Electronic Supplementary Information

Fabrication of wafer-scale free-standing quantum dot/polymer nanohybrid films for white-light-emitting diodes using electrospray method

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Materials of $AgIn_5S_8$/ZnS-QDs synthesis.[S1, S2]

Silver nitrate ($AgNO_3$, 99 %, Aldrich), indium(lll) acetylacetonate ($In(acac)_3$, 99.99 %, Aldrich), sulfur (S, 99.98 %, Aldrich), zinc stearate (10-12 % Zn basis, Aldrich), dodecanethiol (DDT, 98 %, Aldrich), oleic acid (OA, 90 %, Aldrich), oleylamine (OLA, 70 %, Aldrich), 1-octadecene (ODE, 30 90 %, Aldrich), and trioctylphosphine (TOP, 90 %, Aldrich).

Characteristics of $AgIn_5S_8$/ZnS-QD

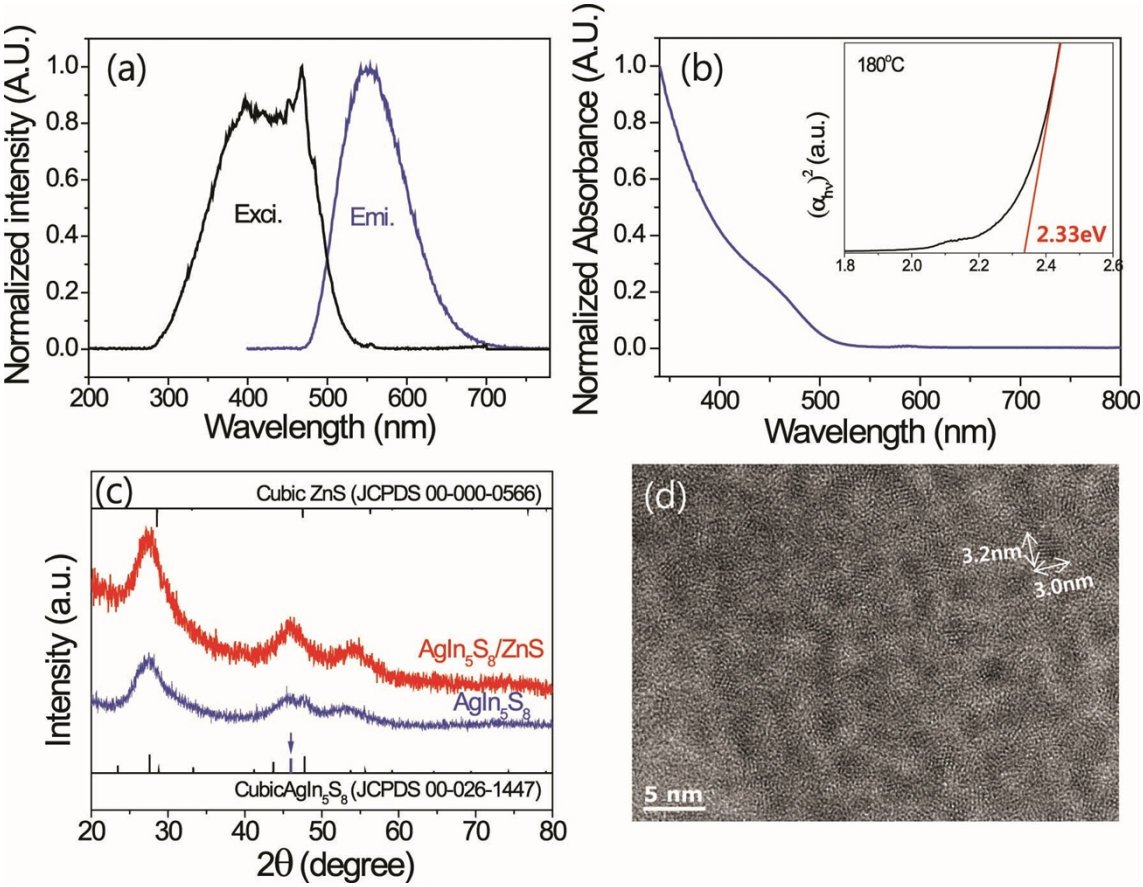

Figure S1. (a) Emission and excitation spectra, (b) absorbance (inset: bandgap), (c) X-ray diffraction (XRD) patterns (Vertical blue color line of the location marked by arrow indicates the (203) plane of cubic $AgIn_5S_8$, as shown in ref. S1, S2), and (d) transmission electron microscopy (TEM) image of $AgIn_5S_8$/ZnS QDs.

S1. Hong, S. P.; Park, H. K.; Oh, J. H.; Yang, H.; Do, Y. R. *J. Mater. Chem.* **2012**, *22*, 18939-18949.
S2. Qasrawi, A. F.; *J. Alloys Compd*. **2008**, *455*, 295-297.

Optical properties of the high QD loaded e-sprayed NHB films

FE-SEM images

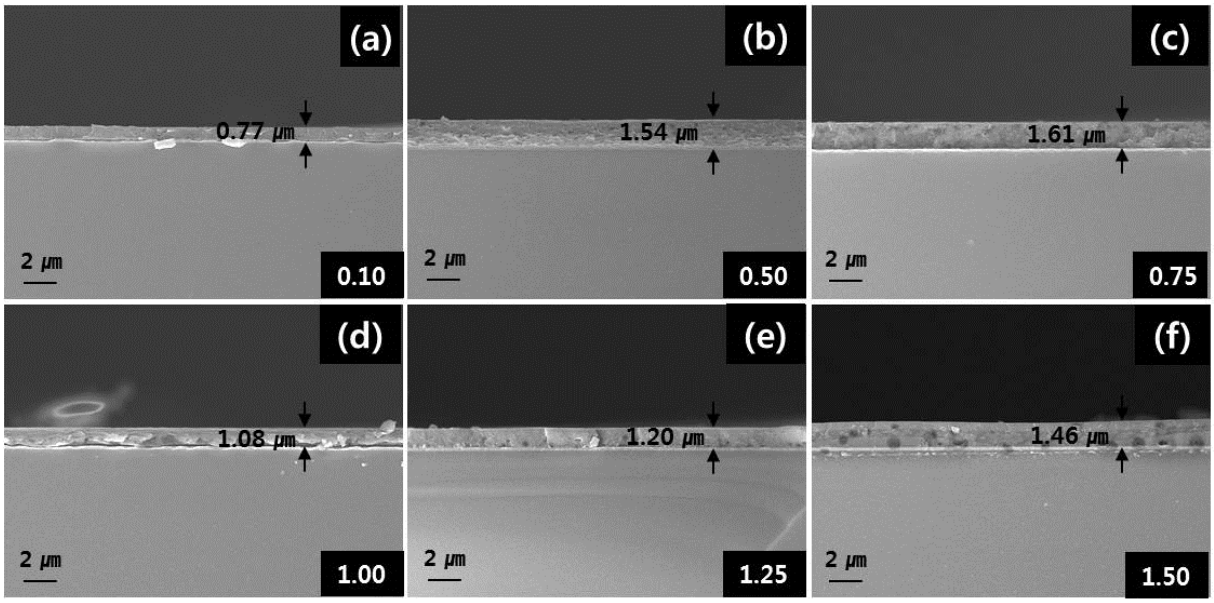

Figure S2. Cross-sectional FE-SEM images of the thickness of QD/PMMA-NHB films with different QD concentration in polymer. (a) 10 parts, (b) 50 parts, (c) 75 parts, (d) 100 parts, (e) 125 parts, and (f) 150 parts. This NHB films were used for the PL intensity study shown in Figure 3. For the normalization of PL intensity, a film thickness of 1.2 μm was used.

Comparision the optical properties of QD/PMMA-NHB films using e-spray coating and spin-coating process.

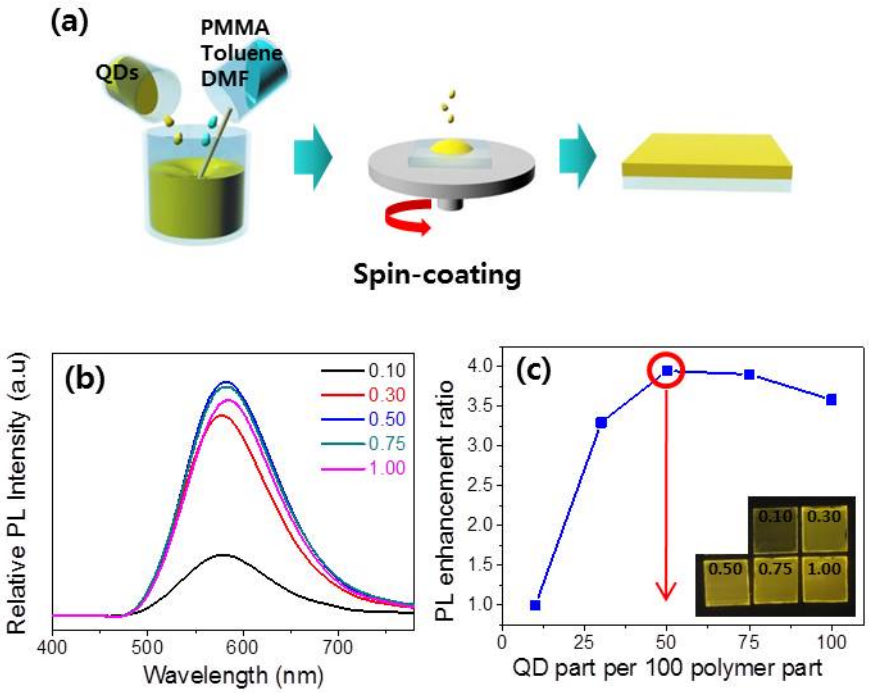

Figure S3 (a) Schematic illustration of fabrication process for QD/PMMA-NHB based DC phosphor film using spin-coating method. (b) PL spectra and (c) PL enhancement ratio of QD/PMMA-NHB films as a function of QD part per 100 polymer parts. The inset photograph is QD/PMMA-NHB films as a function of QD part per 100 polymer parts under UV irradiation.

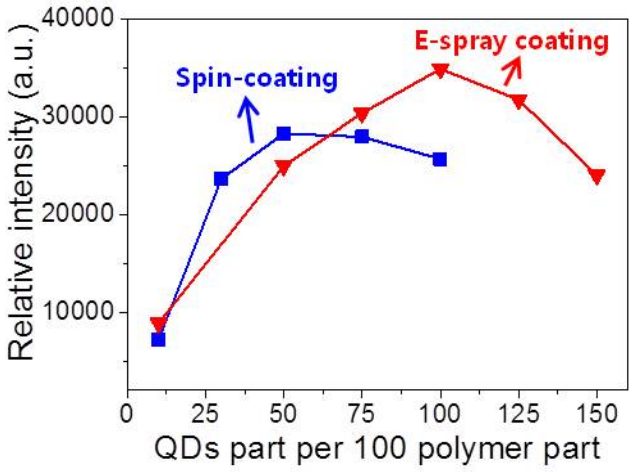

Figure S4. Relative PL intensity of QD/PMMA-NHB films using different coating process (spin-coating and e-spray coating).

Optical properties of the high QD loaded e-sprayed NHB films

FE-SEM images

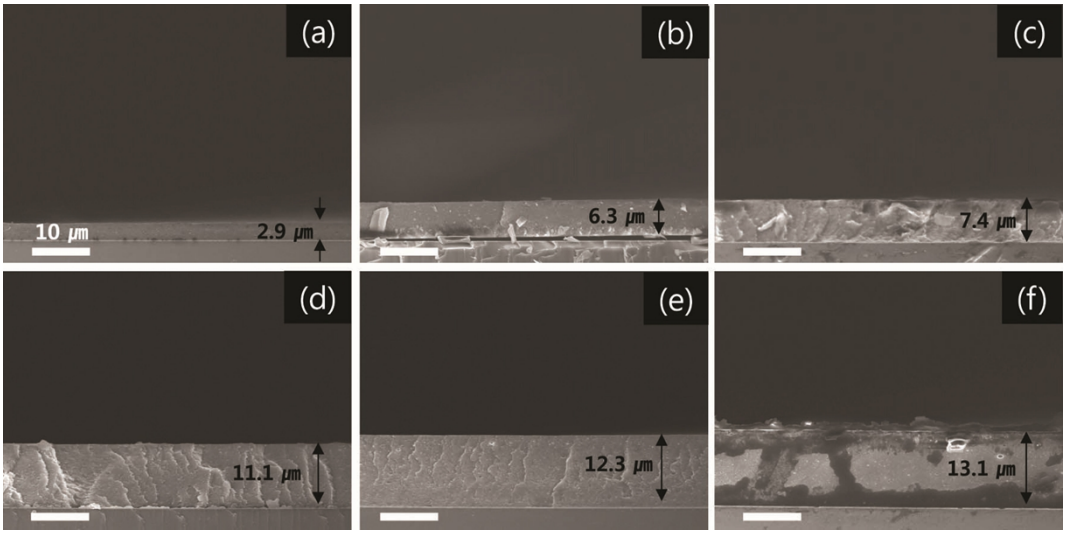

Figure S5. Cross-sectional FE-SEM images of QD/PMMA NHB films with different thicknesses.

Uniformity evaluation of free-standing NHB films

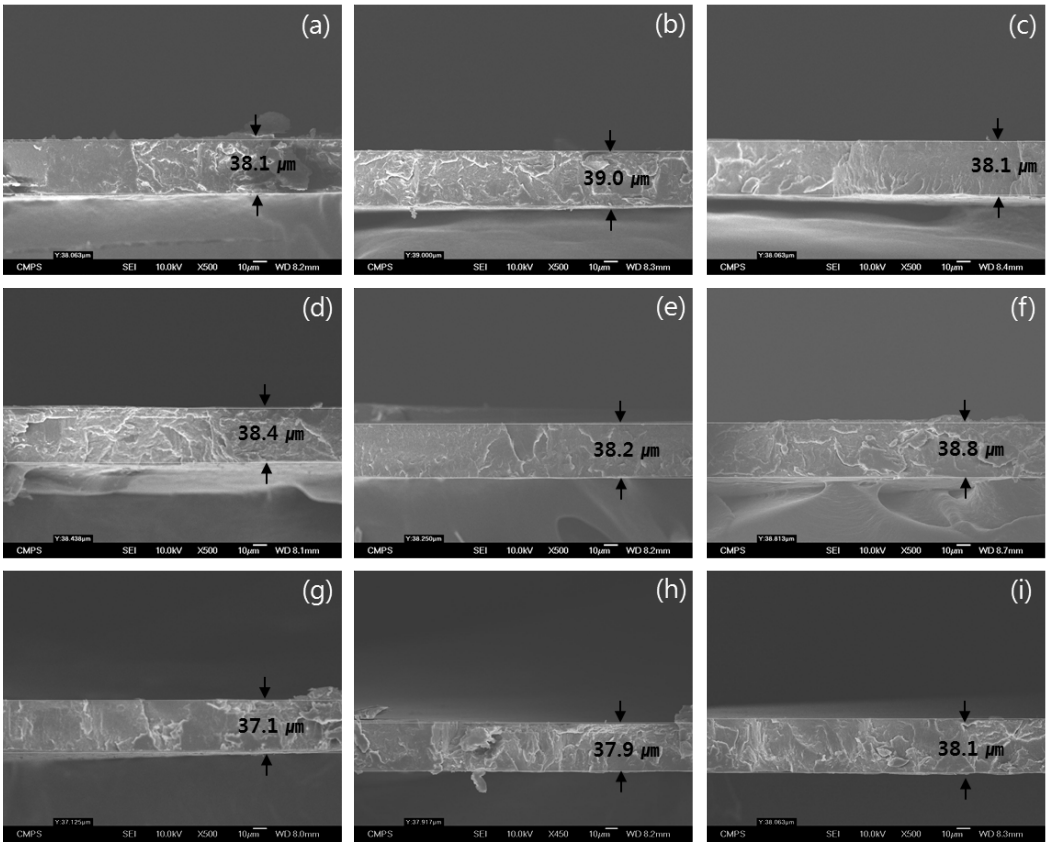

Figure S6. Evaluation of the film uniformity at various areas. The free-standing NHB films were divided into 9 pieces and the thickness was measured by FE-SEM. The thickness was 38±1 μm, confirming that the wafer-scale free-standing NHB films were uniform throughout the entire area.

FE-SEM images

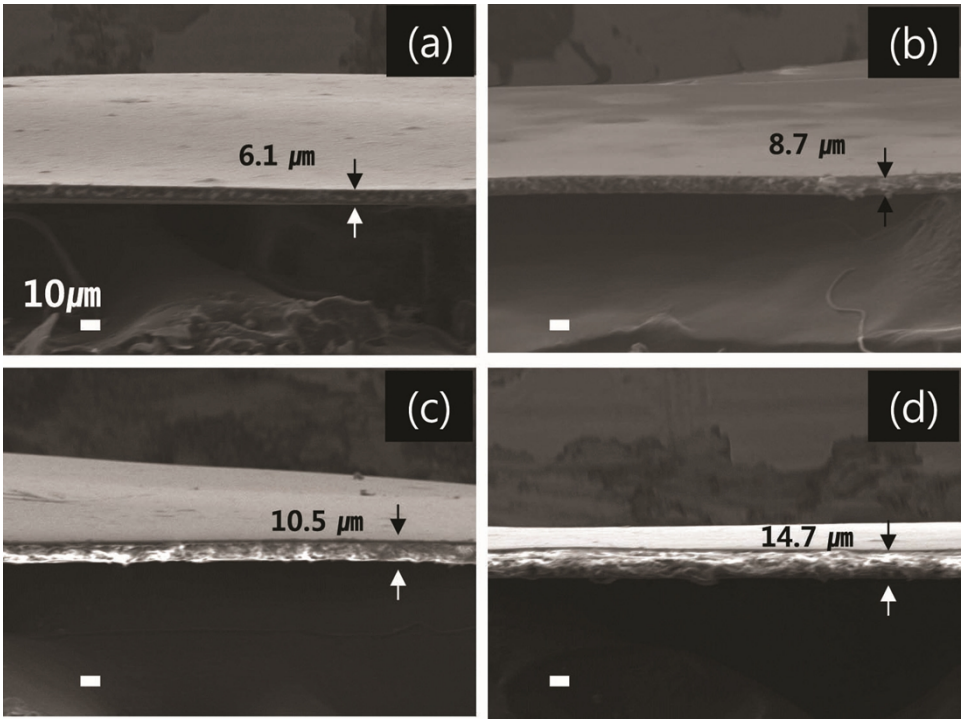

Figure S7. Cross-sectional FE-SEM images of QD/PMMA NHB films used in remote-type W-LEDs.