Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C.

Support Information

Stable and self-healing perovskite for high-speed underwater optical wireless communication

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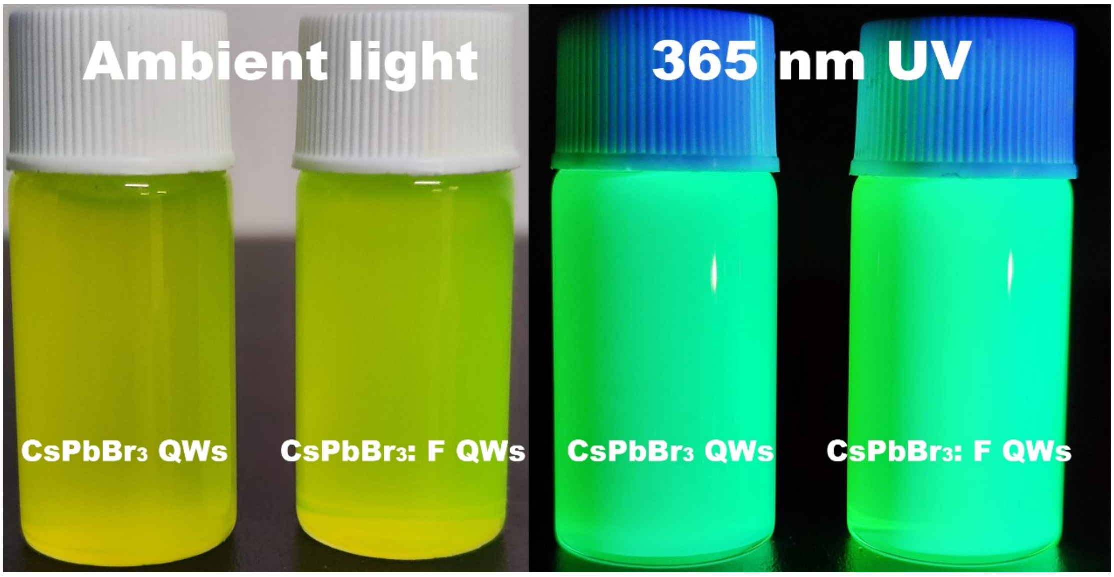

Figure S1 Photographs of $CsPbBr_3$:F QWs and $CsPbBr_3$ QWs solutions in toluene under ambient light and 365 nm UV light.

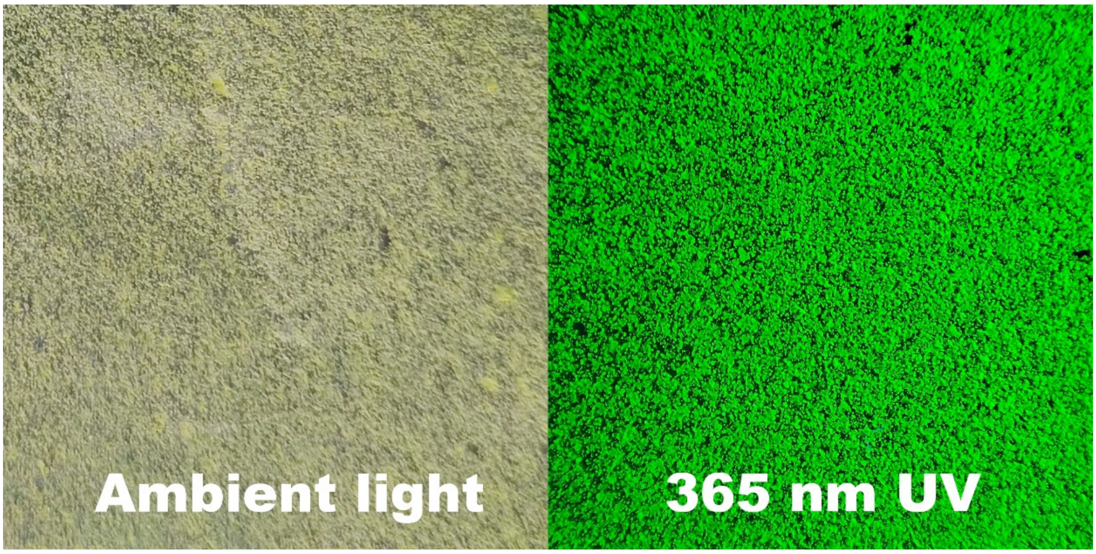

Figure S2 Photographs of electrospun $CsPbBr_3$: F QWs -SEBS fiber under ambient light and 365 nm UV light.

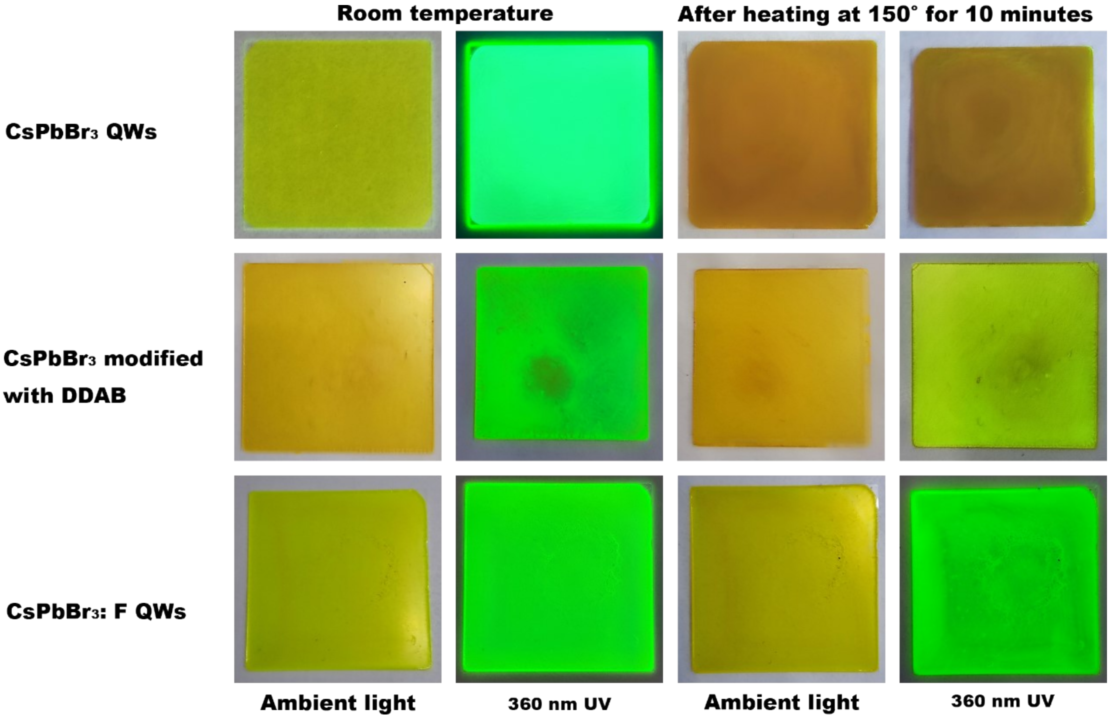

Figure S3 Photographs of $CsPbBr_3$:F QWs, $CsPbBr_3$ QWs, and $CsPbBr_3$ modified with DDAB after heating to 150°C for 10 minutes under 365 nm UV light and natural light.

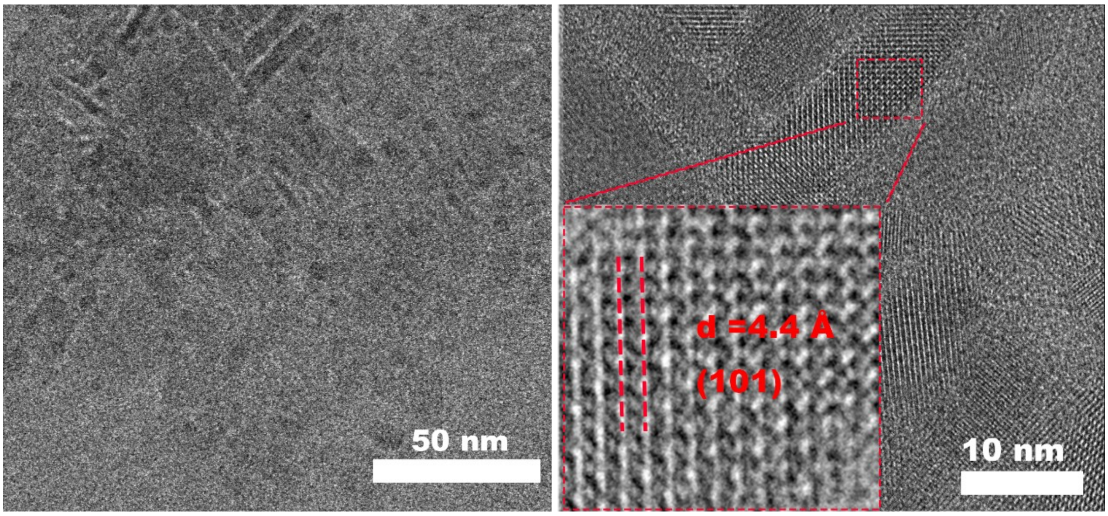

Figure S4 TEM and HRTEM images of $CsPbBr_3$ QWs. $CsPbBr_3$ QW displays lattice fringes with an interplanar spacing of 4.4 Å, corresponding to the (101) lattice plane.

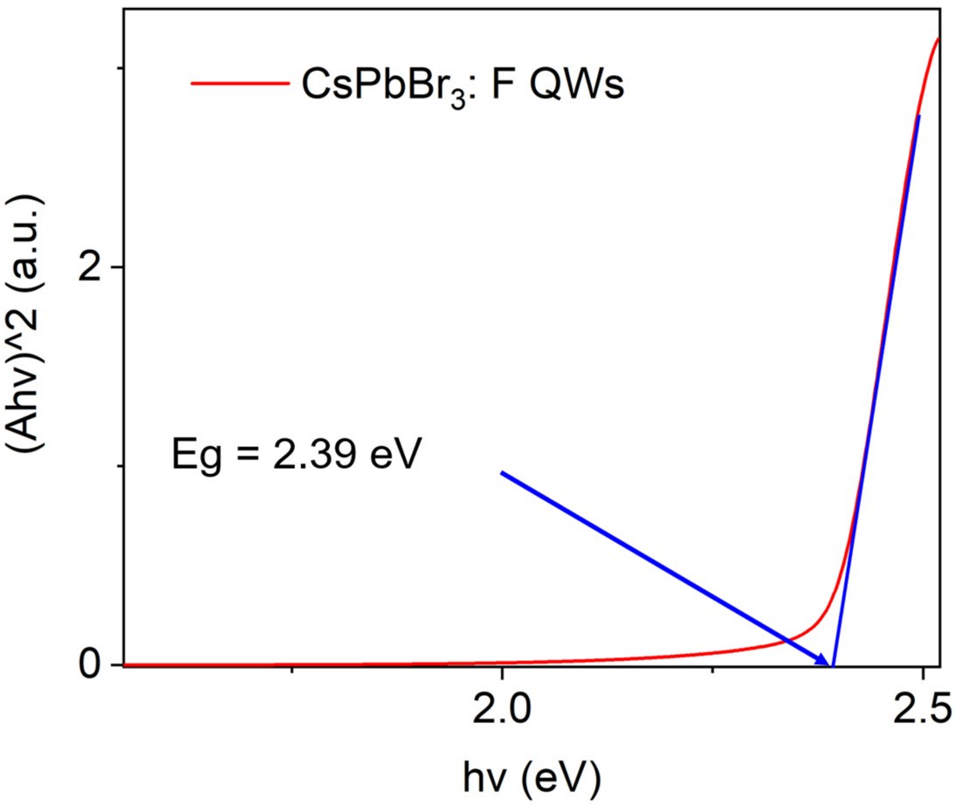

Figure S5 Kubelka-Munk plots of $CsPbBr_3$:F QWs.

Table S1 Fitting parameters of $CsPbBr_3$:F QWs and $CsPbBr_3$ QWs.

Sample	τ_1（ns）	τ_2（ns）	A_1	A_2	τ_{avg}（ns）
QWs	65.38	8.35	0.25	0.75	49.55
$CsPbBr_3$: F QWs	58.28	5.76	0.48	0.52	53.20

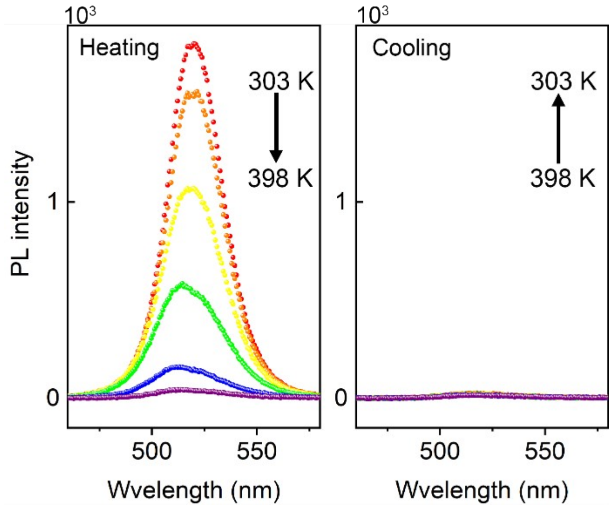

Figure S6 The PL intensity of $CsPbBr_3$ QWs during the heating process from 303 K to 393 K and the subsquent cooling process from 393 K to 303 K.

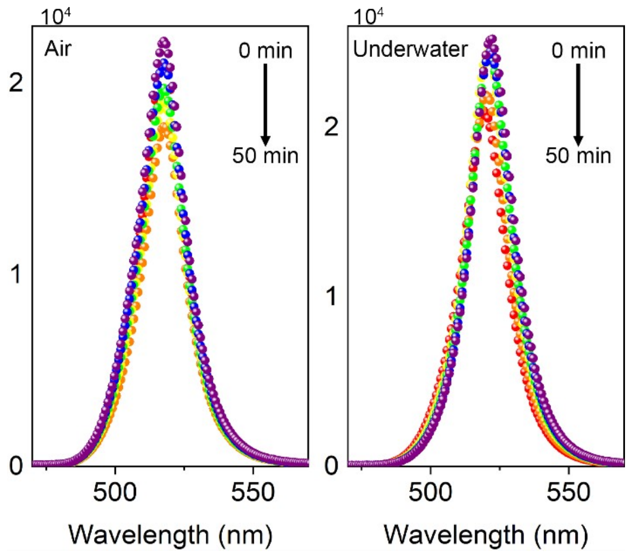

Figure S7 The PL intensity of TFE-HF-QWs in air and water recorded from 0 minutes to 50 minutes.

Table S2 Communication performance of perovskites-based devices in previous literatures and this work

Material	Light source（nm）	PLQY	Communication environment	Date rate	Ref
$CsPbBr_{1.8}I_{1.2}$ (solution)	LED (450)	~78%	Air	300 Mbps	[1]
$CsPbBr_3$ (thin film)	LD (375)	~73%	Air	34 Mbps	[2]
$CsPbBr_3$ (in glass)	LD (450)	~70%	Water	185 Mbps	[3]
$CsPbBr_3$ (in solution)	LD (440)	~70%	Water	40 Mbps	[4]
$CsPbBr_3$:F (in colloids)	LD (450)	~65.6%	Water	60 Mbps	This work

References:

[1] S. Mei, X. Liu, W. Zhang, R. Liu, L. Zheng, R. Guo, P. Tian, High-Bandwidth White-Light System Combining a Micro-LED with Perovskite Quantum Dots for Visible Light Communication, ACS Appl. Mater. Interfaces 2018，10, 5641-5648.

[2] C.H. Kang, I. Dursun, G. Liu, L. Sinatra, X. Sun, M. Kong, J. Pan, P. Maity, E.-N. Ooi, T.K. Ng, O.F. Mohammed, O.M. Bakr, B.S. Ooi, High-speed colour-converting photodetector with all-inorganic $CsPbBr_3$ perovskite nanocrystals for ultraviolet light communication, Light Sci. Appl. 2019，8，94.

[3] M. Xia, S. Zhu, J. Luo, Y. Xu, P. Tian, G. Niu, J. Tang, Ultrastable Perovskite Nanocrystals in All‐Inorganic Transparent Matrix for High‐Speed Underwater Wireless Optical Communication, Adv. Opt. Mater. 2021，9，2002239.

[4] X. Li, Z. Tong, W. Lyu, X. Chen, X. Yang, Y. Zhang, S. Liu, Y. Dai, Z. Zhang, C. Guo, J. Xu, Underwater quasi-omnidirectional wireless optical communication based on perovskite quantum dots, Opt. Express 2022，30，1709.