All-inorganic halide-perovskite polymer-fiber-photodetector for high-speed optical wireless communication: supplement

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Supplementary Information

All-inorganic halide-perovskite polymer-fiber-photodetector for high-speed optical wireless communication

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Fig. S1. Normalized absorption and photoluminescence (PL) intensity of CsPbBr$_3$ nanocrystals in IBOA composite with varying concentrations of (a) 20 mg/mL, (b) 10 mg/mL, (c) 5 mg/mL, (d) 2 mg/mL, (e) 1 mg/mL, (f) 0.5 mg/mL, and (g) 0.2 mg/mL, as well as the corresponding absorption edge with different NCs concentrations. (h) The PL intensity and overlapping percentage of emission-absorption calculated from (a) to (g).
Fig. S2. Photoluminescence excitation (PLE) spectrum of CsPbBr$_3$-IBOA composite

Fig. S3. Normalized photoluminescence and absorption spectra of pristine CsPbBr$_3$ NCs
Fig. S4. (a) Photograph of CsPbBr₃ NCs in toluene, CsPbBr₃ NCs in IBOA and PI, as well as pristine IBOA and PI samples. (b) Raman spectra of CsPbBr₃ NCs (see green line), IBOA (see blue line), CsPbBr₃-IBOA composite (see both red and black lines under 633-nm and 532-nm excitation, respectively). The Raman spectra of IBOA was acquired with 532 nm as no signal was observed under 633-nm excitation. The peak position indicated with the asterisk mark (*), especially the peaks at ~87 and 128 cm⁻¹, were assigned to the vibrational mode of [PbBr₆]⁴⁻ octahedron, as well as the Cs⁺ cations, while the broader peak at ~309 cm⁻¹ was assigned to the second-order phonon mode of the octahedron¹. The two distinct peaks indicated with number sign (#) at the peak positions of ~487, 625 and 632 cm⁻¹ appeared in both pristine IBOA and CsPbBr₃-IBOA mixture under 633-nm excitation.

Fig. S5. Time-resolved photoluminescence (TRPL) decay trace for CsPbBr₃-IBOA composite with varying concentrations of 10 mg/mL, 2 mg/mL, 0.5 mg/mL and 0.075 mg/mL, yielding an average lifetime of ~3.49 ± 0.5 ns.
Fig. S6. Comparison of the received optical power measured from the polar angles ($\theta$) of perovskite-polymer scintillating fiber (black), the commercial Si-based photodetector (red), as well as with additional aspheric condenser lens on the Si-based photodetector (blue).

Fig. S7. (a) Normalized power received from the perovskite-polymer fiber as a function of the illuminated length from the edge of the sample, yielding a self-reabsorption loss of 0.0615 cm$^{-1}$. (b) Measured BER as a function of the illuminated distance from the edge of the sample at 23 Mbit/s based on the non-return-to-zero on-off-keying (NRZ-OOK) modulation scheme.
**Fig. S8.** (a) Measured channel capacity over the transmission channel at varying light intensities. The maximum transmitter power was fixed at 45.7 mW and gradually reduced using a sets of neutral density filters. (b) Normalized channel capacity with varying light power as calculated using the area under the curve measured in (a). (c) The achieved BER with varying light power based on a 4-QAM-OFDM signal with the net data rate of 87.4 Mbit/s.

**References:**