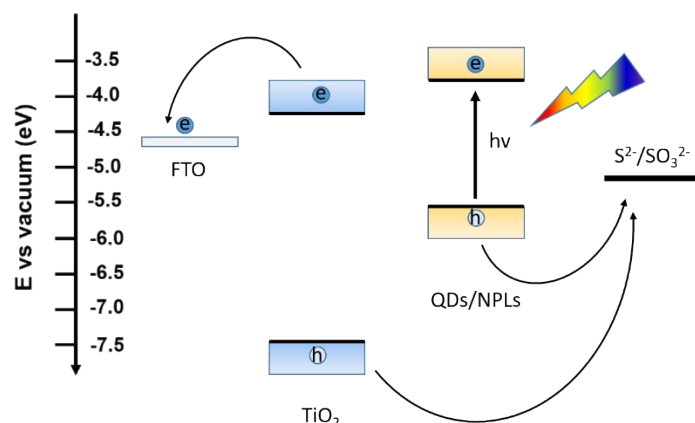
**Figure S5** TEM (a) and HRTEM (b) images of CdSe QDs/TiO<sub>2</sub> nanoparticles heterostructure via electrophoretic deposition.



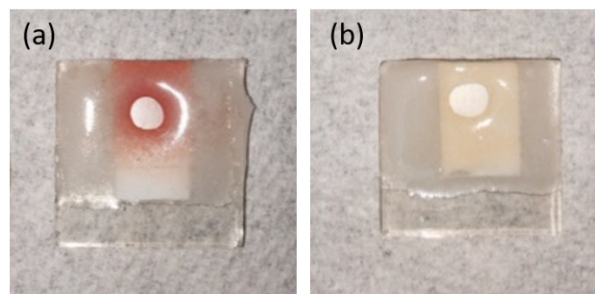
**Figure S6** (a) Cross-sectional SEM image of CdSeS NPLs/TiO<sub>2</sub> photoanode via MAP-assisted attachment. EDS mapping analysis of all the elements in relevant CdSeS NPLs/TiO<sub>2</sub> electrode including (b) Ti, (c) O, Cd (e), S (f) and (g) Se. (d) EDS line mapping of the highlighted path in the SEM image.



**Figure S7** (a) Cross-sectional SEM image of CdSeS NPLs/TiO<sub>2</sub> photoanode via EPD. EDS mapping analysis of all the elements in relevant CdSeS NPLs/TiO<sub>2</sub> electrode including (b) Ti, (c) O, Cd (e), S, (f) and (g) Se. (d) EDS line mapping of the highlighted path in the SEM image.



**Figure S8** Band alignment and schematic diagram of PEC cell



**Figure S9** Photographs of photoanodes based on CdSe NPLs via electrophoretic deposition (a) and MPA-assisted attachment (b).

**Table S1** PL lifetimes of all investigated heterostructures.

<b>Samples</b>	<b>PL lifetime (ns)</b>	
	<b>Electrophoretic deposition</b>	<b>MPA-assisted attachment</b>
CdSe QDs/TiO <sub>2</sub>	10.7	18.2
CdSe QDs/ZrO <sub>2</sub>	26.1	36.2
CdSe NPLs/TiO <sub>2</sub>	21.9	23.6
CdSe NPLs/ZrO <sub>2</sub>	28.6	30.3
CdSeS NPLs/TiO <sub>2</sub>	21.9	28
CdSeS NPLs/ZrO <sub>2</sub>	30.6	34.6