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Supporting information for

Influence of Polymeric Electrets on the Performance of Derived Hybrid Perovskite-Based Photo-memory Devices

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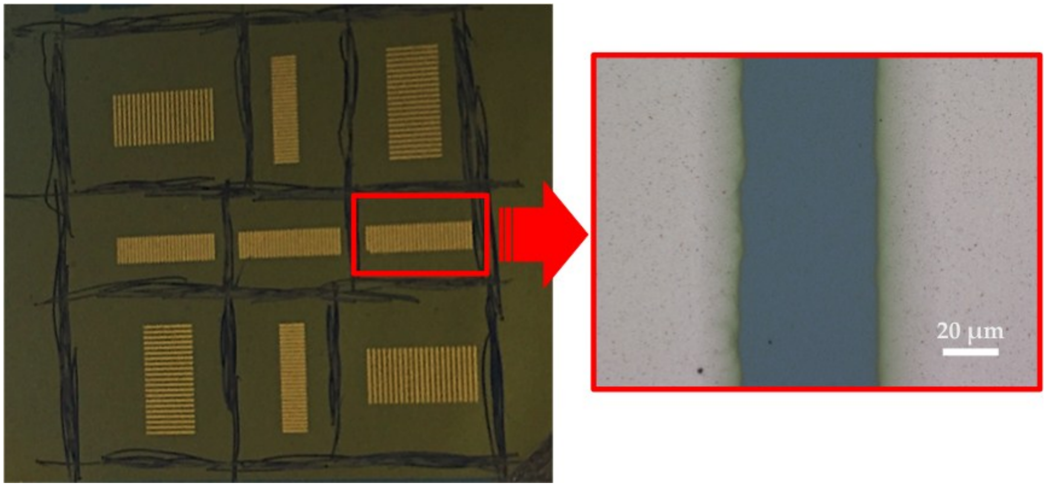

Figure S1. Optical image of the device using perovskite/PMAA as the gate dielectric. (Each pixel area was preserved by scratching as revealed.)

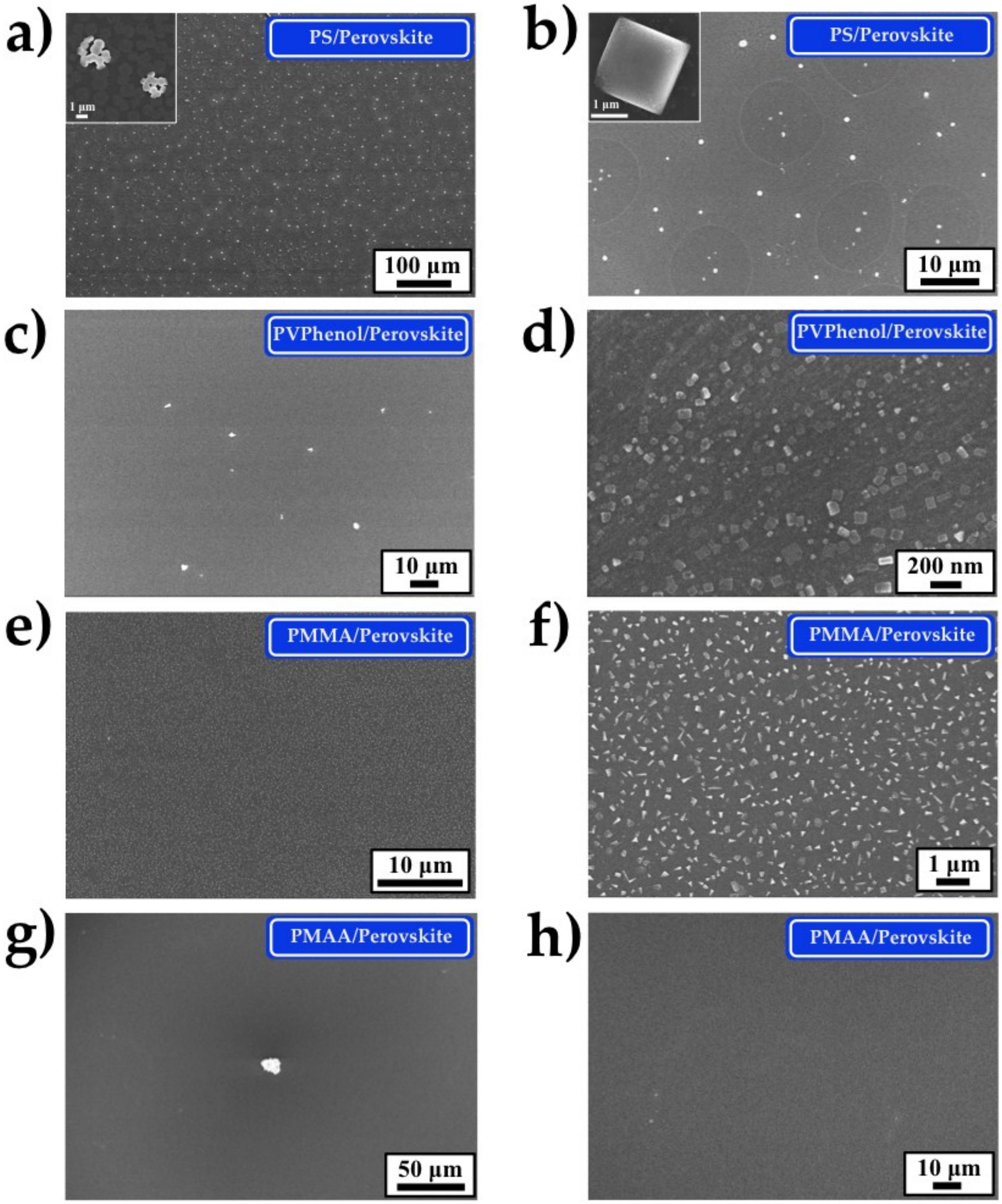

Figure S2. The surface SEM images of the polymer/perovskite blends based on a-b) PS, c-d) PVPh, e-f) PMMA, and g-h) PMAA.

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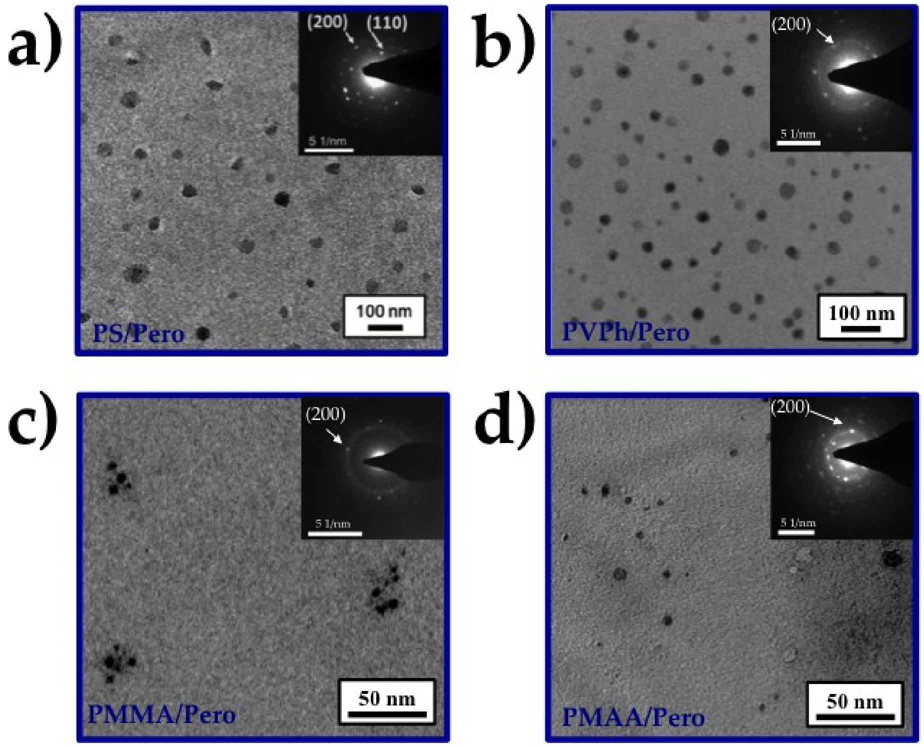

Figure S3. The transmission electron microscope (TEM) images of the polymer/perovskite blends based on a) PS (result shown in our previous work),[1] b) PVPh, c) PMMA, and d) PMAA with an inset of SAED.

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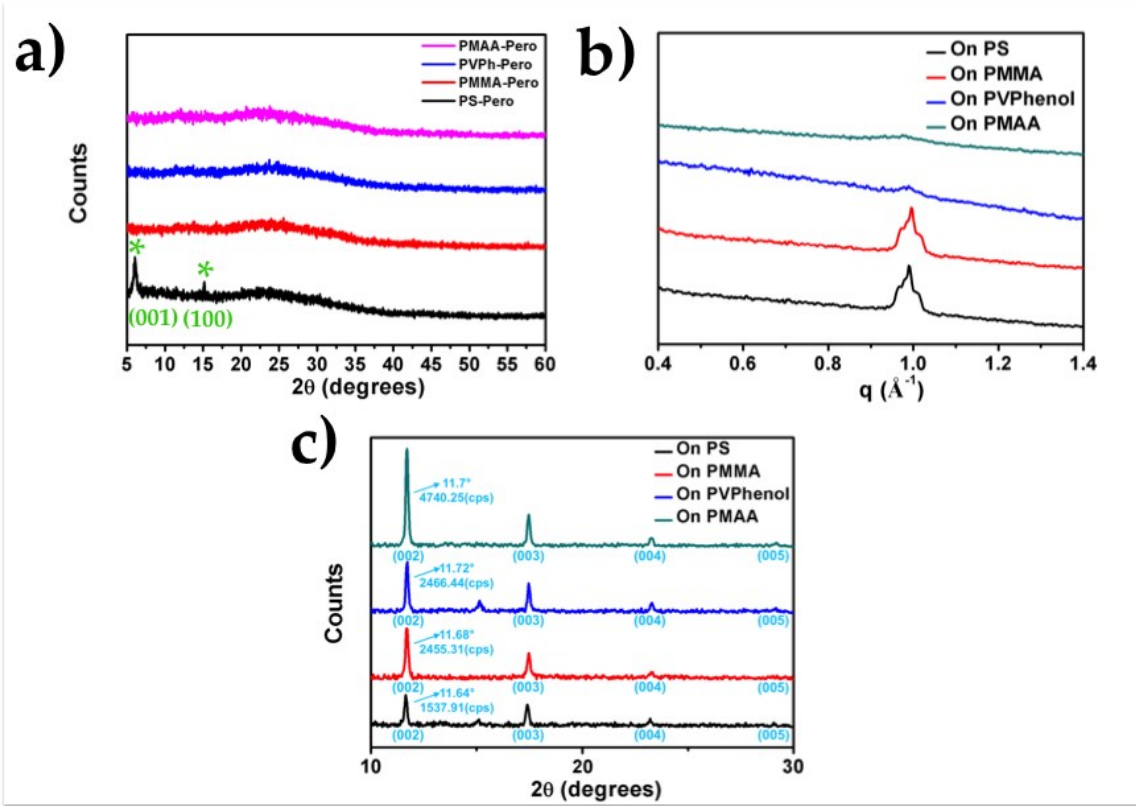

Figure S4. a) XRD (X-ray diffraction / θ-2θ mode) peaks of the perovskite particles. b) Profile of first peak ((100) plane) for GIXD patterns of the polymer/perovskite blends. c) XRD pattern of the pentacene grains grown on different hybrid layers.

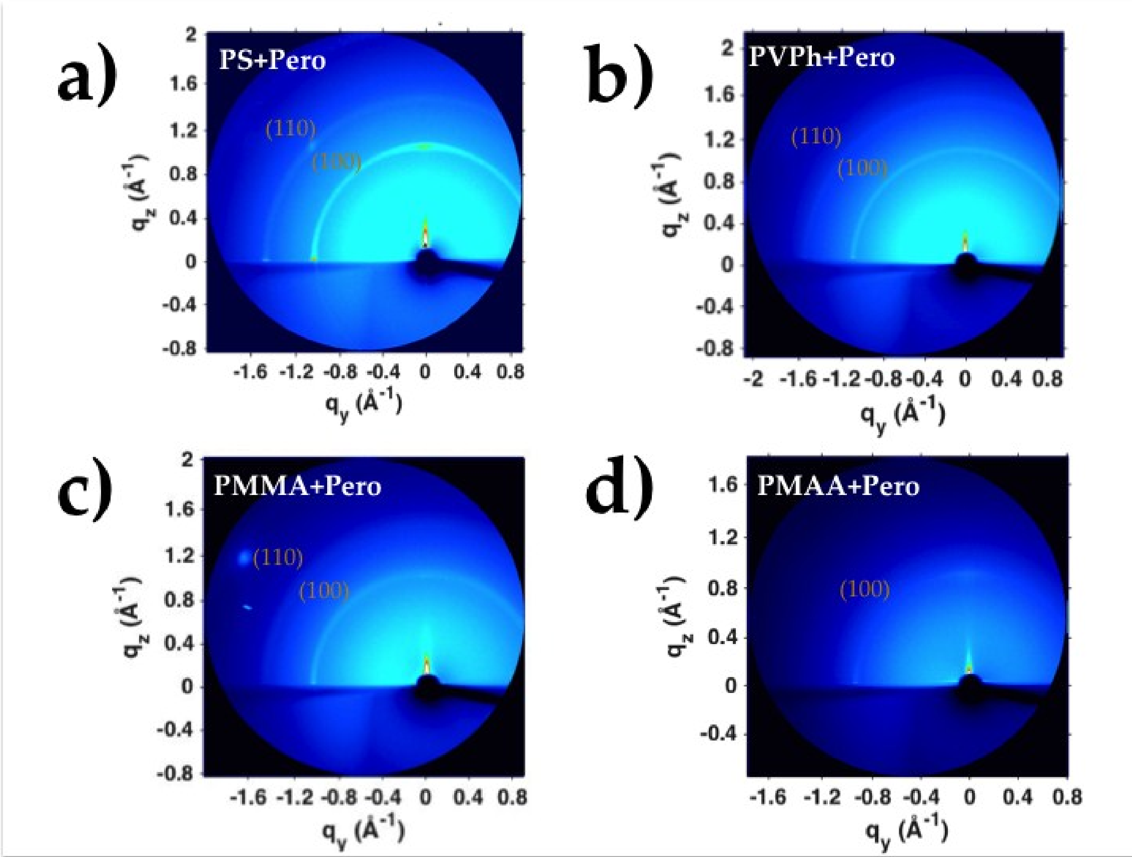

Figure S5. Grazing Incident X-ray Diffraction (GIXD) patterns of the polymer/perovskite blends based on a) PS, b) PVPh, c) PMMA, and d) PMAA.

Table S1. Volume averaged grain size and crystallite size of the pentacene grains and perovskite nanoparticles calculated using Scherrer's equation.

Sample	Crystallite size	Sample	Crystallite size
Polymer / Single-halide perovskite ($MAPbBr_3$) (weight ratio of 2 / 1)			
Perovskite crystallite size in PS	25.76	**Pentacene** on PS – Perovkite layer	61.52
Perovskite crystallite size in PVPh	24.0	**Pentacene** on PVPh – Perovskite layer	57.01
Perovskite crystallite size in PMMA	17.5	**Pentacene** on PMMA – Pero layer	63.53
Perovskite crystallite size in PMAA	8.29	**Pentacene** on PMAA – Pero layer	67.79

Volume averaged grain size *D*
(size of crystallite)

Scherrer's Equation

$$D = \frac{K\lambda}{FWHM\ \cos\theta}$$

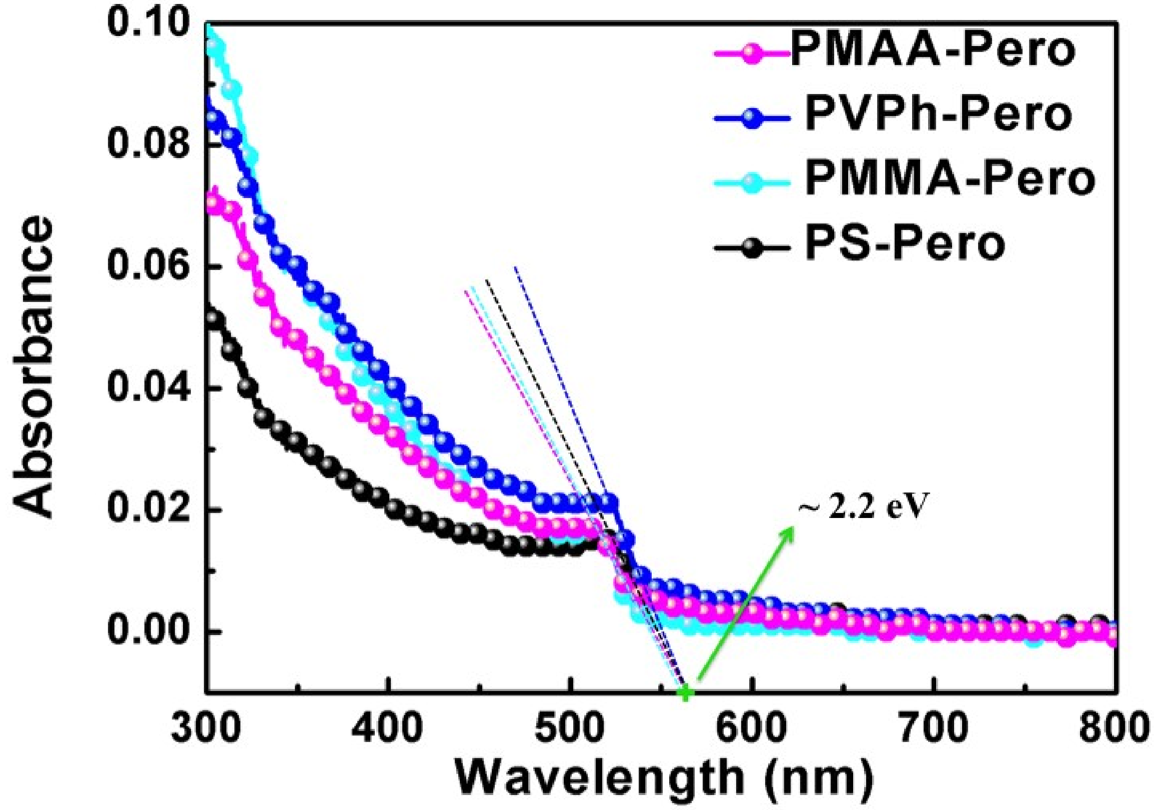

Figure S6. UV-vis spectra of the polymer/perovskite blends, wherein the onset of the absorption edge is indicated.

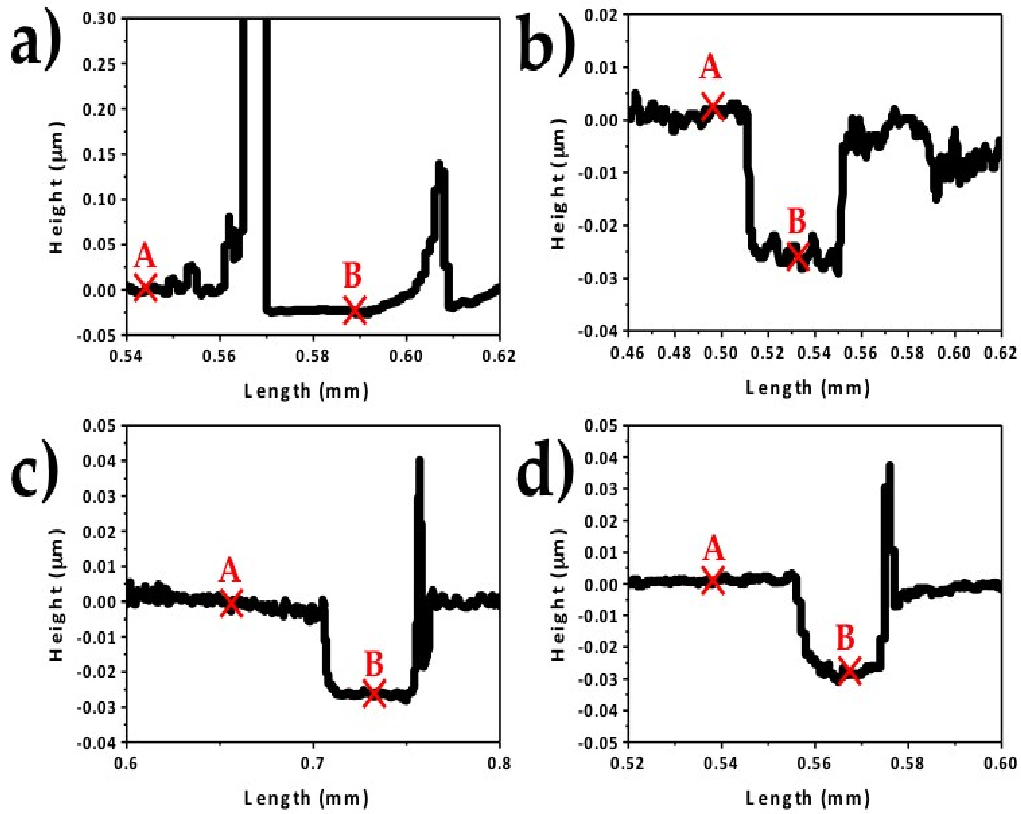

Figure S7. Surface profiles of the spin-coated perovskite/polymer films. (A and B represent the maximum and minimum thickness (after scratch), respectively.)

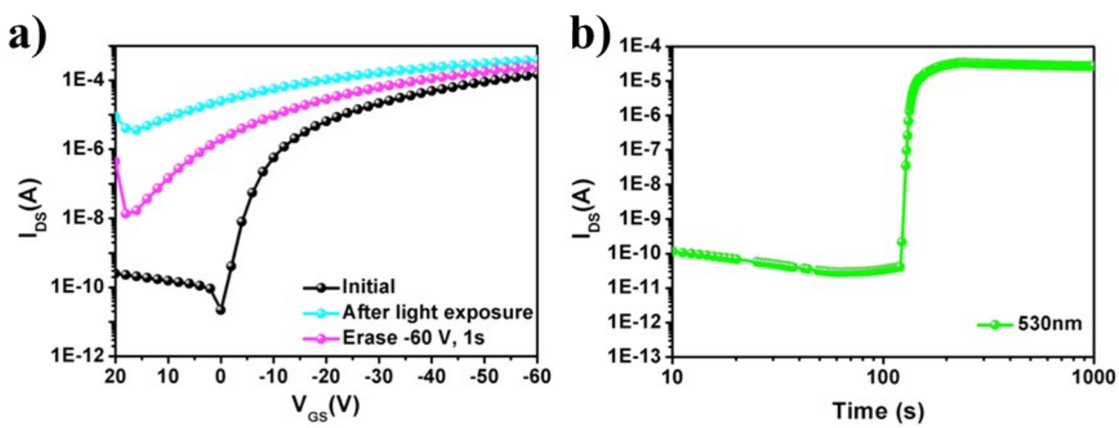

Figure S8. (a) Transfer curve of the perovskite/PMAA-based photo-memory device at V_{DS} = −60 V, wherein the light exposure is under 530-nm green light for 120 s. (b) Temporal IDS curves of the perovskite/PMAA-based photo-memory device at V_{DS} = −5 V with light programming for 120 s at 530 nm.

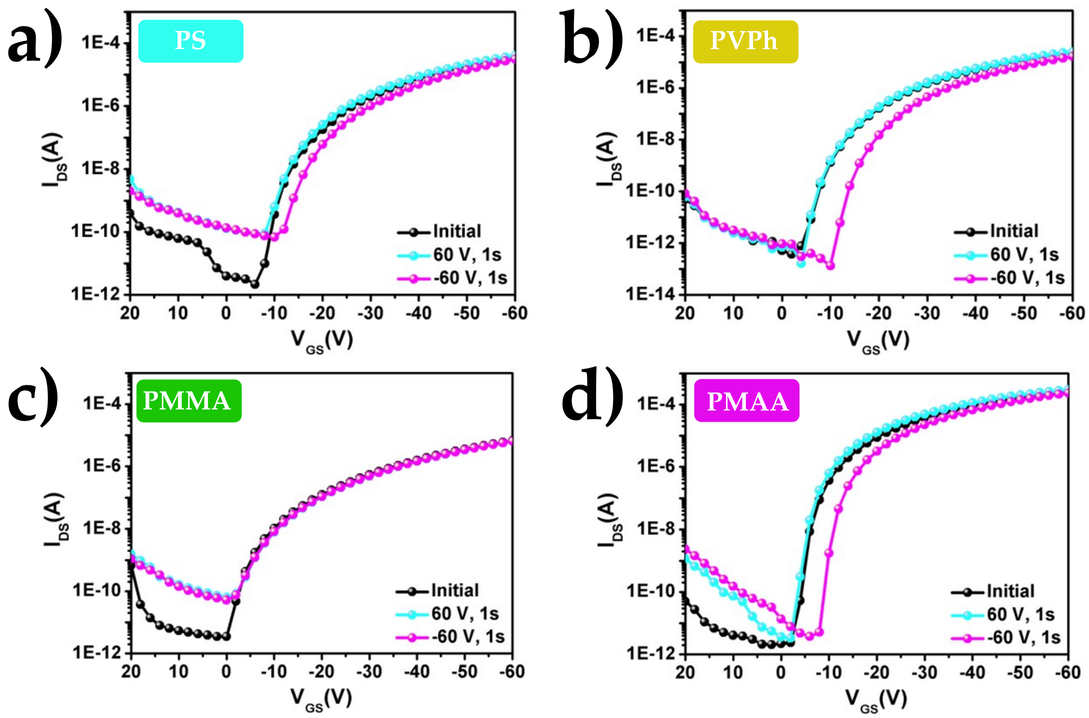

Figure S9. Transfer characteristics of the photo-memory devices using neat polymer as the charge-trapping layer: a) PS, b) PVPh, c)PMMA, and d) PMAA.

Table S2. Photo-memory properties of the studied hybrid perovskite-based photomemory devices using different polymer matrix in the charge-trapping layer.

Sample	V_{TH} (V)		I_{ON} / I_{OFF} ($x10^3$)	μ_{max} ($x10^{-2}$) (cm^2/V^3 s)
	Initial	After light		
Polymer / Single-halide perovskite ($MAPbBr_3$) (weight ratio of 2 / 1)				
PS - Pero	-19.5 ± 2.27	-11.3 ± 2.25	1.19	1.23±0.14
PVPh - Pero	-20.8 ± 2.02	10.7 ± 2.73	112.2	1.77±0.06
PMMA - Pero	-18.8 ± 3.14	22.3 ± 3.47	258.8	5.51±0.22
PMAA - Pero	-18.4 ± 3.28	21.1 ± 3.88	582.3	2.53±0.07

Table S2: Light illumination time is 120s for writing process and voltage application for which -60 V gate biases was applied during erasing processes. Applied light source was a 450 nm blue light emitting laser pen with intensity of 71 mW cm^{-2}. I_{ON} and I_{OFF} are assigned as the current levels from the transfer curves before and after light irradiation at a reading gate voltage of 0V.

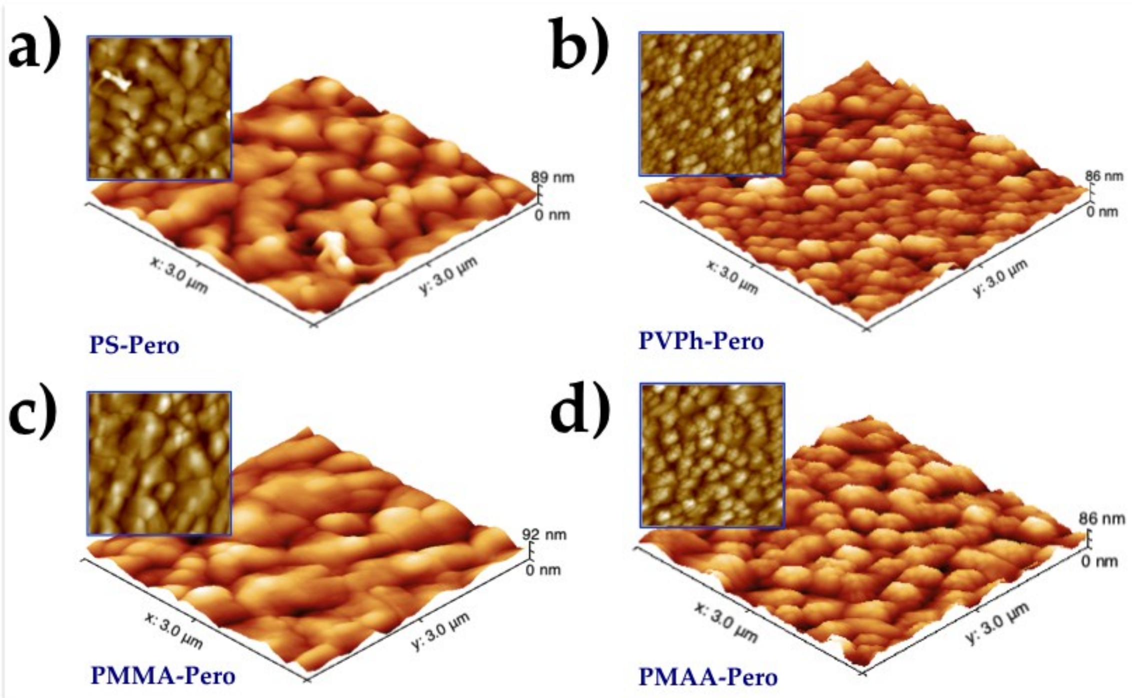

Figure S10. The AFM images of the pentacene film growth on the polymer/perovskite blends based on a) PS, b) PVPh, c) PMMA, and d) PMAA.

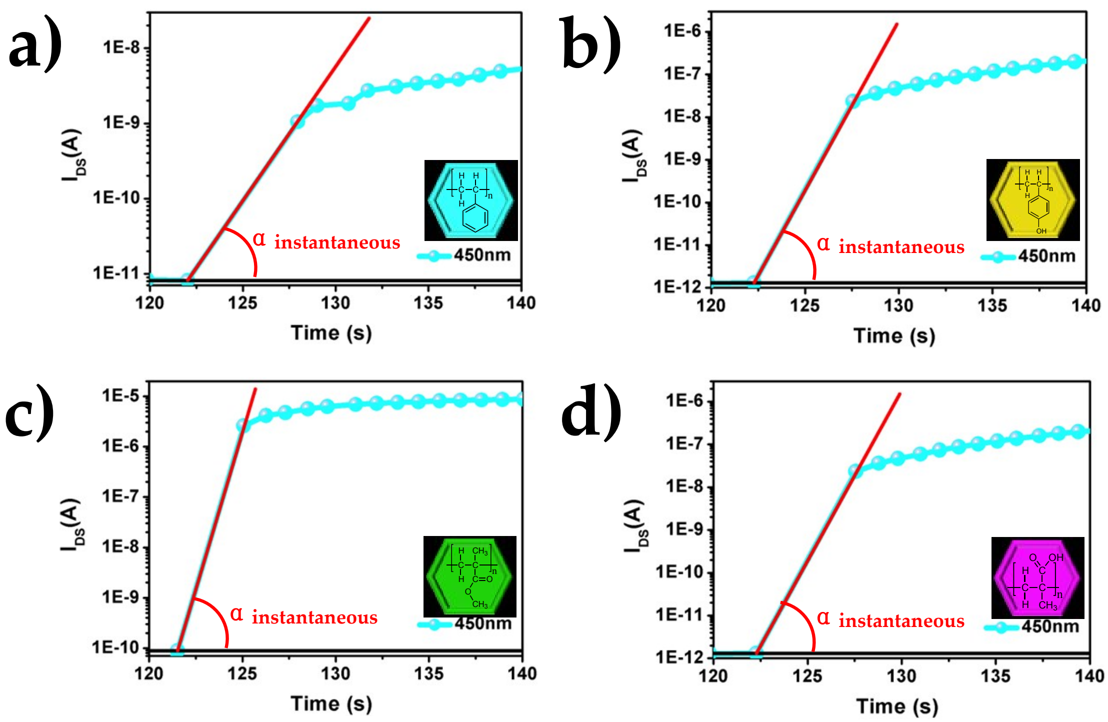

Figure S11. Enlarged temporal I_{DS} curves, which indicates the slope of the first instantaneous jump at the transition, at V_{DS} = − 60 V with light programming (450 nm, 71 mW cm^{-2} for 120 s): a) PS, b) PVPh, c) PMMA, and d) PMAA.

Notes and references

1 J.-Y. Chen, Y.-C. Chiu, Y.-T. Li, C.-C. Chueh, W.-C. Chen, Adv. Mater., 2017, 29, 1702217.