Supporting Information

Quadruple-Cation Lead-Free Perovskite-Inspired Materials Enable High-Speed Self-Powered Photodetection

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Table S1. Thickness of Sb-based PIM thin film with different PEA I addition

PEAI	**0**	**0.03**	**0.05**	**0.07**	**0.1**
Thickness (nm)	254.2±3.5	251.8±4.1	253.3±5.2	252.1±2.3	252.7±2.0

Table S2. Key parameters of the Normalized time-resolved PL (TRPL) curves obtained from biexponential function fitting.[a,b]

	A_1	τ_1 (ns)	A_2	τ_2 (ns)
PEA0	0.720	4.681	0.376	190.47
PEA0.03	0.648	5.282	0.342	197.82
PEA0.05	0.722	10.091	0.332	206.07
PEA0.07	0.579	17.724	0.447	269.76
PEA0.1	0.698	13.926	0.221	268.02

[a]The data were collected at the maximum of the Sb-based PIM emission (~615 nm).

[b]The TRPL decay curves for the samples could be fitted using the following biexponential decay function:

$$I = A_1 e^{\frac{-x}{\tau_1}} + A_2 e^{\frac{-x}{\tau_2}} \quad (1)$$

where τ_1 and τ_2 are the lifetimes associated with fast (typically non-radiative) and slow (typically radiative) decay processes, respectively. A_1 and A_2 are the percentage contributions of the non-radiative and radiative components of TRPL decay curves, respectively.

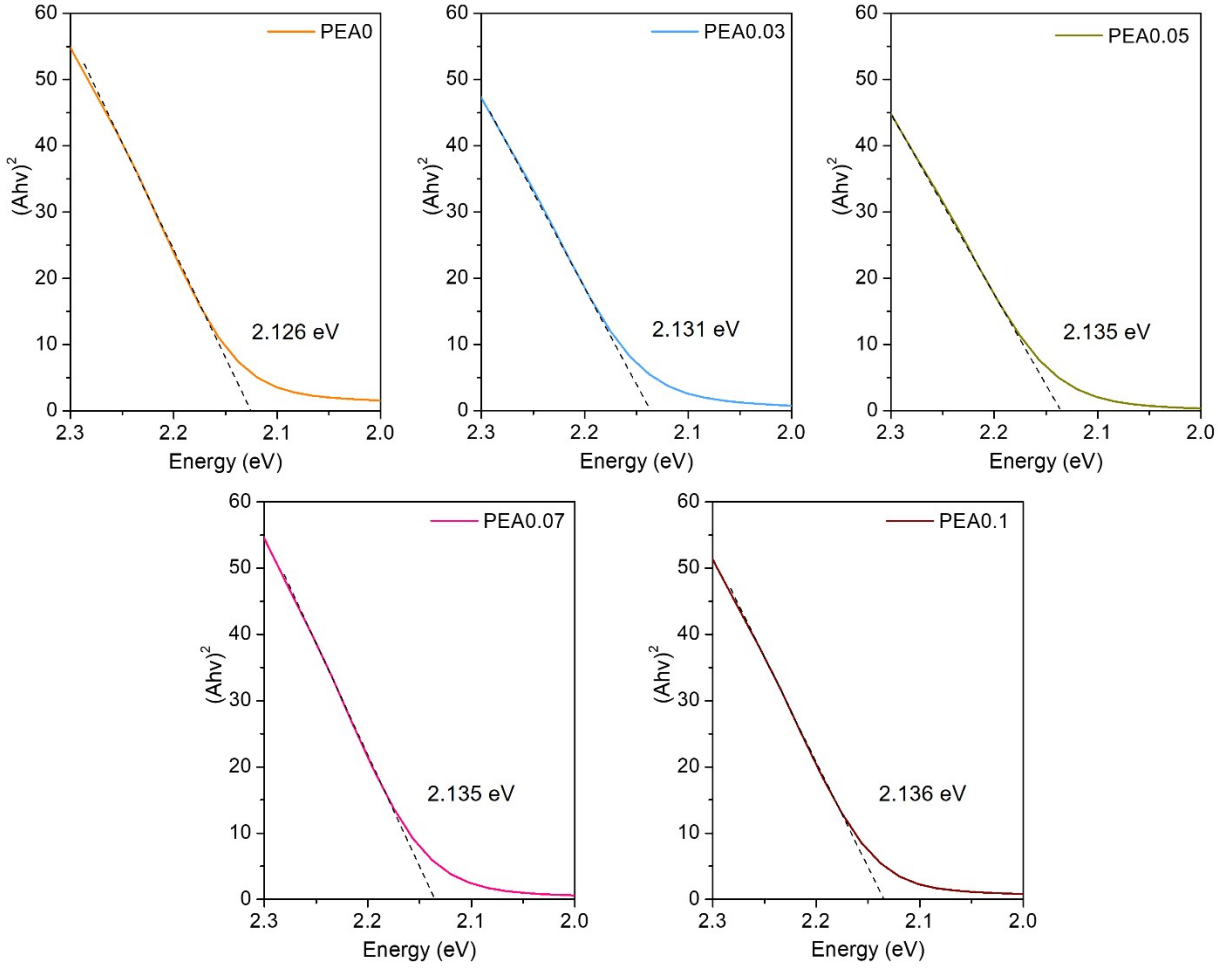

Fig. S1. Tauc plots for the representative Sb-based PIM films with PEAI incorporation.

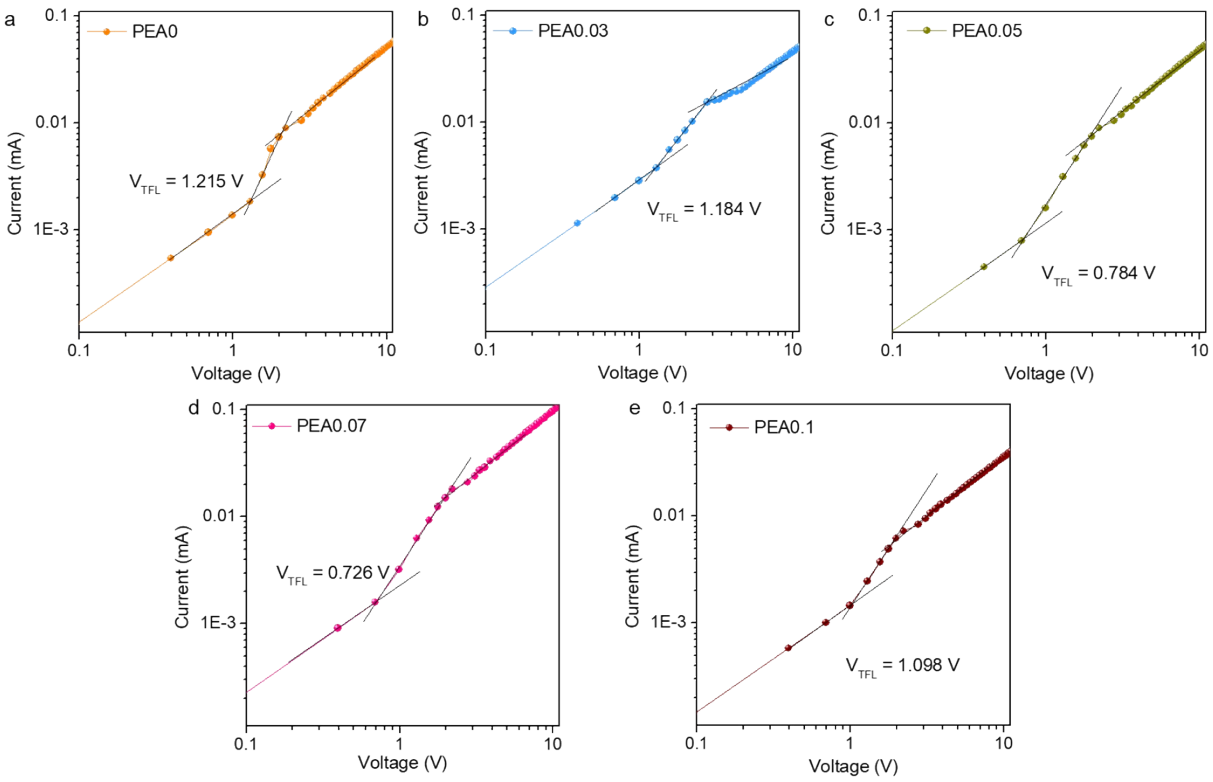

Fig. S2. SCLC curves of the devices prepared using Sb-PIM films with different amounts of PEAI additive.

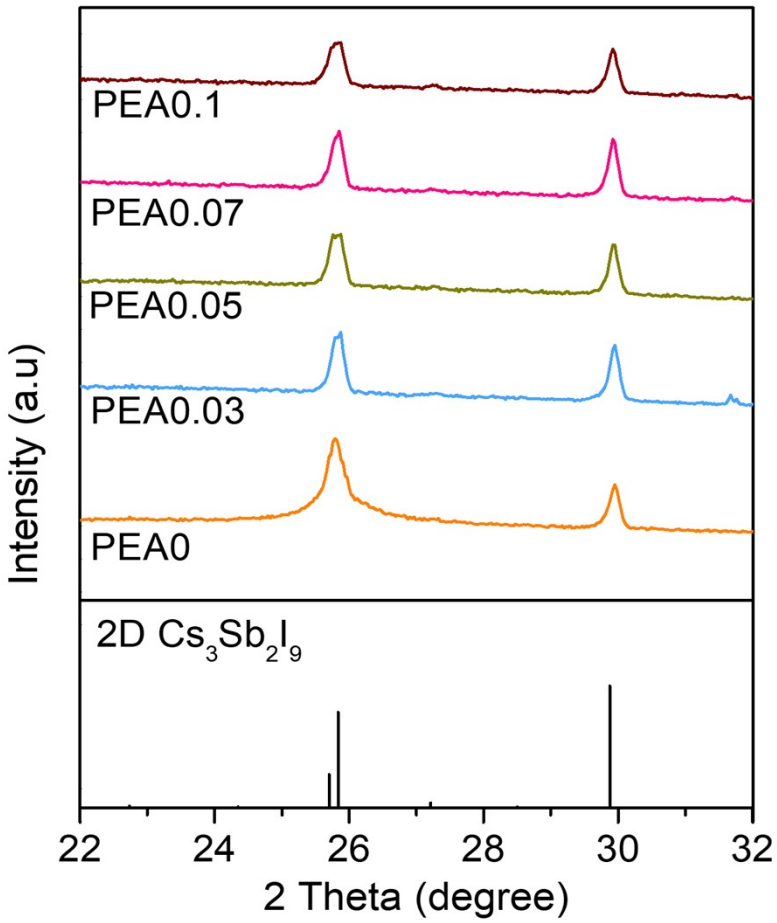

Fig. S3. XRD spectra of the Sb-based PIM films prepared with varying PEAI ratios; the reference pattern of a 2D layered $Cs_3Sb_2I_9$ crystal structure is also shown in the bottom panel.

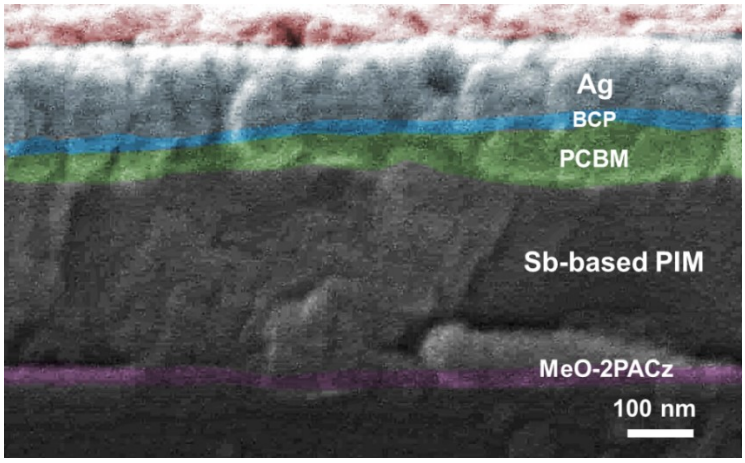

Fig. S4. Cross-sectional SEM image of the inverted Sb-based PSCs with a device structure of ITO/MeO-2PACz/Sb-based PIM layer/PCBM/BCP/Ag electrode.

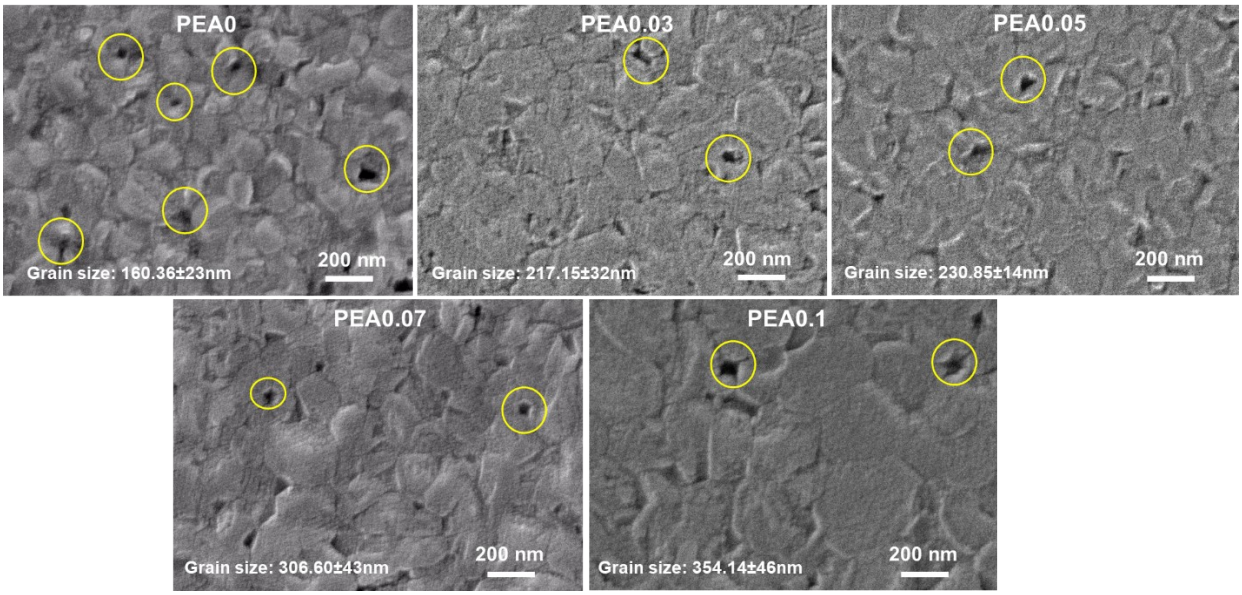

Fig. S5. Top-view SEM images of the Sb-based PIM films prepared with different amounts of PEAI; the yellow circles indicate the pinholes of the films.

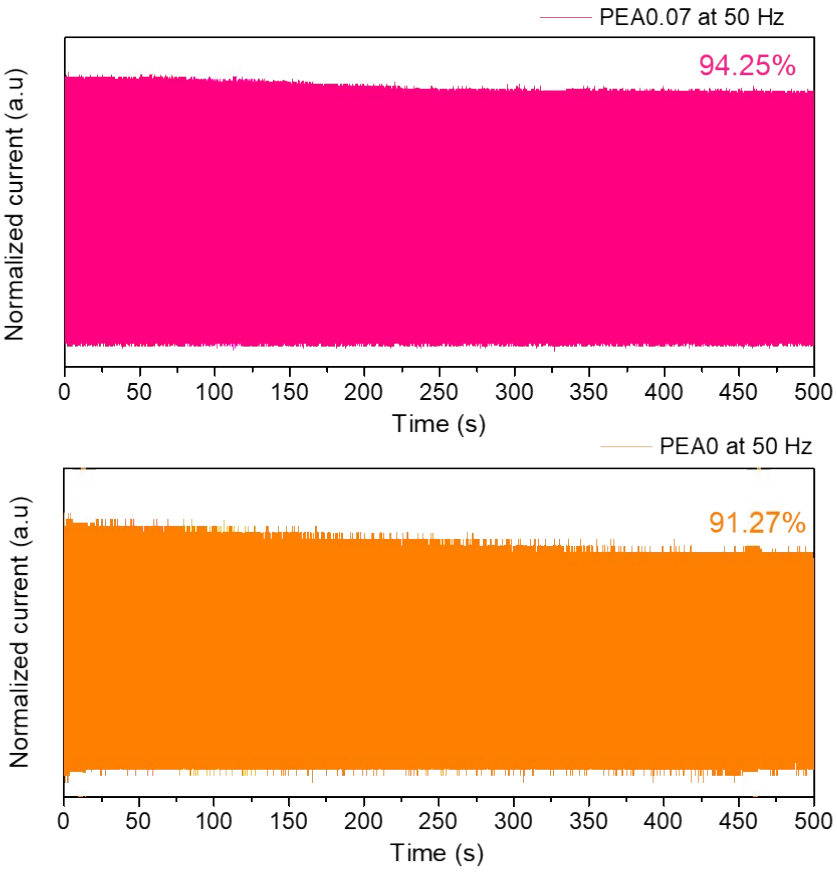

Fig. S6 The long-term cyclic switching stability of the Sb-based PDs with and without PEA0.07.