Supplementary Information

Preparation of Perovskite-Embedded Monodisperse Copolymer Particles and Its Application for High Purity Down-Conversion LEDs

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Figure S1. (a) Energy dispersive X-ray (EDX) mapping of Pb (red dots) in PbBr₂-embedded p(MMA-co-4-VP) particles prepared by SEP (M4V-10). (b) Magnified image of a PbBr₂ NP embedded in a copolymer particle. Since PbBr₂ has a higher electron affinity than copolymer particles, PbBr₂ NP appears as a black dot. Lattice pattern is found in the TEM image due to the crystallinity of the PbBr₂ NP.

4-VP ratio	Total Monomer [mL]	PDI ^{a)}	DLS diameter [nm]	Conversion [%]
0.0	2.0	0.059	256	68.8
0.1	2.0	0.007	328	87.4
0.2	2.0	0.016	368	88.5
0.3	2.0	0.005	401	96.2
0.4	2.0	0.003	458	84.7

Table S1. SEP conditions and results of p(MMA-co-4-VP) without PbBr₂ NPs

^{a)} Polydispersity index

Fitting equation in Figure 2(b) is as follows:

 $Y = 399.19825 + (-134.95471) \exp[(-9.40695) X_1]$

(Equation S1)

Y: Hydrodynamic diameter of PbBr₂ NPs-embedded copolymer particles [nm]

X₁: 4-VP ratio

Fitting equation in **Figure 2(c)** is as follows:

$$Y = A + 110*X_2$$
 (Equation S2)

Y: Hydrodynamic diameter of PbBr₂ NPs-embedded copolymer particles [nm]

- A: Constant given for each 4-VP ratio
- X₂: Total monomer amount [mL]

Assuming that $X_1 = 0.05$, $X_2 = 2$ mL, Y obtained from equation S1 is 314.88 nm. Substitution Y in equation S2 to 314.88 nm gives A = 94.88. Solving equation S2 for 4-VP ratio = 0.10, 0.15, 0.25, 0.30 with same procedure gives A values as follows:

4-VP ratio	A value	
0.05	94.9	
0.1	126.5	
0.15	146.3	
0.25	166.4	
0.30	171.2	

Table S2. Calculated A values at each 4-VP ratio



Figure S2. CIE color coordinates of perovskite NPs-embedded 3D PCs. Chromaticity coordinates of the perovskite NPs-embedded 3D PC optical films in CIE 1931 color spaces were evaluated by using CS-100A. Color coordinate of the perovskite NPs-embedded 3D PC optical films were (0.13, 0.17), (0.07, 0.77) and (0.70, 0.28) for blue, green and red optical films, respectively.



Figure S3. PL of green emissive CH₃NH₃PbBr₃ NPs without (dash line) and with (solid line) 3D PC.



Figure S4. (a) Time-dependent PL intensities of perovskite NPs without passivation (black square) and perovskite NPs embedded in p(MMA-co-4-VP) particles (red circle) at 25 °C with 60% relative humidity. (b) Time-dependent PL intensities of perovskite NPs without passivation (black square) and perovskite NPs embedded in p(MMA-co-4-VP) particles (red circle) at 60°C with 10% relative humidity.