Supplementary information

High stability of robust anti-thermal-quenching lead-free double perovskite crystals for optoelectronic devices and high-performance fibers

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Table S1. Chemical composition (at %) of $Cs_2NaHo_{1-x}Cl_6$:xSb^{3+}measured by EDS.

x	Cs	Na	Ho	Cl	Sb
0	21.52	8.59	10.96	58.93	/
0.008	16.18	22.10	8.85	51.81	1.06

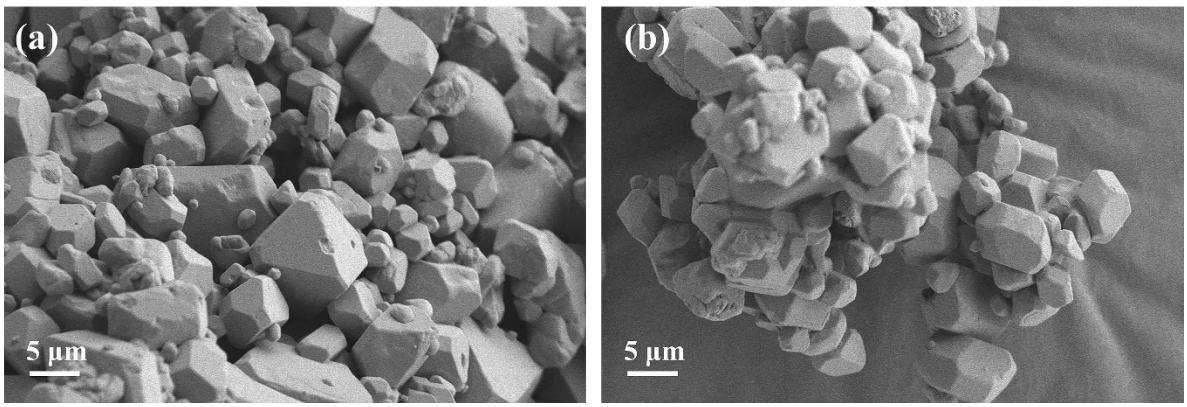

Figure S1 Scanning electron microscope (SEM) images of $Cs_2NaHoCl_6:Sb^{3+}$perovskite crystals (PCs).

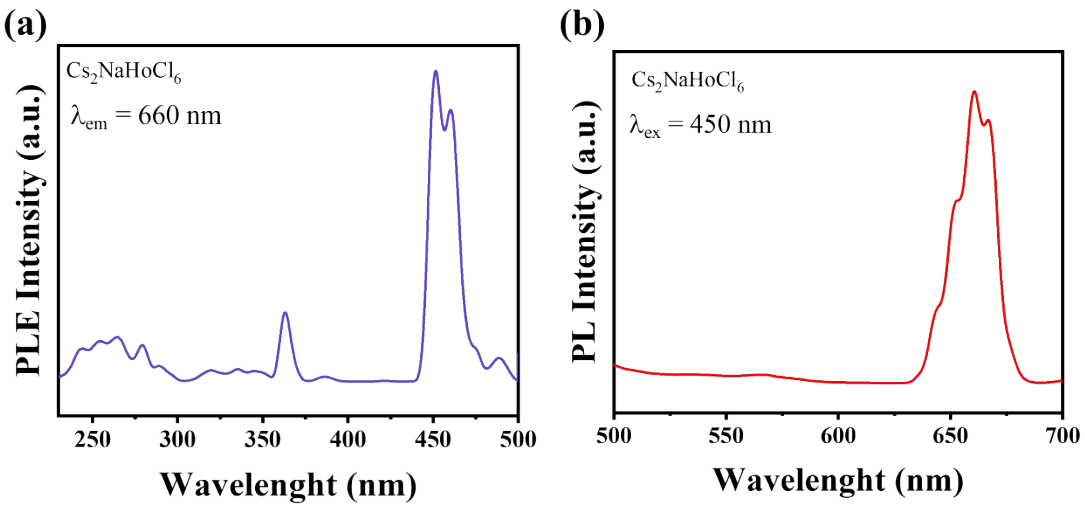

Figure S2 (a) Photoluminescence excitation (PLE) spectrum of $Cs_2NaHoCl_6$ PCs. (b) Photoluminescence (PL) spectrum of $Cs_2NaHoCl_6$ PCs.

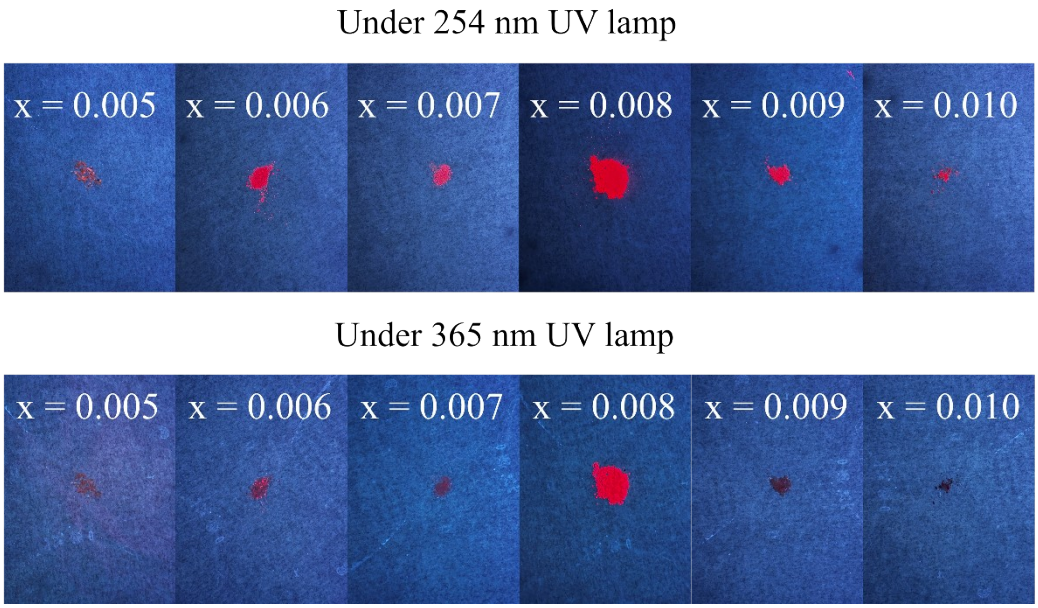

Figure S3 Fluorescence performance of $Cs_2NaHo_{1-x}Cl_6$:xSb^{3+} PCs under ultraviolet (UV) lamp (254 nm, 365 nm).

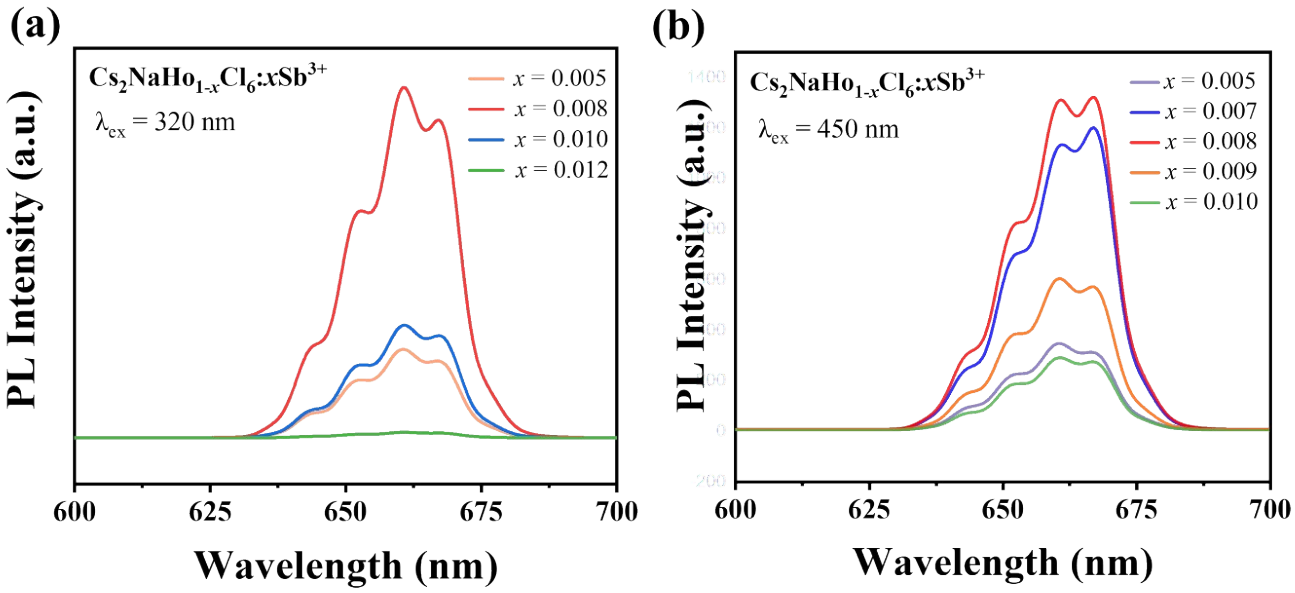

Figure S4 PL (excited by 320 nm UV-light) spectra of $Cs_2NaHo_{1-x}Cl_6$: xSb^{3+} PCs. PL (excited by 450 nm blue-light) spectra of $Cs_2NaHo_{1-x}Cl_6$: xSb^{3+} PCs.

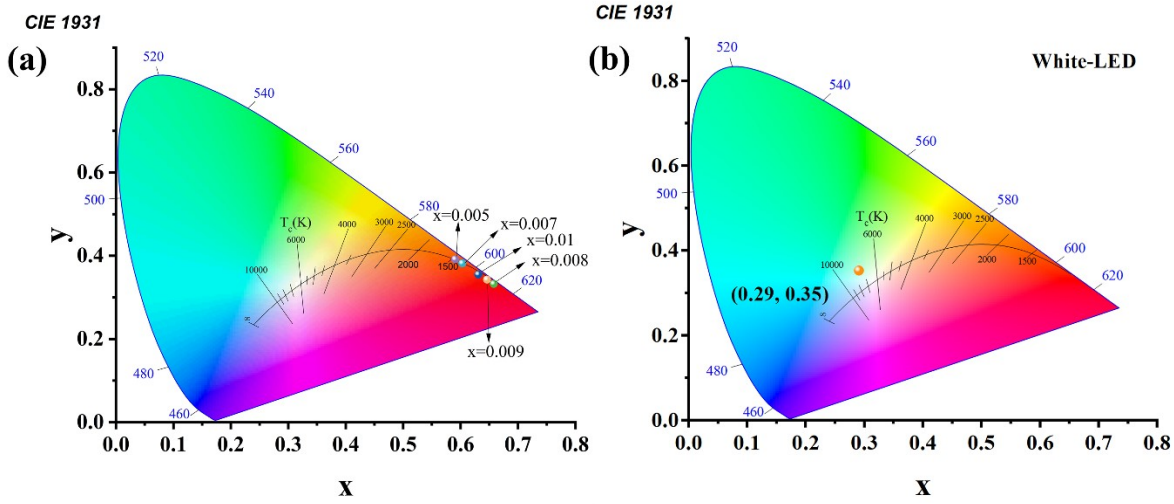

Figure S5 (a) Commission Internationale de L'Eclairage (CIE) color coordinates of $Cs_2NaHo_{1-x}Cl_6$: $x$$Sb^{3+}$ PCs. (b) CIE color coordinates of white LED.

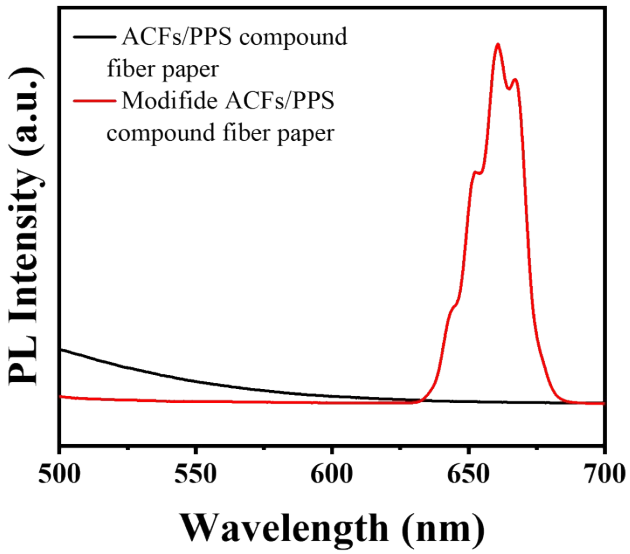

Figure S6 PL (excited by 250 nm UV light) spectra of aramid chopped fibers (ACFs) and polyphenylene sulfide (PPS) compound fiber without modification and modified.

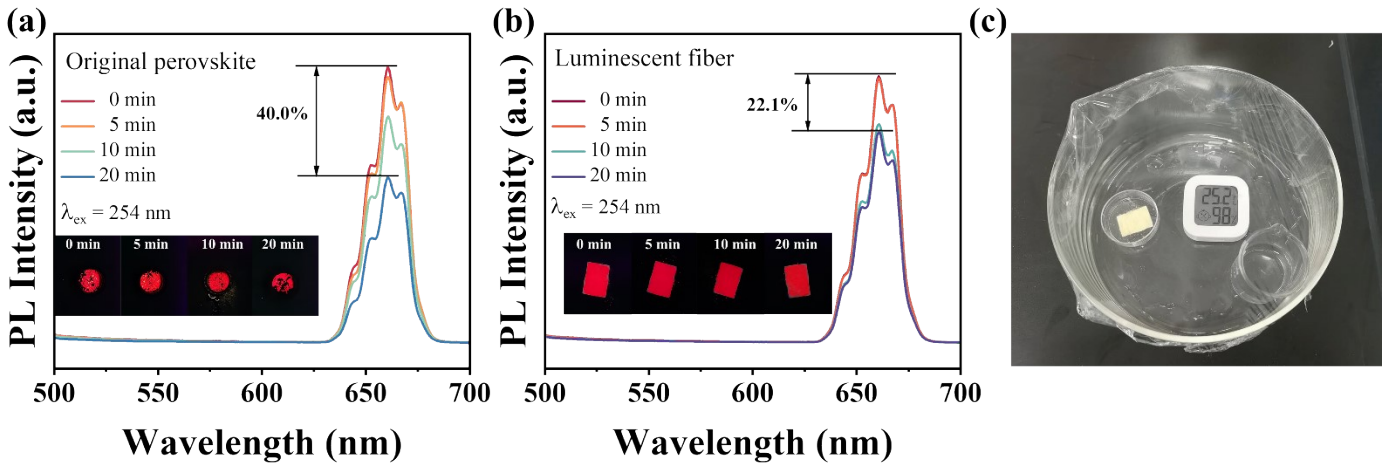

Figure S7 (a) PL spectra of the original perovskite powder at 98% humidity. (b) PL spectra of luminescent fibers at 98% humidity. (c) Luminescence stability test in humid environments.

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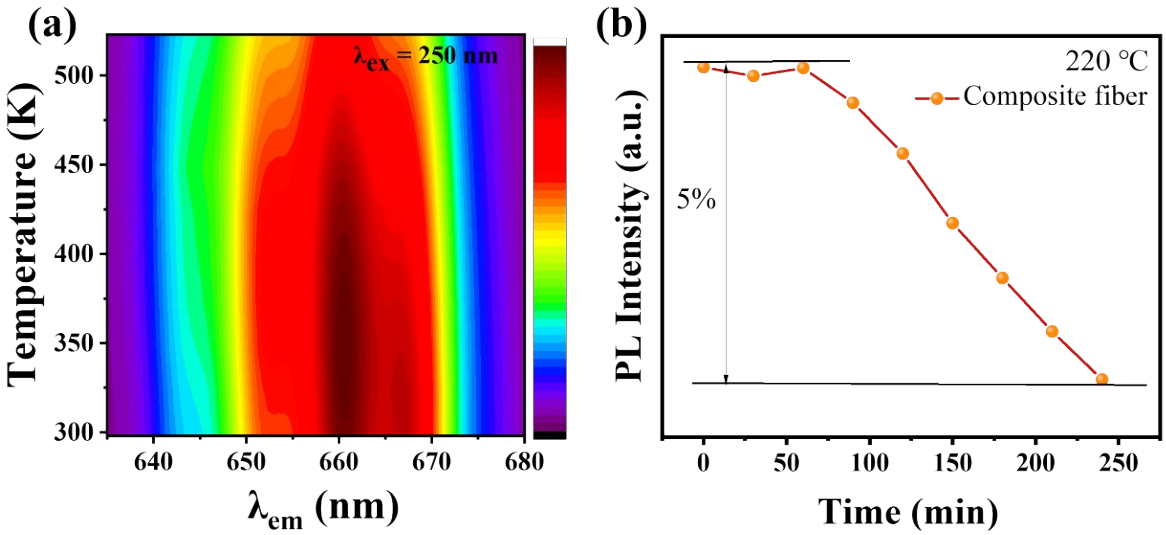

Figure S8 (a) Temperature-dependent PL spectra of ACFs/PPS flexible luminescent fiber paper. (b) The luminescence intensity of flexible luminescent fiber changes at a sustained 220 ℃.