Supporting Information

Aligned Packaging of *in-situ* Grown $CsPbBr_3$ Nanorods within Polystyrene Nanofibers for Enhanced Polarized Luminescence Properties

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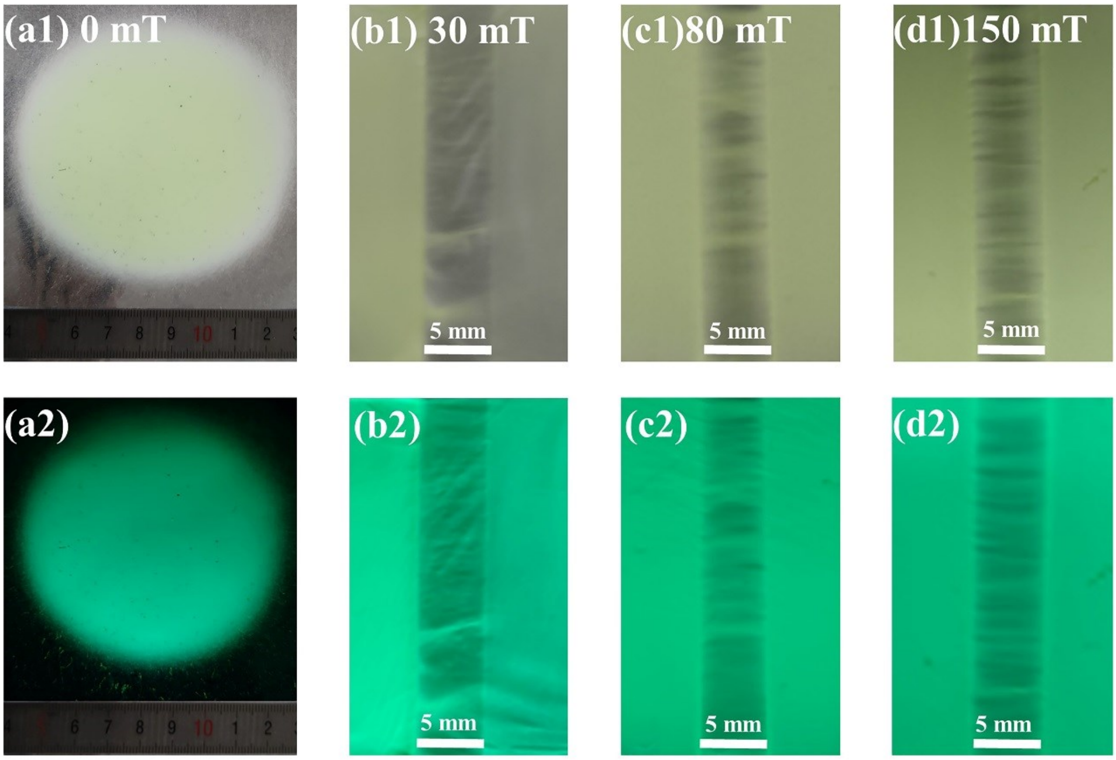

Fig. S1 (a-d) Photographs of $CsPbBr_3$ NR@PS membranes prepared with different magnetic field strengths under daylight (top) and UV irradiation (bottom).

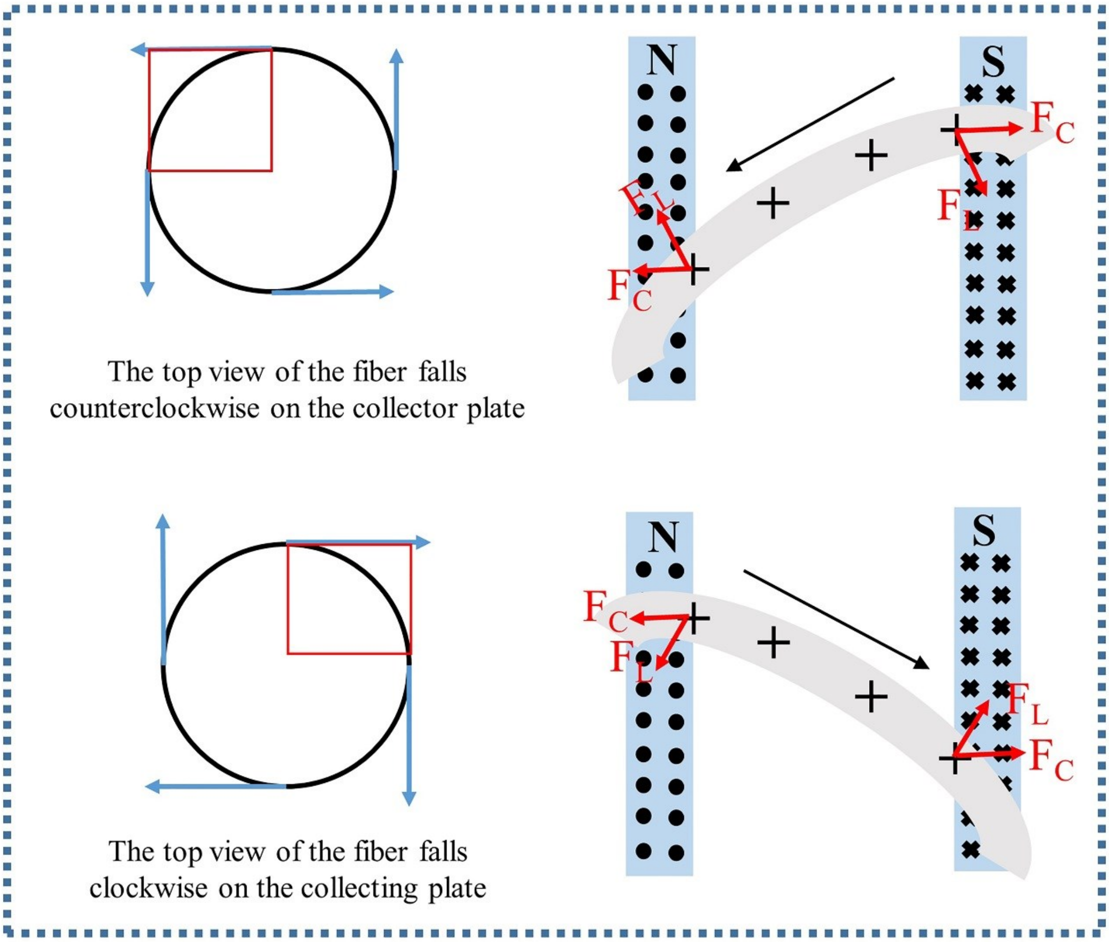

Fig. S2 Mechanism diagram of the fiber macro-orientation in the membrane with the assistant of the magnetic field force.

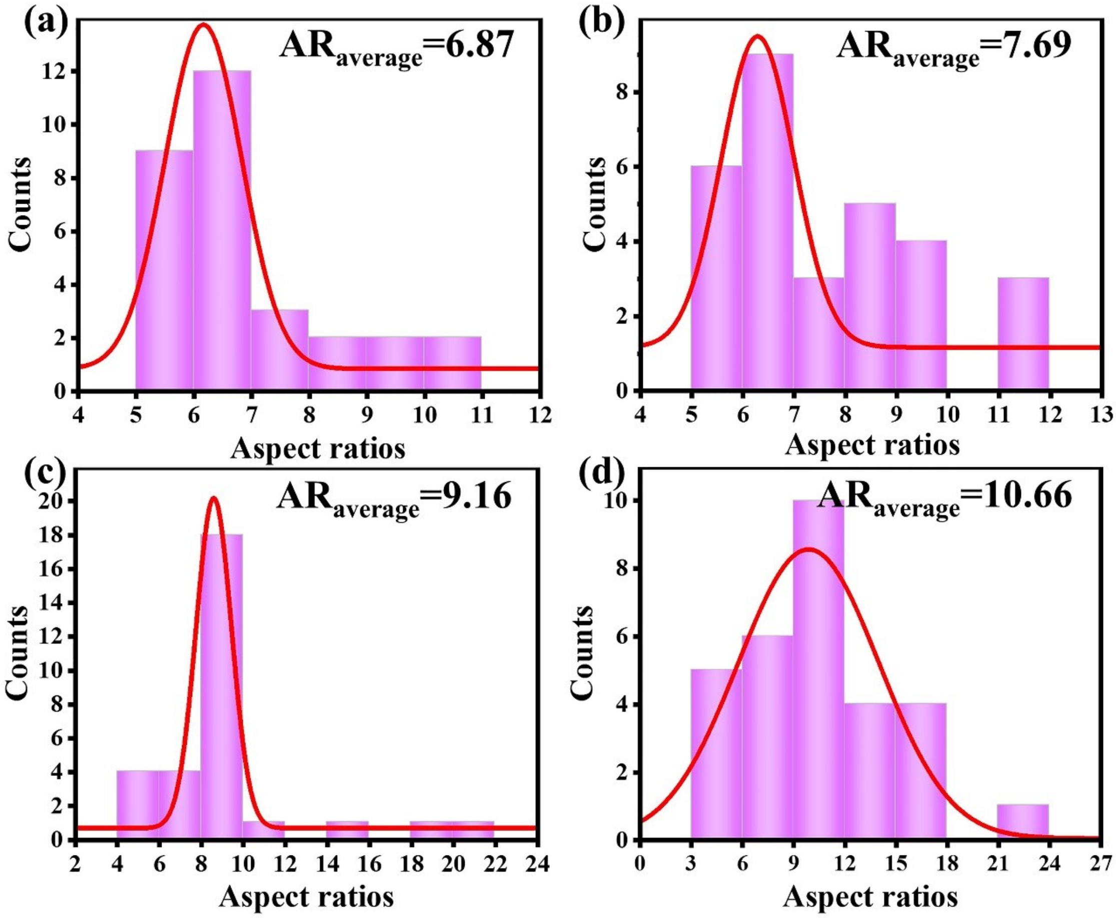

Fig. S3 (a-d) The aspect ratios distribution histograms for $CsPbBr_3$ NR@PS nanofibers prepared with different magnetic field strengths. (a): 0 mT; (b): 30 mT; (c): 80 mT; (d): 150 mT.

Table S1 Aspect ratios (AR) of the $CsPbBr_3$ NRs prepared with different magnetic field strengths

Sample	**Fiber diameter$_{avg}$ (nm)**	**Nanorod diameter$_{avg}$ (nm)**	**Nanorod length$_{avg}$ (nm)**	**AR$_{avg}$**
0 mT	600	25	171	6.87
30 mT	540	24	178	7.69
80 mT	491	22	180	9.16
150 mT	428	23	229	10.66

Table S2 Overview of aspect ratios and polarization ratios of halide perovskite nanocrystals coated by polymer

Materials	Synthetic method	AR	Macroscopic orientation	P_{em}	P_{ex}	Size (cm^2)	Ref.
$CsPbBr_3$ NR@PS	Magnetic field assisted electrospinning	10.6	Yes	0.23		0.5×10	This work
$CsPbBr_3$ NR@PS	Electrospinning	7	No	~	~	~	1
$MAPbBr_3$ NR@PVA	Electrospinning (Parallel positioned conductor strips with an air gap as collector)	6	Yes	~	0.42±0.03	0.5×2	2
$CsPbBr_3$ NR@PU	Electrospinning (Parallel positioned conductor strips with an air gap as collector)	~	Yes	0.3	~	Centimeter level	3
$MAPbBr_3$ NR@ PVDF	Drop-cast stretch	~	No	0.33	~	~	4

Table S3 Optical parameters of $CsPbBr_3$ NR@PS nanofiber membranes prepared with different magnetic field strengths

Sample	Absorption Peak (nm)	E_g (eV)	PL Peak (nm)	FWHM (nm)	τ_1 (ns)	A_1 (%)	τ_2 (ns)	A_2 (%)	τ_3 (ns)	A_3 (%)	τ_{avg} (ns)
0 mT	537.6	2.347	516.3	23.01	5.81	65.97	20.57	30.10	123.61	3.93	50.44
30 mT	540.3	2.342	516.0	23.06	5.85	66.00	19.93	30.38	121.17	3.62	47.16
80 mT	540.6	2.337	517.2	23.05	5.31	63.26	18.67	32.59	110.69	4.15	45.60
150 mT	540.3	2.340	516.4	22.91	5.67	63.07	18.52	33.38	117.41	3.55	44.82

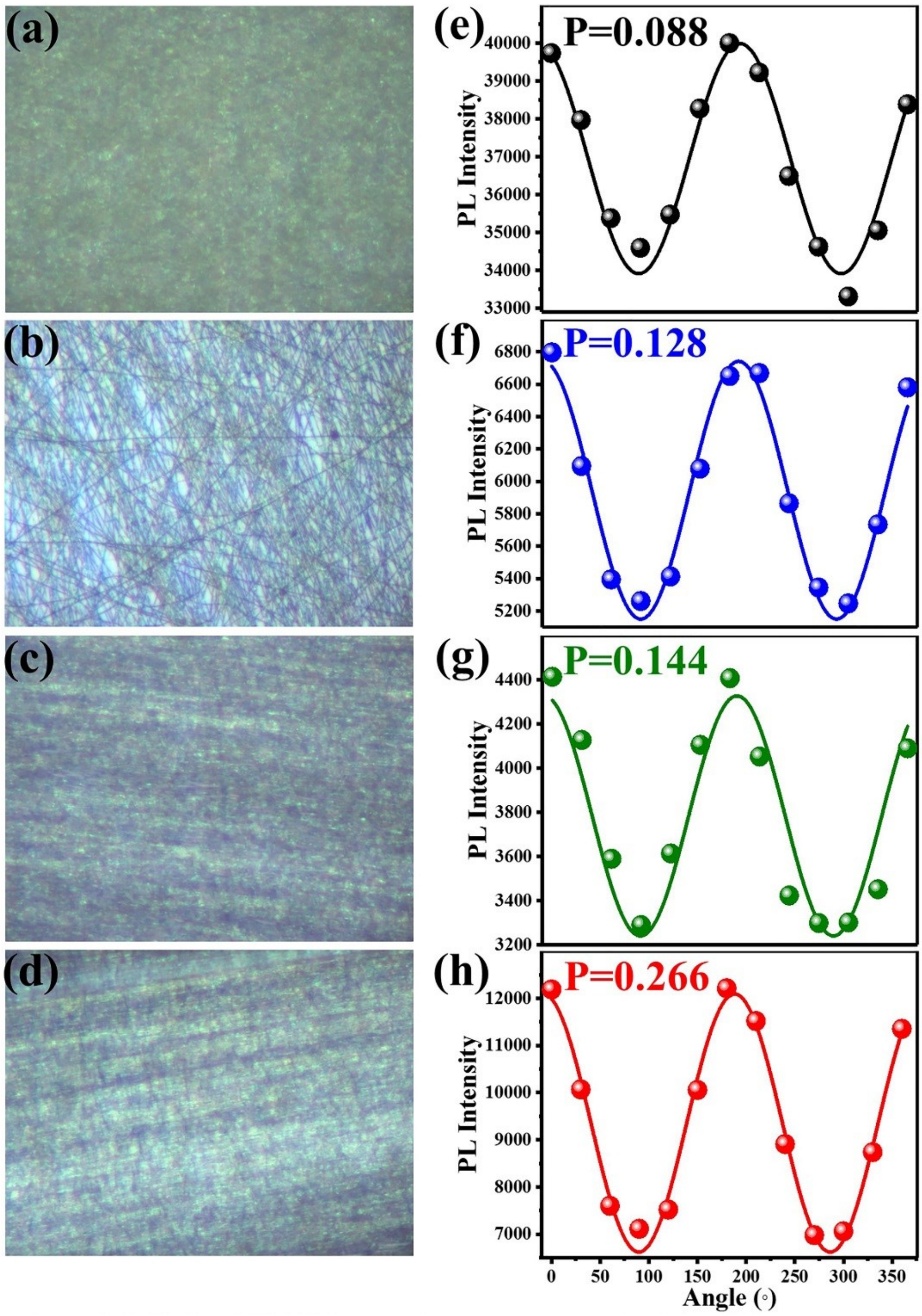

Fig. S4 (a-d) Micrographs of $CsPbBr_3$ NR@PS membranes prepared with different magnetic field strengths; (e-h) polarization anisotropy of the emission of $CsPbBr_3$ NR@PS nanofiber membranes prepared with different magnetic field strengths. (a, e): 0 mT; (b, f): 30 mT; (c, g): 80 mT; (d, h): 150 mT.

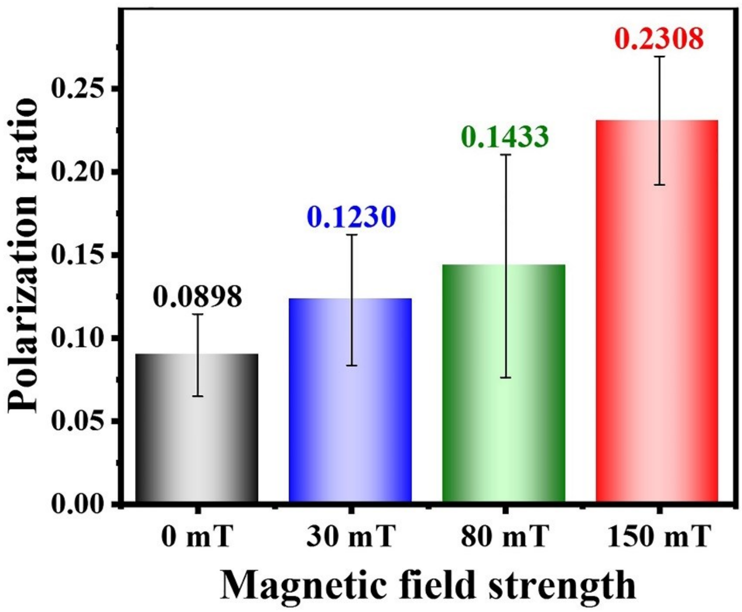

Fig. S5 The histograms of the average polarization ratios of the aligned $CsPbBr_3$ NR@PS nanofiber membranes prepared with different magnetic field strengths.

Table S4 The polarization ratios of the $CsPbBr_3$ NRs obtained theoretically with different magnetic field strengths

Sample	$\varepsilon_{(CrPbBr_3)}$	$\varepsilon_{(PS)}$	**AR**	$P_{experiment}$	$P_{em\text{-}theory}$	$P_{ex\text{-}theory}$
0 mT	6.35	2.45	6.87	0.0898	0.206	0.473
30 mT	6.35	2.45	7.69	0.1230	0.215	0.482
80 mT	6.35	2.45	9.16	0.1433	0.227	0.492
150 mT	6.35	2.45	10.66	0.2308	0.236	0.499

The calculation process of theoretical luminance polarization ratios:

Due to the experimental preparation of perovskite nanocrystals with larger AR, the physical model of dielectric confinement effects compared with quantum confinement effects is more suitable for describing the polarization optical performance of $CsPbBr_3$ NR@PS fiber membrane. The polarization emission (P_{em}) and polarization excitation (P_{ex}) of $CsPbBr_3$ NR@PS nanofibers can be calculated by the dielectric ellipsoid model,[2] which described as follows:

$$P_{em} = \frac{9(k^2-1)^2}{23k^4+34k^2+3} \tag{1}$$

$$P_{ex} = \frac{1-k^2}{1+k^2} \tag{2}$$

where k is the ratio of field strength between the major and minor axes of $CsPbBr_3$ NRs and can be calculated as

$$k = \frac{\varepsilon_1 + (\varepsilon_2 - \varepsilon_1)n_{//}}{\varepsilon_1 + (\varepsilon_2 - \varepsilon_1)n_{\perp}} \tag{3}$$

where ε_1 and ε_2 represent the dielectric constant of PS and $CsPbBr_3$ NRs, respectively. $n_{\parallel}$ and $n_{\perp}$ can described by the major (c) and minor axes (a) of the ellipsoid as following

$$n_{//} = \frac{1-\left(\sqrt{1-\frac{a^2}{c^2}}\right)^2}{2\left(\sqrt{1-\frac{a^2}{c^2}}\right)^3}\left(\ln\frac{1+\sqrt{1-\frac{a^2}{c^2}}}{1-\sqrt{1-\frac{a^2}{c^2}}} - 2\sqrt{1-\frac{a^2}{c^2}}\right) \tag{4}$$

$$n_{\perp} = \frac{1}{2}(1-n_{//}) \tag{5}$$

Reference:

1. H. Zhang, D. Fu, Z. Du, H. Fu, G. Shao, W. Yang and J. Zheng, *Ceram. Int.*, 2020, **46**, 18352-18357.
2. L. Meng, C. Yang, J. Meng, Y. Wang, Y. Ge, Z. Shao, G. Zhang, A. L. Rogach and H. Zhong, *Nano Res.*, 2019, **12**, 1411-1416.
3. T. Guner, G. Topcu, U. Savaci, A. Genc, S. Turan, E. Sari and M. M. Demir, *Nanotechnology*, 2018, **29**, 135202.
4. W.-G. Lu, X.-G. Wu, S. Huang, L. Wang, Q. Zhou, B. Zou, H. Zhong and Y. Wang, *Adv. Opt. Mater.*, 2017, **5**, 1700594.