In situ synthesis and stabilization of perovskite quantum dots in electrospinned fibers

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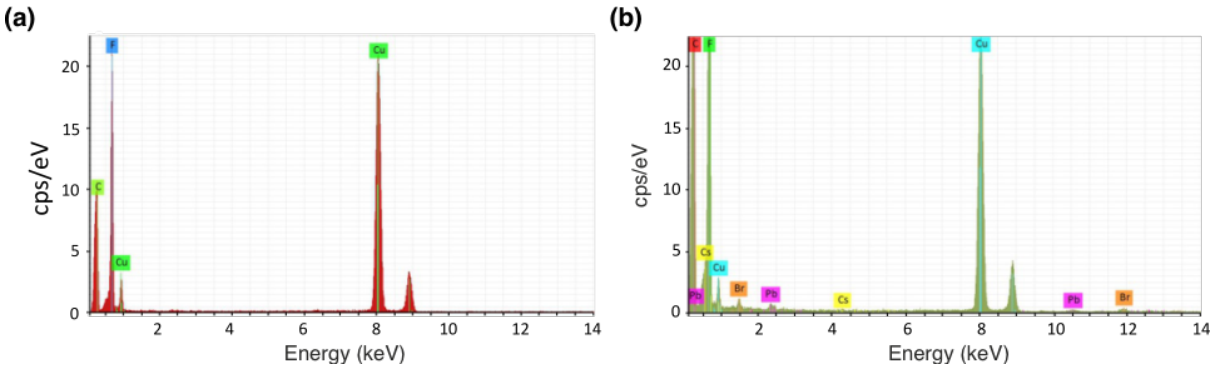

Fig. S1. (Color online) EDX spectra of the control sample (a) and sample S7 (b).

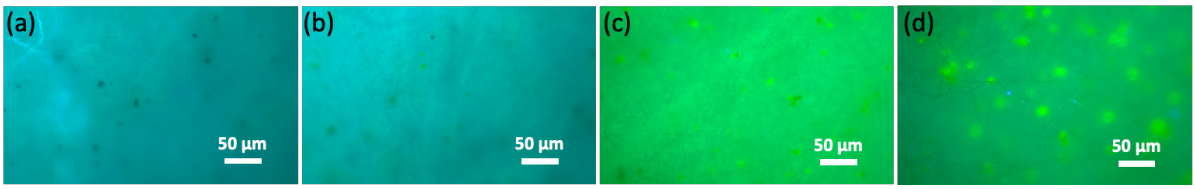

Fig. S2. (Color online) Luminescent images of sample S1 (a), S2 (b), S7 (c) and S8 (d).

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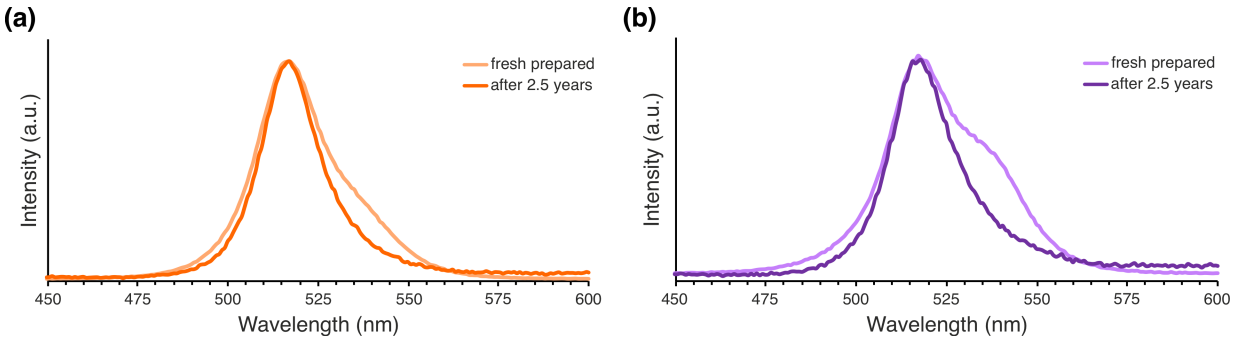

Fig. S3. (Color online) Emission spectra (λ_{ex} = 365 nm) of samples S7 (a) and S8 (b).

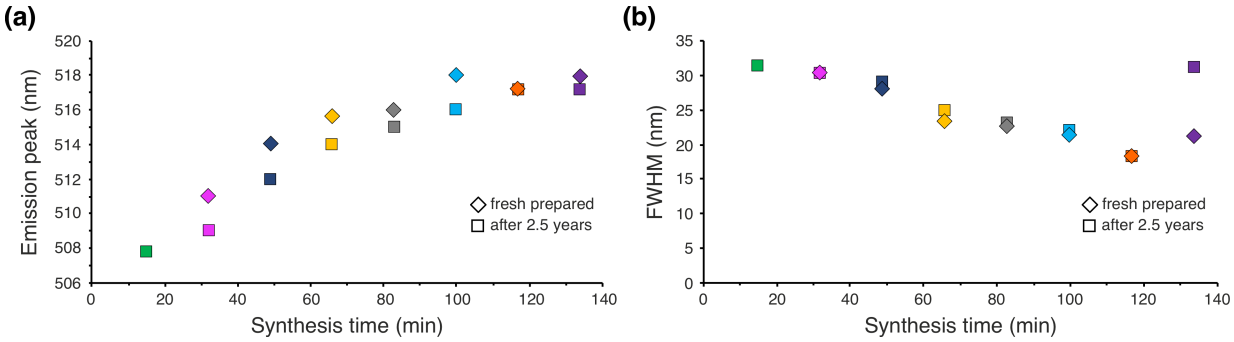

Fig. S4. (Color online) Sample stability test: (a) emission peak position (λ_{ex} = 365 nm) and (b) FWHM value dependences on samples synthesis time.

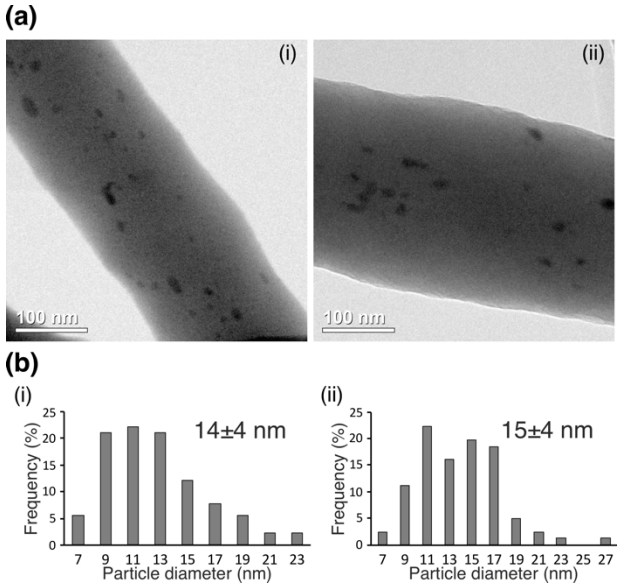

Fig. S5. (Color online) TEM images of nonwoven fibers (a) and perovskite QDs size distribution diagrams (b) of samples S7 (i) and S8 (ii) after 2.5 years.

An estimate for the diffusion coefficient of perovskite particles in the spinning solution

Following Holyst et al. [1], the diffusion coefficient of nanoparticles in the polymer solution is determined by Stokes–Einstein formula $D_A=k_BT/6\pi\eta r$, where r is the nanoparticle radius and η is the nanoviscosity. The value of η is estimated according to the formula:

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$$\eta = \eta_0 \exp\left(K r^a x^{0.75a}\right), \qquad \text{(S1)}$$

where

$$K = b\left[\left(\frac{\mu_P}{4/3\pi N_A}\right)^{-3/4} R_g^{5/4}\right]^a,$$

η_0 is the solvent macroviscosiry, μ_P is the polymer molar mass (in g mol^{-1}), x is the polymer mass concentration (in g cm^{-3}), N_A is the Avogadro constant, a=0.7, b=1.45, R_g=0.02 $\mu_P^{0.58}$ is the polymer gyration radius (in nm). Using η_0 = 0.7435 mPa s, μ_P= 0.625 and $r \sim(\Omega_A/2)^{1/3}$, where Ω_A is the volume of the perovskite binary compound, yields $D_A \sim 2\times10^{-10}$ m^{2}s^{-1}.

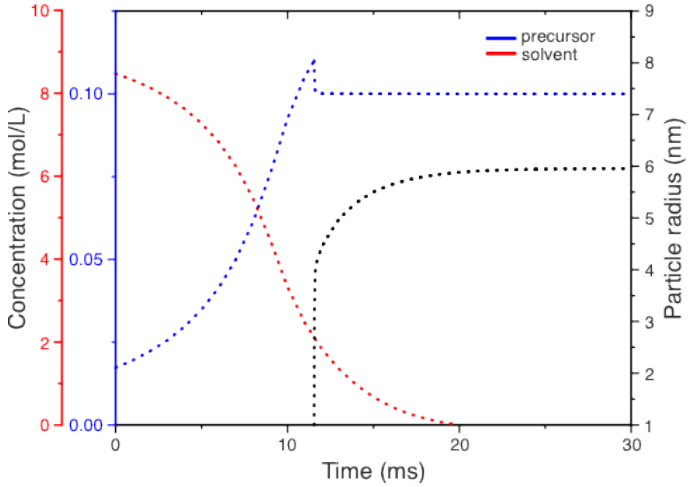

Fig. S6. (Color online) Dependence of the solvent concentration (red lines), precursor concentration (blue lines) and the radius of perovskite particles (black lines), versus the growth time for the case corresponding to the lower initial concentration of solvent. The following values of the model parameters are used: T=25°C, k_g=0.5 m s^{-1}, $\tilde{p}_S$ =1013 Pa, Ω_S =0.172 nm^3, R^*=1 nm.

References

[1] Holyst R, Bielejewska A, Szymański J, et al. Scaling form of viscosity at all length-scales in poly(ethylene glycol) solutions studied by fluorescence correlation spectroscopy and capillary electrophoresis. Phys Chem Chem Phys, 2009,11: 9025

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