Supporting Information

Free-Standing Nanocomposite Multilayers with Various Length-scales and Functionalities

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Figure S1. Photographic images of size-controlled CdSe@ZnS QD solution stabilized by (a) oleic acid.

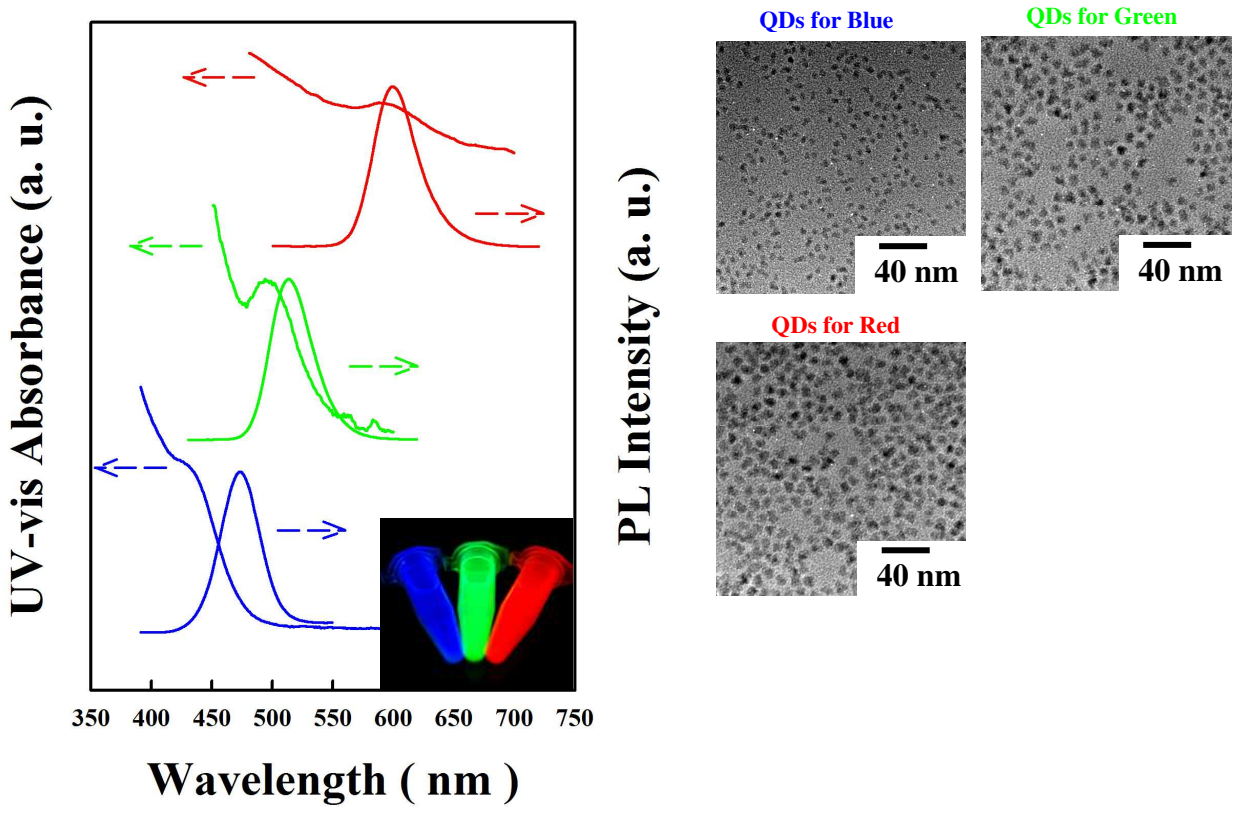

Figure S2. UV-vis and PL spectra of size-controlled CdSe@ZnS solutions. The inset shows the photographic images of PS-N_3-SH -stabilized CdSe@Zns solutions. Although the respective size of CdSe core and ZnS shell is difficult to measure due to their *in-situ* formation, the size of CdSe core can be speculated from the size of optical tunable CdSe quantum dots reported in a number of previous papers. TEM images of CdSe@ZnS nanoparticles with blue emission (diameter ~ 4.5 nm), green emission (5.4 nm) and red emission (5.6 nm).

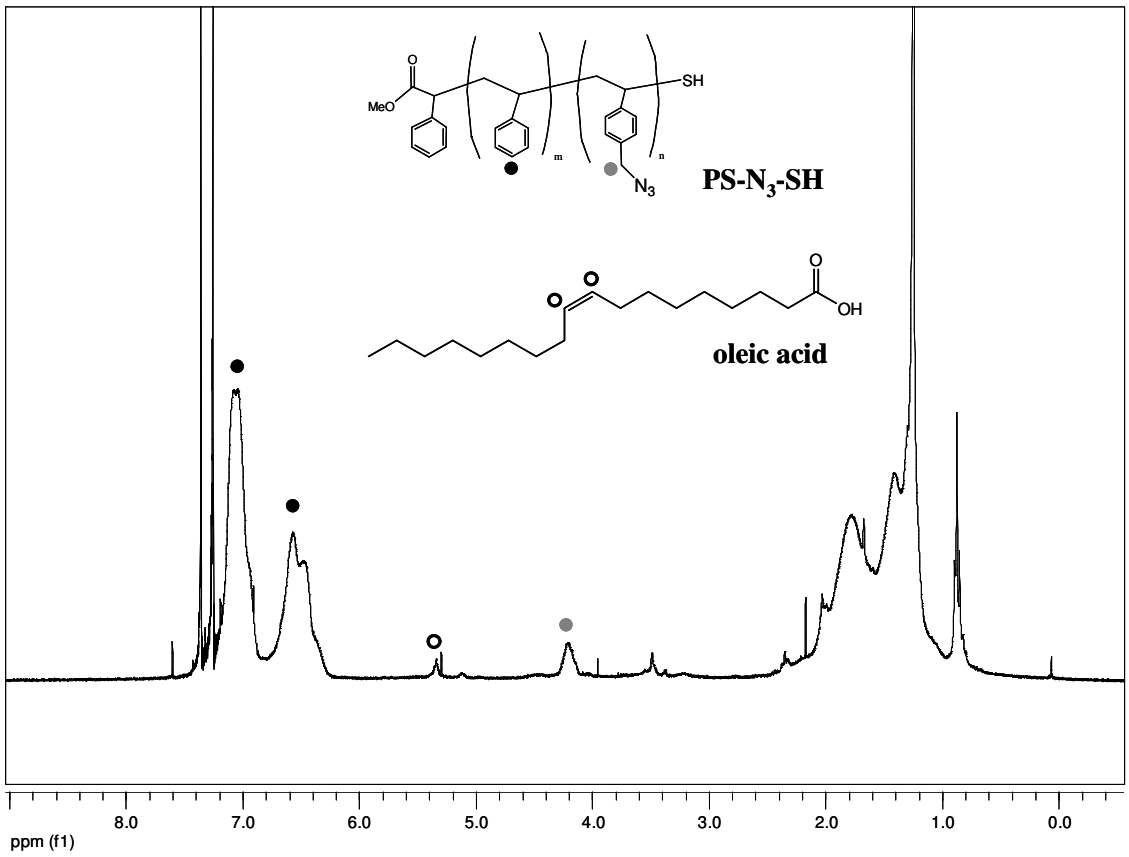

Figure S3. NMR data of PS-N_3-SH -stabilized CdSe@ZnS.

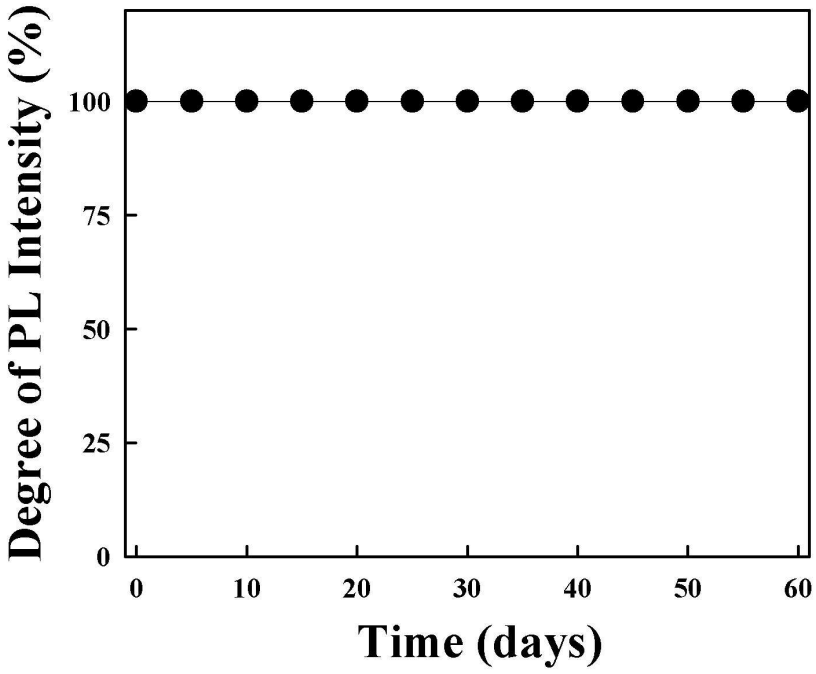

Figure S4. PL intensity of free-standing blue QD multilayers measured at 400 nm as a function of time. This film with about 9 μm thickness was prepared onto NaCl substrate at spinning speed of 3000 rpm and then separated from substrate. We have not observed any PL quenching of free-standing film in a given period (at ambient condition).

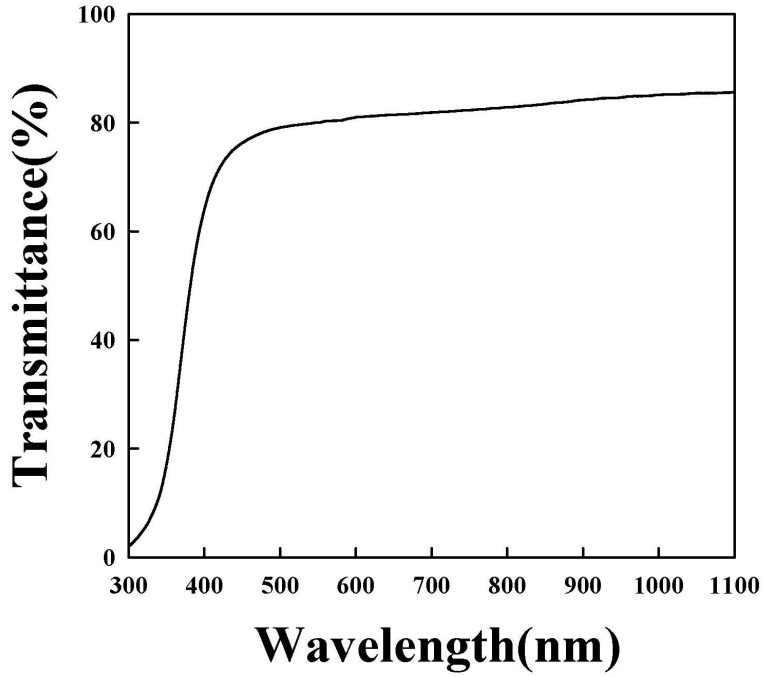

Figure S5. Light transmission curve of free-standing $(PS\text{-}N_3)_{40}$ multilayers prepared using 4 wt% $PS\text{-}N_3$ solution.

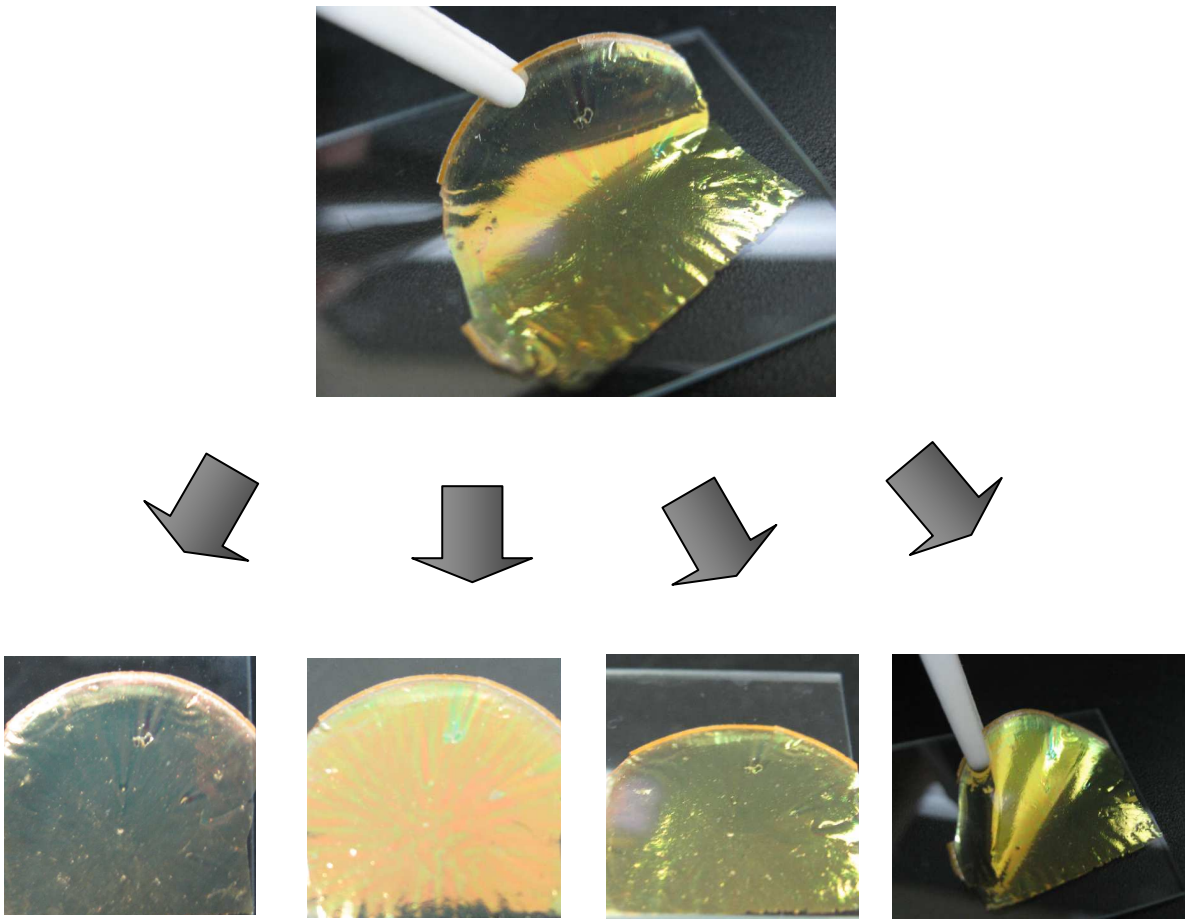

Figure S6. Photographic images of free-standing (PS-N_3-SH-stabilized green QDs: PS-N_3)$_{28}$ films revealing strong structural color features from different view angles. The internal structure of film is shown in Figure 5b.

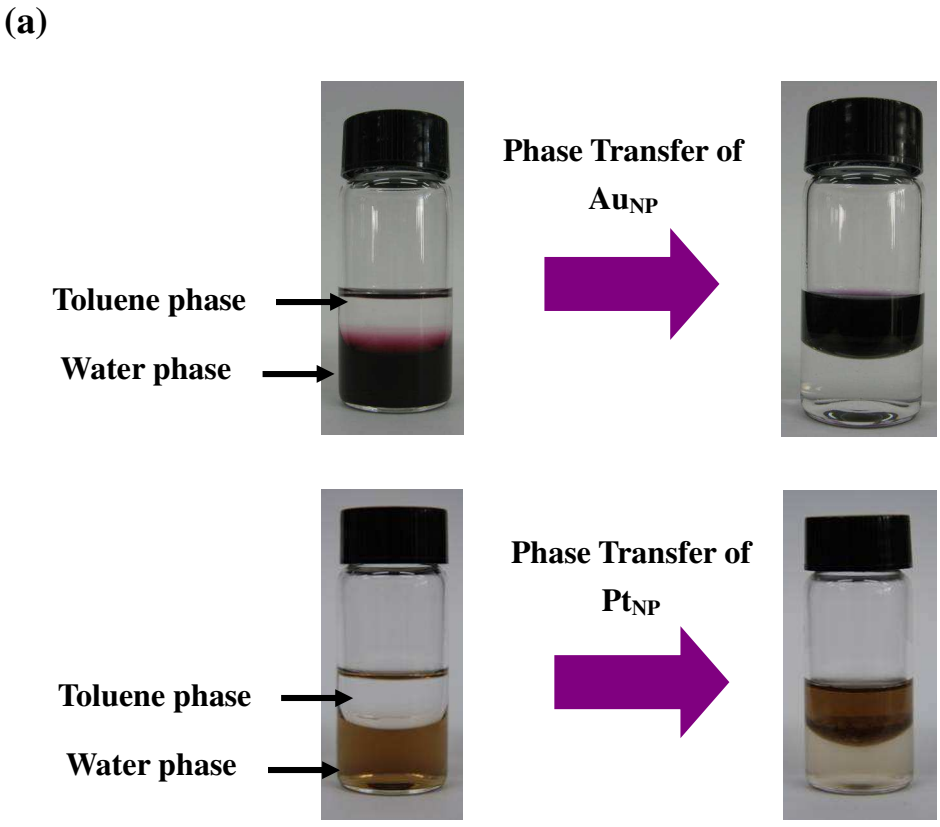

Figure S7. Photographic images of (a) citrate ion-stabilized Au_{NP} or Pt_{NP} solution before phase transfer and PS-N_3-SH-stabilized Au_{NP} or Pt_{NP} solution after phase transfer and (b) free-standing (PS-N_3-SH-stabilized Au_{NP})$_{40}$ films spin-deposited at 1500 rpm. The size of Au_{NP} and Pt_{NP} is about 13 and 6 nm, respectively.