Supporting Information

Highly Efficient and Environmentally Stable Flexible Color Converters based on Confined $CH_3NH_3PbBr_3$ Nanocrystals

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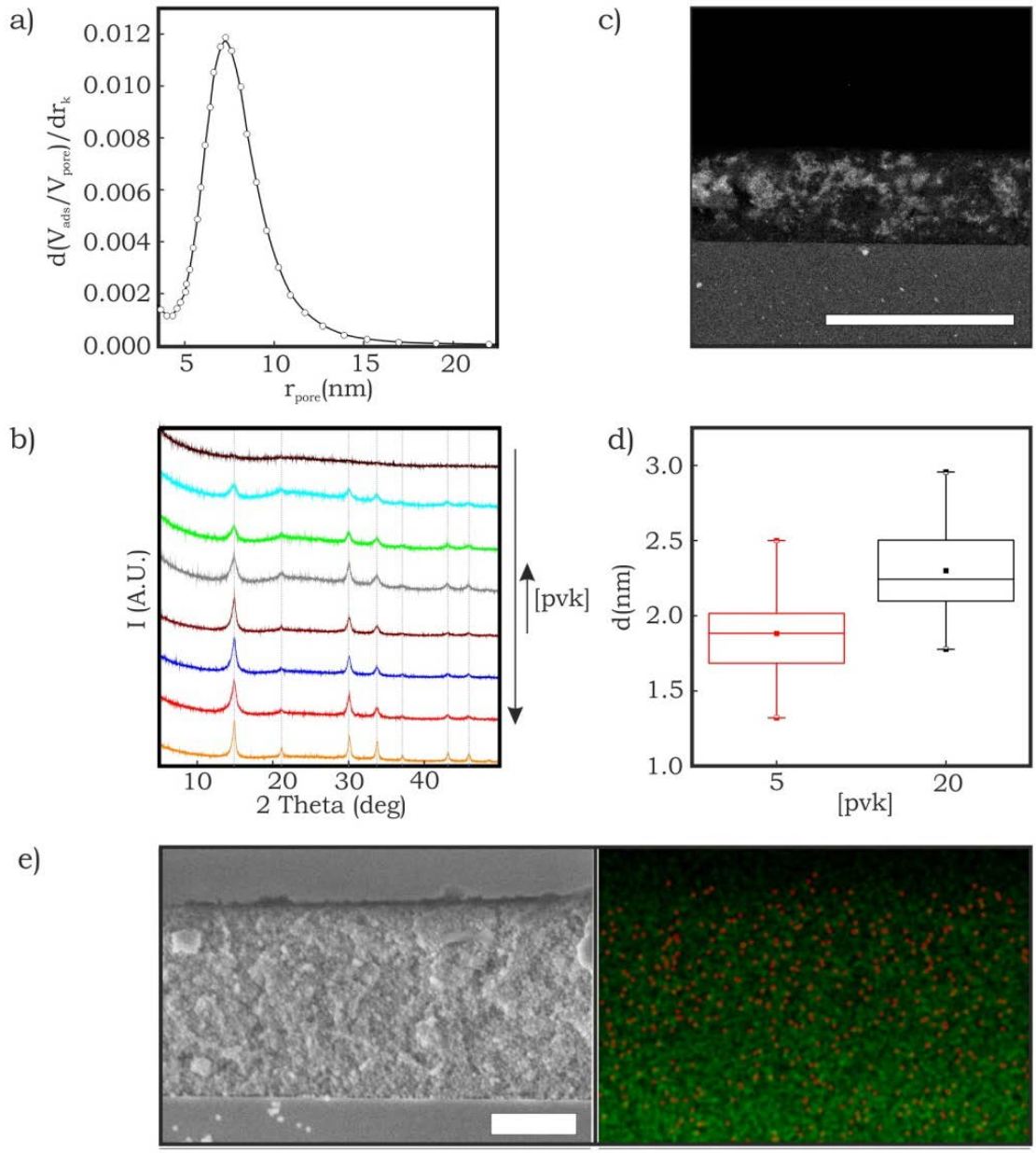


Figure S1. a) Pore size distribution inside silica nanoparticles matrices. b) XRD pattern of the different $MAPbBr_3$ nanocrystals encapsulated in the SiO_2 mesoporous scaffold and prepared with different precursor concentration. Gray lines indicate the reference peaks of bulk $MAPbBr_3$ macrocrystals. c) SEM backscattered electron image of a cross section of a SiO_2 nanoparticle mesoporous film including $MAPbBr_3$ nanocrystals prepared from a solution with a 5 wt.% of precursors. Scale bar is 2 μm. d) Box chart representation of the size distribution of perovskite nanocrystals corresponding to the synthesis with a 5 wt.% and 20 wt.% concentrated solutions of precursors. e) Left image: SEM micrograph of a cross section of $MAPbBr_3@SiO_2$ sample, identical to the one in figure S1c. Right image: EDX chemical mapping for lead (red spots) and silicon (green spots).Scale bar is 500 nm.

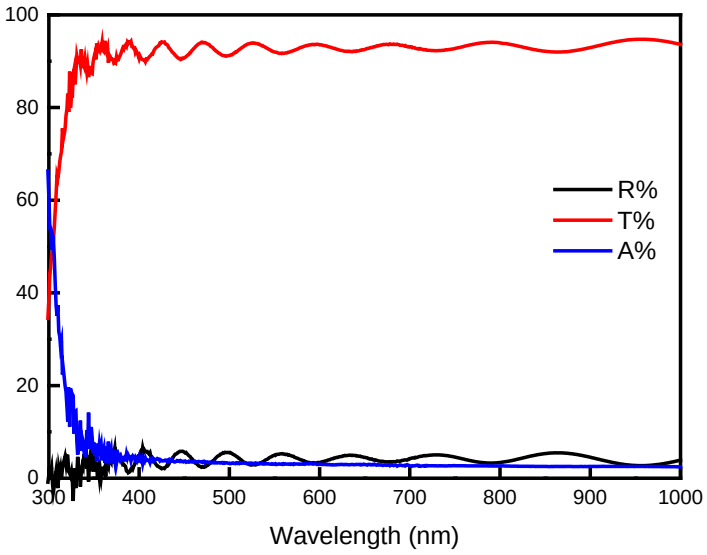


Figure S2. UV-Vis reflectance, transmittance and absorptance (black, red and blue curves, respectively) of a silica NPs layer deposited on glass substrate.

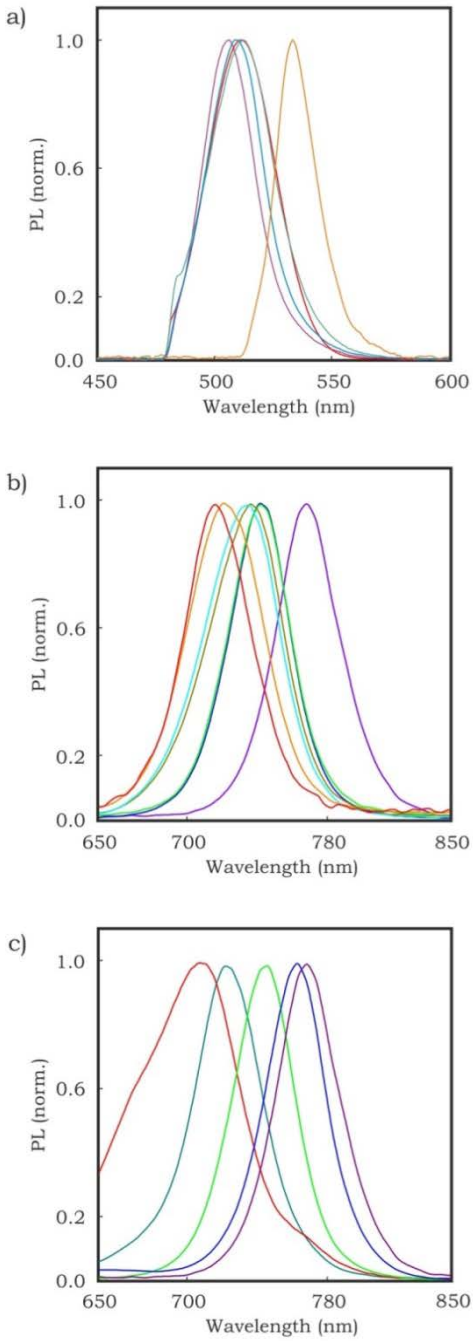
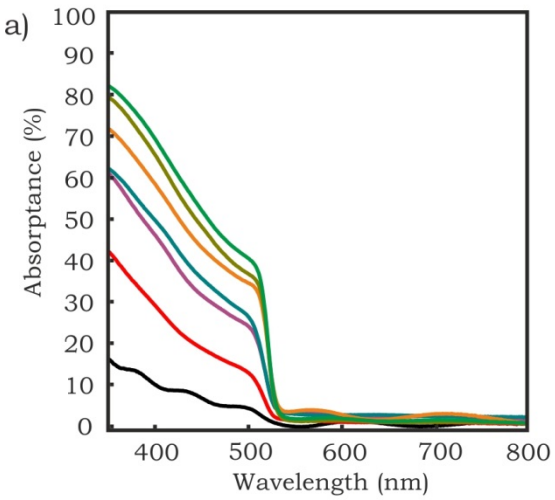


Figure S3. a) Normalized PL spectra of $MAPbBr_3$ nanocrystals from a 20% concentrated solution infiltrated in mesoporous film built up with nanoparticles of TiO_2 (green line), SnO_2 (red line), SiO_2 with a diameter of 30 nm(blue line) and SiO_2 with a diameter of 10 nm (violet line). The orange line corresponds to the emission of a bulk bromide perovskite film. b) Normalized PL spectra of $MAPbI_3$ nanocrystals infiltrated in silica nanoparticles (diameter of 30 nm) scaffold and prepared by varying the concentration of precursors solutions (MAI + PbI_2): 5 wt.% (red line), 10 wt.% (orange line), 15 wt.% (pale blue line), 20 wt.% (dark yellow line), 25 wt.% (green line), 30 wt.% (blue line). The violet curve corresponds to the bulk material. c) Normalized PL spectra of $MAPbI_3$ nanocrystals from a 20 wt.% concentrated solution infiltrated in mesoporous film built up with nanoparticles of TiO_2 (red line), SnO_2 (blue line), SiO_2 with a diameter of 30 nm (green line) and SiO_2 with a diameter of 10 nm (green-cyan line). The violet line corresponds to the emission of a bulk iodide perovskite film.



c)

Sample	E_{bg}(eV)
5%	2.375
10%	2.343
30%	2.329

Figure S4. a) Absorptance spectra from the perovskite-silica systems prepared using a 5wt.% (black line) 10wt.% (red line) 15wt.% (violet line) 20wt.% (blue line) 25wt.% (orange line) 30wt.% (dark yellow line) 35wt.% (green line) b) Tauc plots of the films prepared with perovskites precursor solutions with a concentration of 5wt.%, 10wt.% and 30wt.% (same color line used in a)). c) Band gap energy values extracted from the intersection of the tangent to the curves represented in the Tauc plot with the x axis.

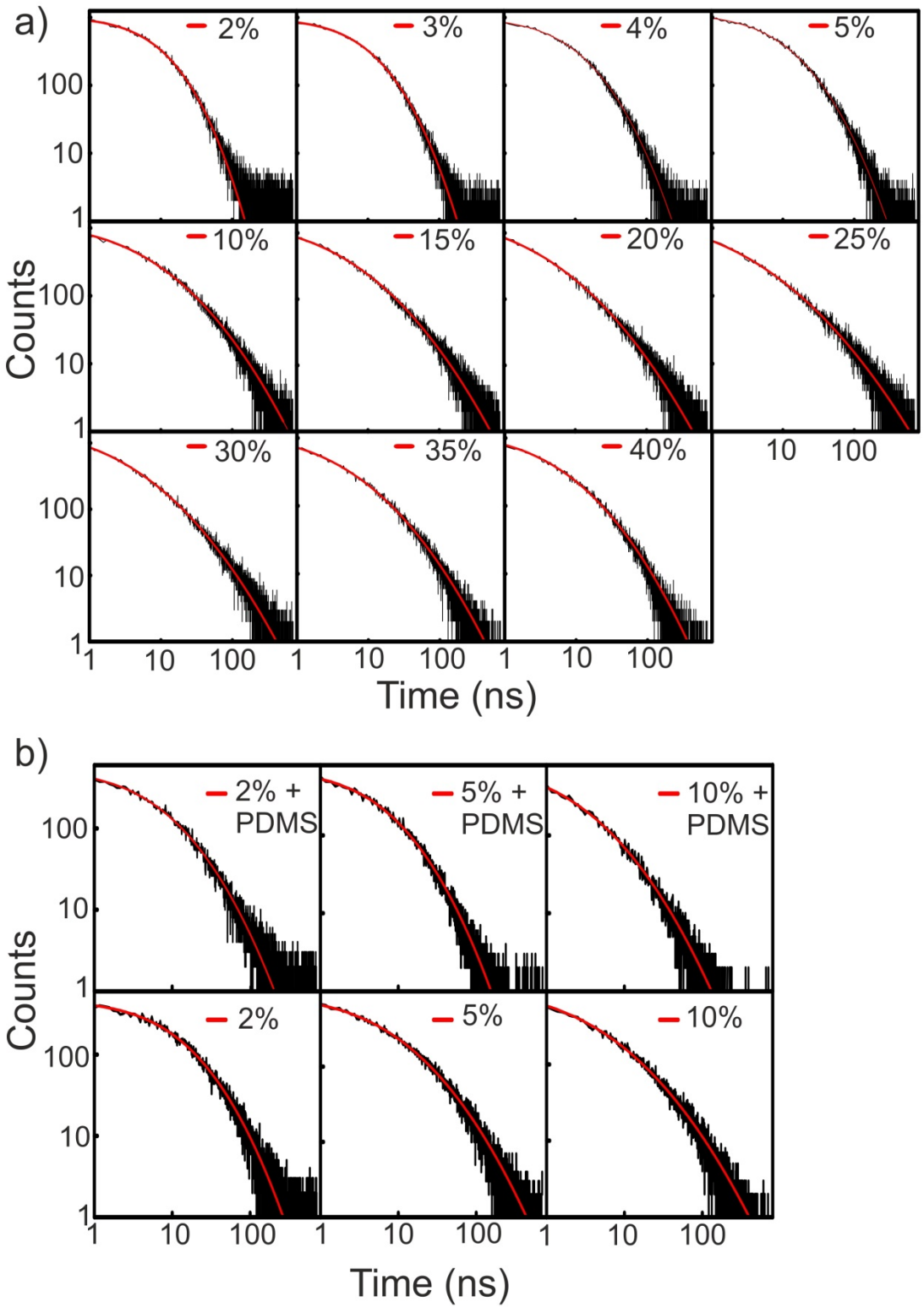


Figure S5. a) Log-log plot of the PL intensity decay curve fittings (red solid line) with the relative raw data (black solid line) for encapsulated $MAPbBr_3$ nanocrystals obtained from different precursor concentration (from 2% to 40%). b) Log-log plot of the PL intensity decay curve fittings (red solid line) with the relative raw data (black solid line) corresponding to the curves plotted in figure 4a.