Supporting Information for

'Probing Charge Transfer in a Novel Class of Luminescent Perovskite-Based Heterostructures Composed of Quantum Dots Bound to RE-Activated $CaTiO_3$ Phosphors'

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#	Precursors (Ratio is 1: 1 unless otherwise noted)	Titanium Precursor	Temp (ºC)	Surfactant (mL)	Time (hr)	Cooling Rate (ºC/min)	Product (composition, morphology, size)
Molten Salt Method							
(Titanium precursor): Pr doped sample							
A	Calcium Oxalate and TiO_2	P25 TiO_2	820	No surfactant	3.5	Natural cooling	
B	Calcium Oxalate and TiO_2	P25 TiO_2	820	No surfactant	3.5	**Quenched**	Avg. Diam.: Increased cubic morphology
C	Calcium Oxalate and TiO_2	P25 TiO_2	820	NP-9 (1.75 mL)	3.5	Natural cooling	Avg. Diameters: 54 ± 13 nm 50% cubes vs. 50% spheres – Pure $CaTiO_3$
D	Calcium Oxalate and TiO_2	P25 TiO_2	820	NP-9 (2.33 mL)	3.5	Natural cooling	Pure $CaTiO_3$
E	Calcium Oxalate and TiO_2	P25 TiO_2	820	Triton X-100	3.5	Natural cooling	Pure $CaTiO_3$
F	Calcium Oxalate and Bulk TiO_2	Bulk TiO_2	820	Triton X-100	3.5	Natural cooling	Average Diameters: 210 ± 22 nm 100% Roughened particles – Pure $CaTiO_3$
G	Calcium oxalate and TiO_2	P25 TiO_2	820	Triton X-100	3.5	Natural cooling	Pure $CaTiO_3$
H	Calcium Oxalate and TiO_2	5 nm TiO_2 NPs	820	NP-9	3.5	Natural cooling	Avg. Diameters: 56 ± 33 nm 30% cubes vs. 70% particles – Pure $CaTiO_3$
Eu doped sample							
1	Calcium Oxalate and 2% Europium Nitrate	Bulk TiO_2	820	Triton X-100	3.5	Natural cooling	Average Diameters: 210 ± 32 nm 100% Roughened particles – Pure $CaTiO_3$
2	Calcium Oxalate and 4% Europium Nitrate	Bulk TiO_2	820	Triton X-100	3.5	Natural cooling	Average Diameters: 220 ± 26 nm 100% Roughened particles – Pure $CaTiO_3$

3	Calcium Oxalate and 6% Europium Nitrate	Bulk TiO_2	820	Triton X-100	3.5	Natural cooling	Average Diameters: 290 ± 35 nm 100% Roughened particles – Pure $CaTiO_3$
Hydrothermal Method							
#	**Precursor Ratios (1M NaOH unless otherwise noted)**	**Ti precursor**	**Temp. (C)**	**Surfactant**	**Time**	**Cooling**	**Product (composition, morphology, size)**
F	0.25 $Ca(OH)_2$ Stock Solution	Ti foil	130	**No surfactant**	**4**	Natural cooling	Avg. Diameters: 278 ± 87 nm Large aggregates of $CaTiO_3$-- with TiO_2 and CaO_4 impurities
G	0.5 M $CaCl_2$ – 30 mL for 4 hours	Ti foil	180	**No surfactant**	4	Natural cooling	Avg. Diameters: 178 ± 87 nm Cubes - No $CaTiO_3$-- with TiO_2 and CaO_4 impurities – Irreproducible!!
H	0.5M $CaCl_2$ – 10 mL		180	**No surfactant**	4	Natural cooling	Avg. Diam.: 500 ± 154 nm Microspheres with CaO_4 impurity-- without HCl wash
I	0.25 $CaCl_2$ – 10 mL		180	**No surfactant**	4	Natural cooling	Avg. Diam.: 380 ± 140 nm Microspheres with reduced intensity of CaO_4 impurities-- **without HCl wash**
J	0.25 $CaCl_2$ – 10 mL		180	**No surfactant**	10	Natural cooling	Avg. Diam.: 500 ± 45 nm Microspheres with reduced intensity of CaO_4 impurities-- **without HCl wash**

Table S1. Detailed reaction parameters and product descriptions for all reactions conducted using both the molten salt and hydrothermal methods for preparing Pr doped-$CaTiO_3$ micron-scale spheres.

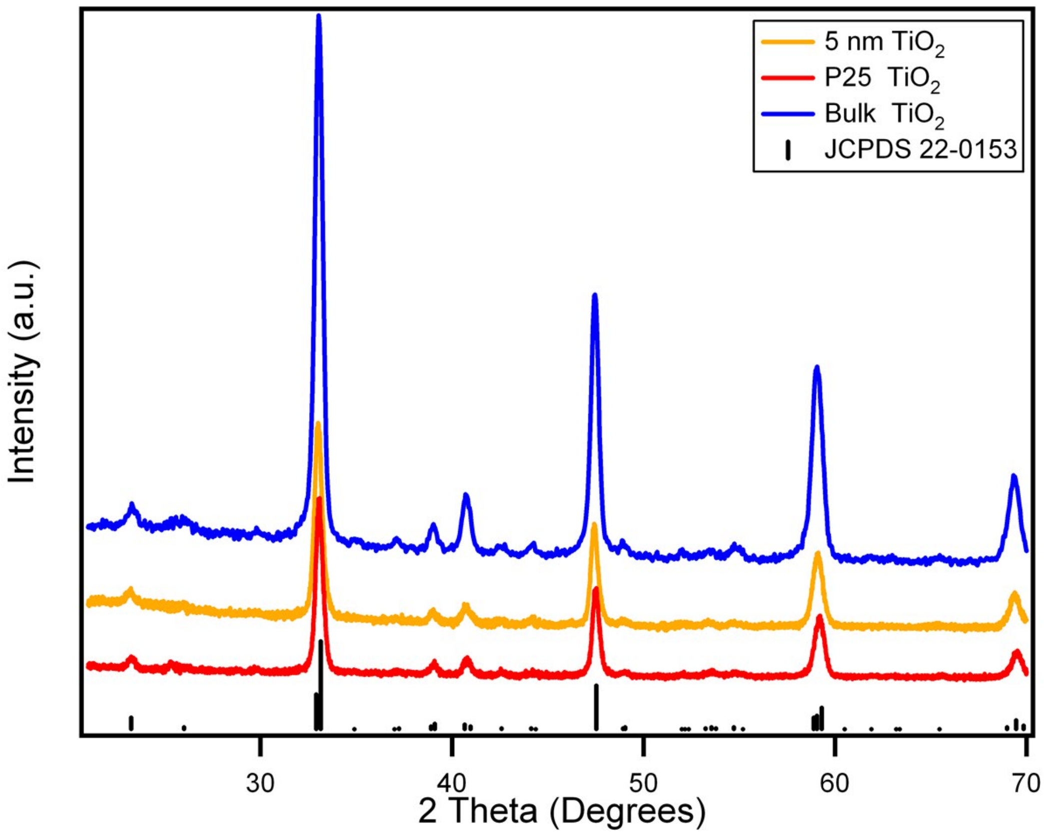

Figure S1. XRD results for samples, prepared using the molten salt method with various titanium precursors.

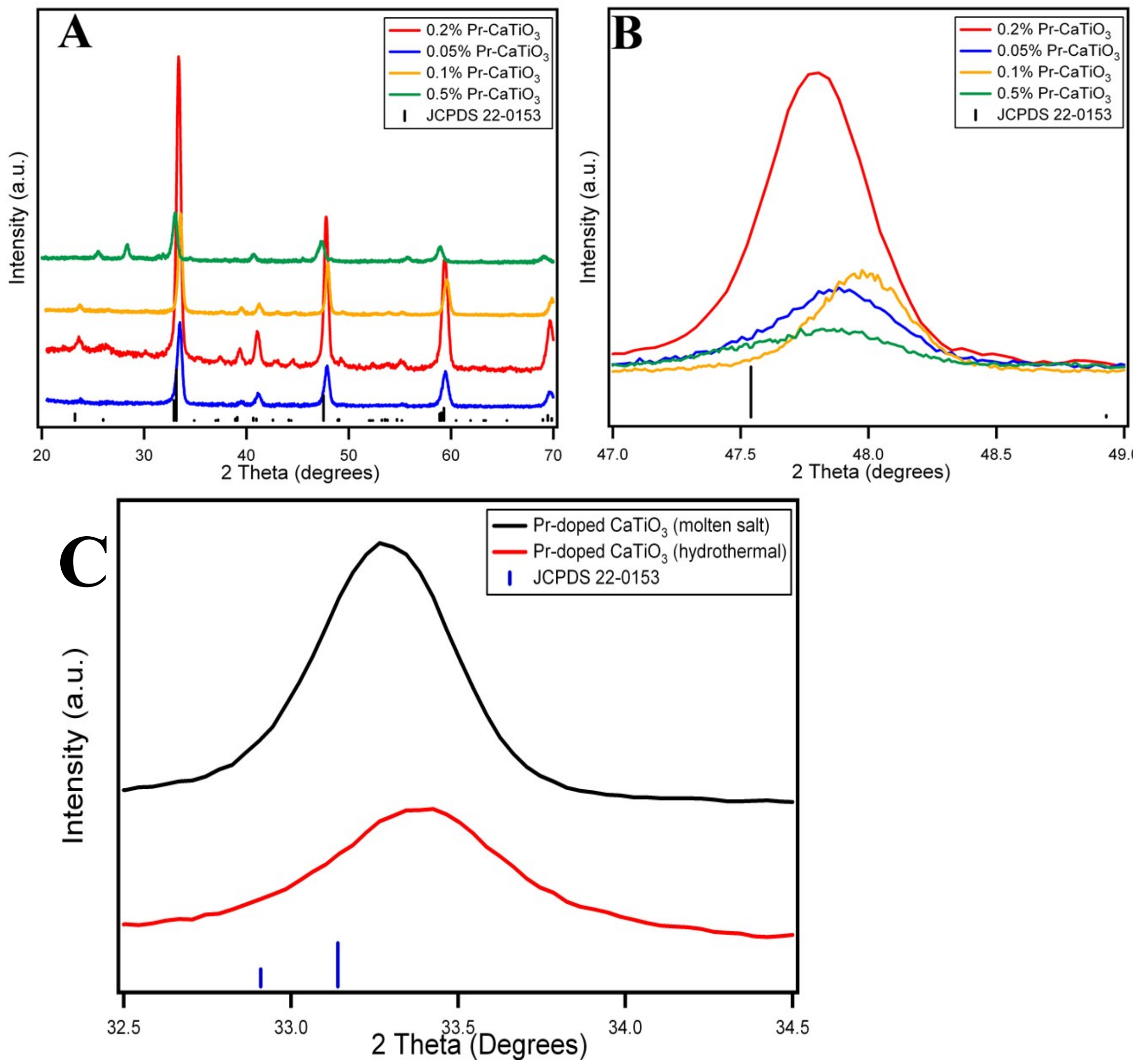

Figure S2. X-Ray Diffraction patterns of (A) 0.2%, 0.05%, 0.1%, and 0.5% Pr-doped $CaTiO_3$; associated peak shifts (B) for a signal centered at a 2θ value of ~47 degrees; as well as peaks shifts (C) for the molten salt-prepared (black) and hydrothermally-generated (red) 0.2% Pr-doped $CaTiO_3$ samples, centered at a 2θ value of ~33 degrees.

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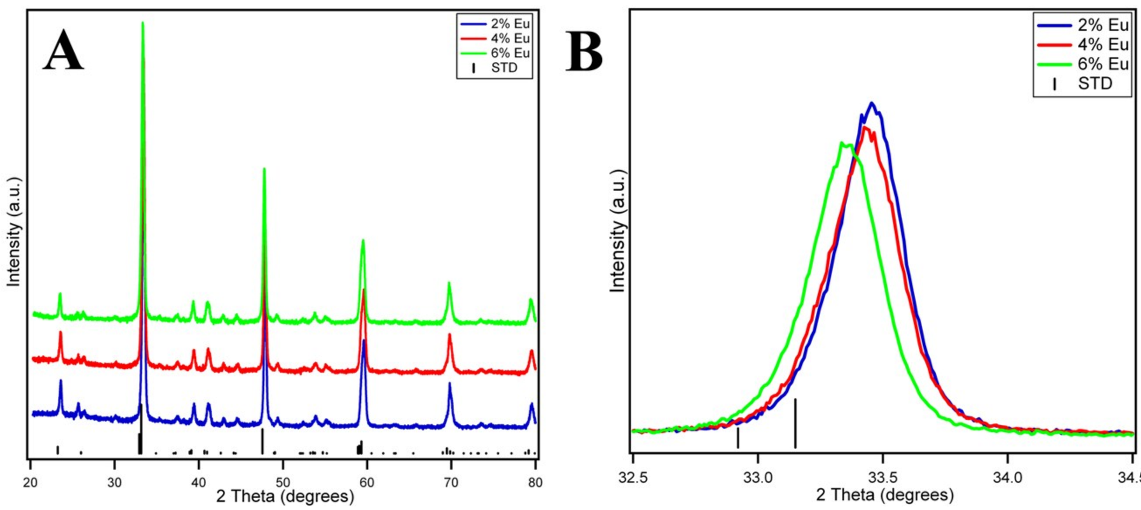

Figure S3. X-Ray Diffraction patterns of (A) 0.2%, 0.05%, 0.1%, and 0.5% Eu-doped $CaTiO_3$ and associated peak shifts for a signal centered at a 2θ of ~33 degrees.

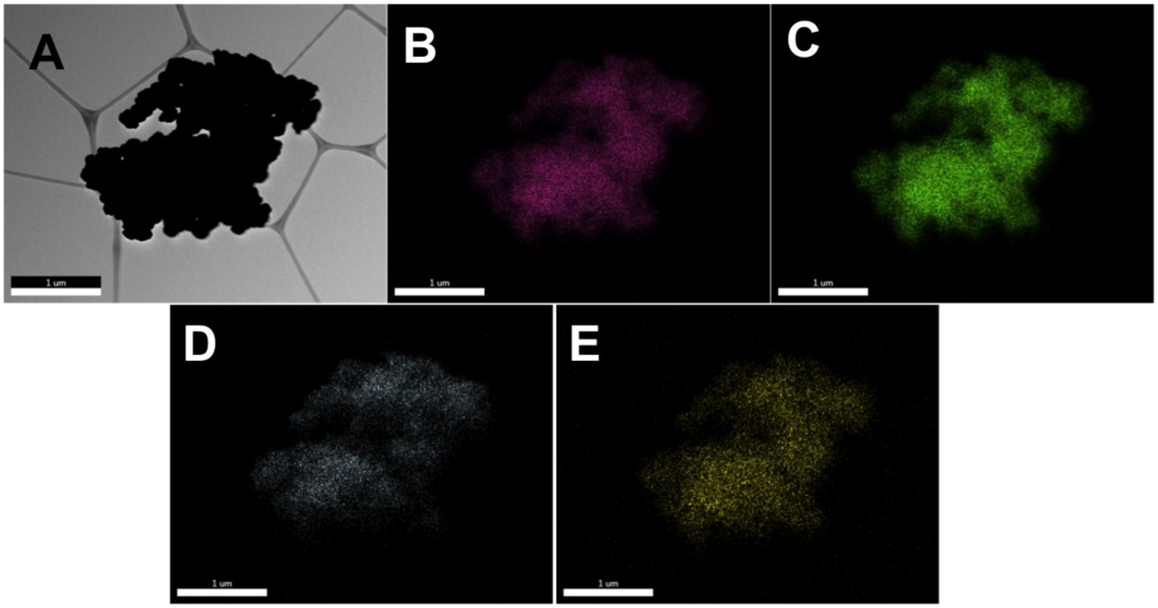

Figure S4. (A) Dark-field STEM image of CdSe QDs anchored onto $CaTiO_3$: Pr heterostructures. Elemental mapping of the same region, as measured by energy dispersive X-ray spectroscopy, highlighting the spatial elemental distribution of (B) Ca, (C) Ti, (D) O, and (E) Pr, respectively. Scale bar is 1 μm for each image.

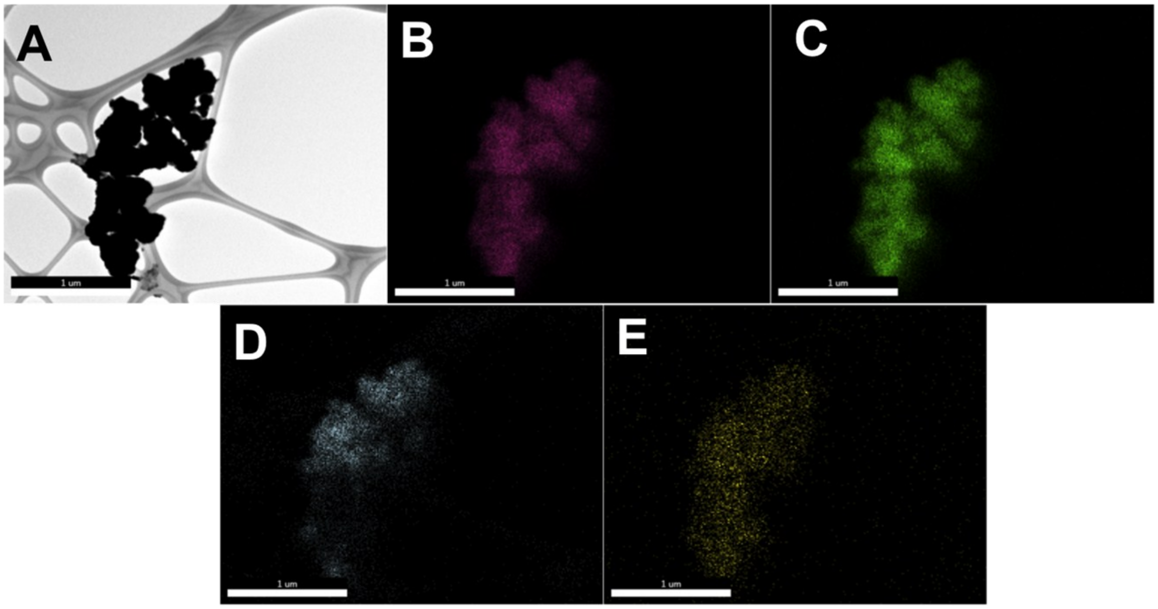

Figure S5. (A) Dark-field STEM image of CdSe QDs anchored onto $CaTiO_3$: Eu heterostructures. Elemental mapping of the same region, as measured by energy dispersive X-ray spectroscopy, highlighting the spatial elemental distribution of (B) Ca, (C) Ti, (D) O, and (E) Eu, respectively. Scale bar is 1 μm for each image.

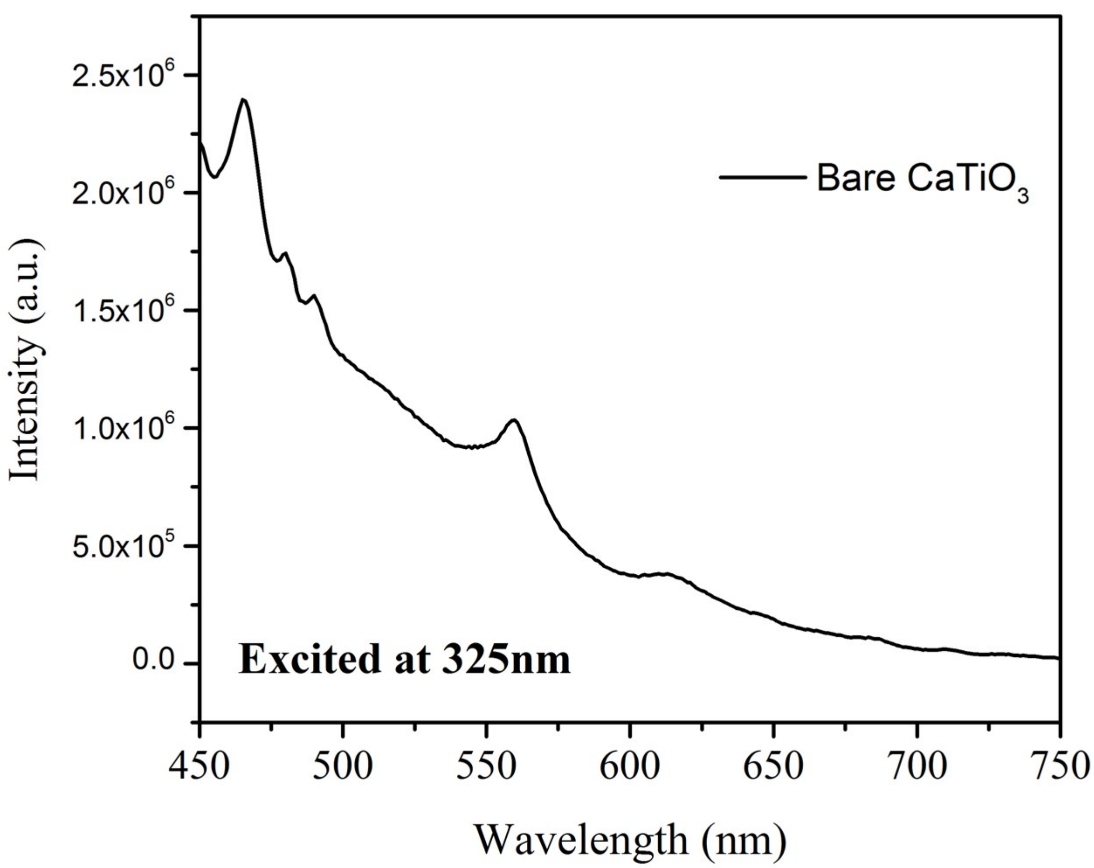

Figure S6. Photoluminescence emission profile of bare $CaTiO_3$.

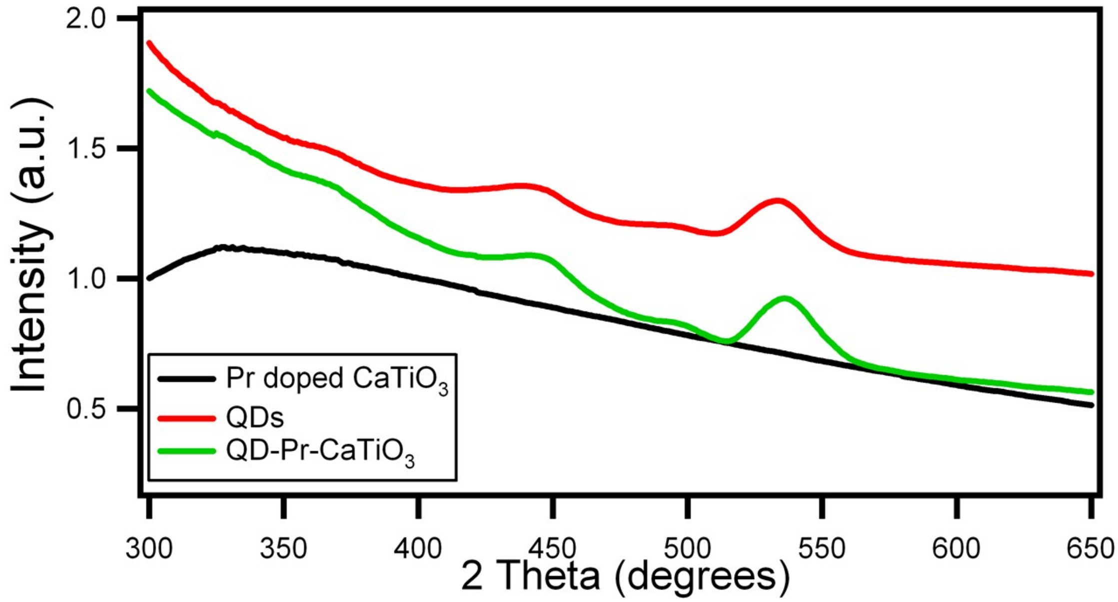

Figure S7. UV-visible spectra of Pr doped $CaTiO_3$, bare CdSe QDs, and Pr-doped $CaTiO_3$ structures, decorated with CdSe QDs.

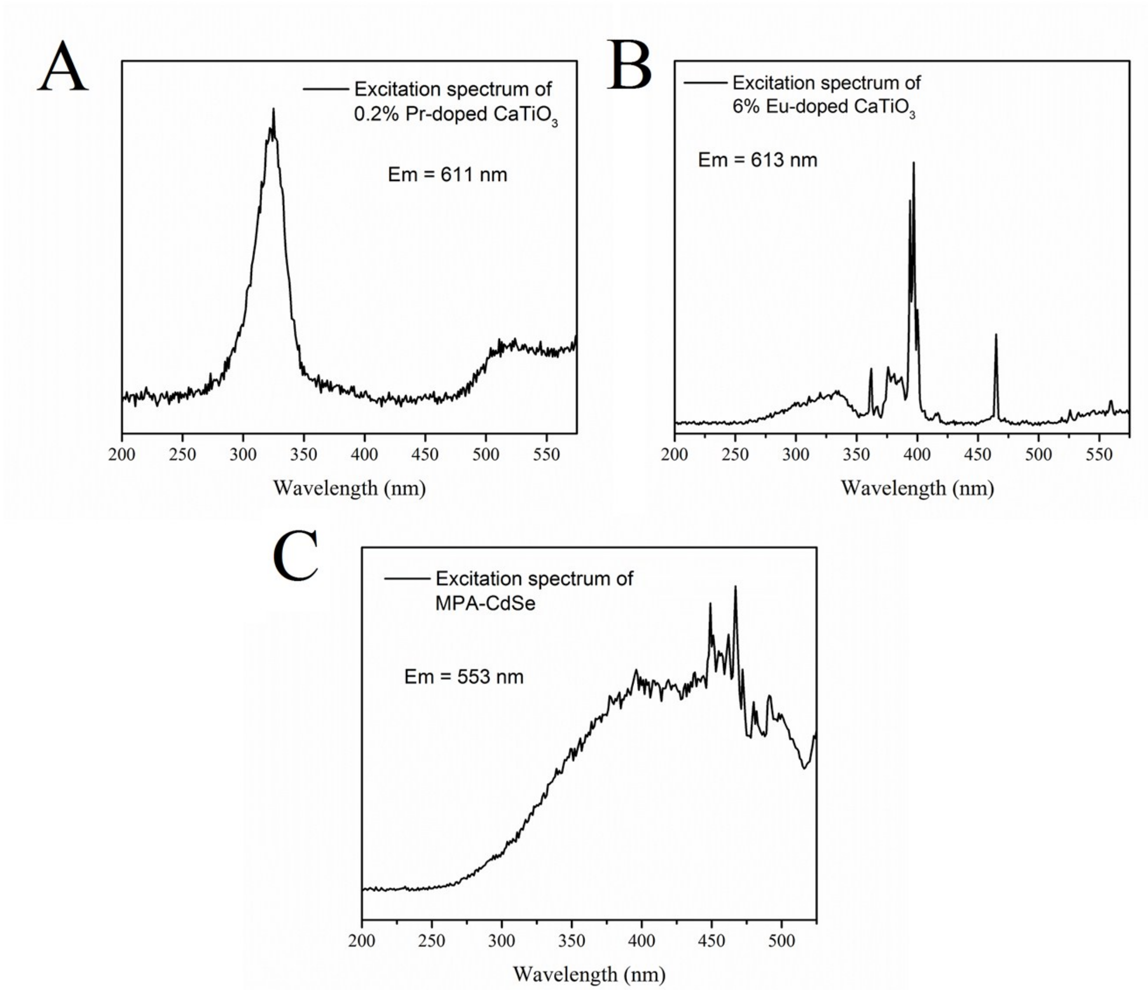

Figure S8. Excitation spectra of Pr-doped $CaTiO_3$, Eu-doped $CaTiO_3$, and MPA-capped CdSe QDs. Emission data were acquired at their respective emission peak positions.

Table S2. BET surface area analysis of as-prepared samples of lanthanide ion-doped $CaTiO_3$

Name	**Surface Area (m^2/g)**
Pr-$CaTiO_3$: MSS (molten salt syn.) method	8.79
Pr-$CaTiO_3$: Hydrothermal method	51.9
Eu-$CaTiO_3$: MSS (molten salt syn.) method	9.56