

## **Electronic Supplementary Information**

### **Air Stable Lead-Free Hybrid Perovskite Employing Self-Powered Photodetection with Electron/Hole Conductor Free Device Geometry**

*Amreen A. Hussain<sup>1\*</sup>, Amit K. Rana<sup>1,2#</sup>, Mukesh Ranjan<sup>1</sup>*

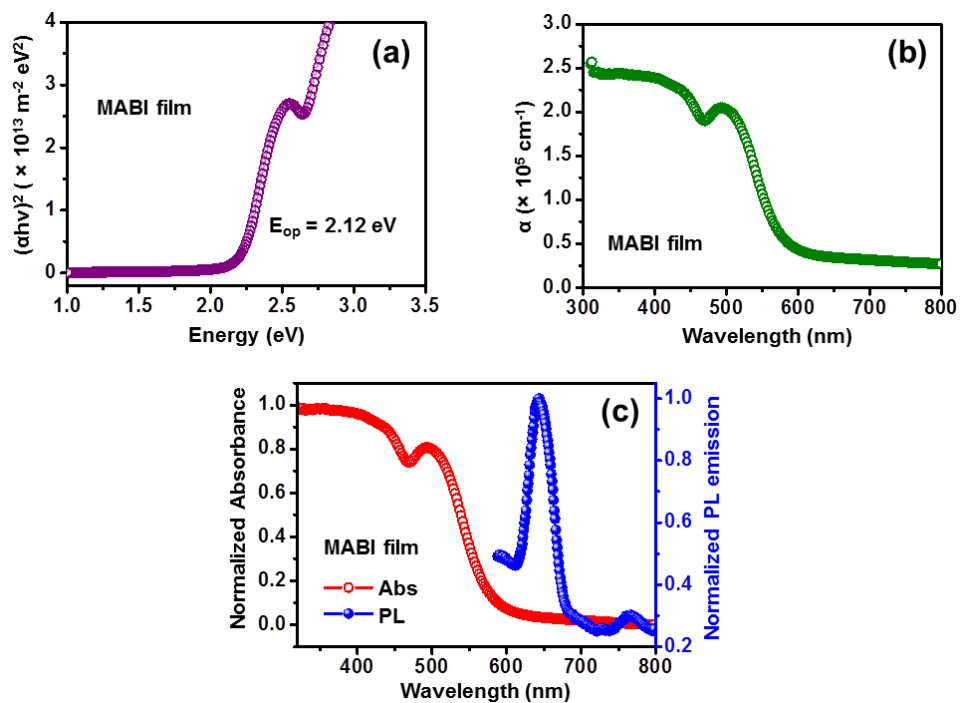
<sup>1</sup>Facilitation Centre for Industrial Plasma Technologies (FCIPT), Institute for Plasma Research  
(IPR), Gandhinagar, Gujarat, India, 382016

\*Correspondence to: amreenhussain8888@gmail.com, amreen.hussain@ipr.res.in

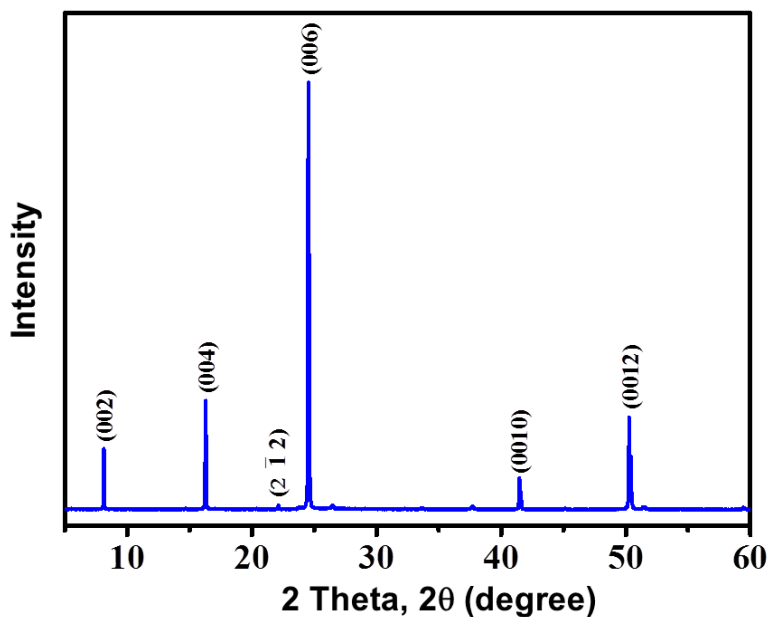
<sup>2#</sup>Present Address: Department of Electrical Engineering, Incheon National University, 119  
Academy Rd. Yeonsu, Incheon, 22012, Republic of Korea.

**Table S1** Prominent diffraction peaks appeared in the XRD pattern of MABI perovskite. The Bragg positions are compared with the previously reported data for MABI perovskite structure (CCDC 1433118).<sup>1</sup> Only the obtained XRD peaks are distinguished and compared here.

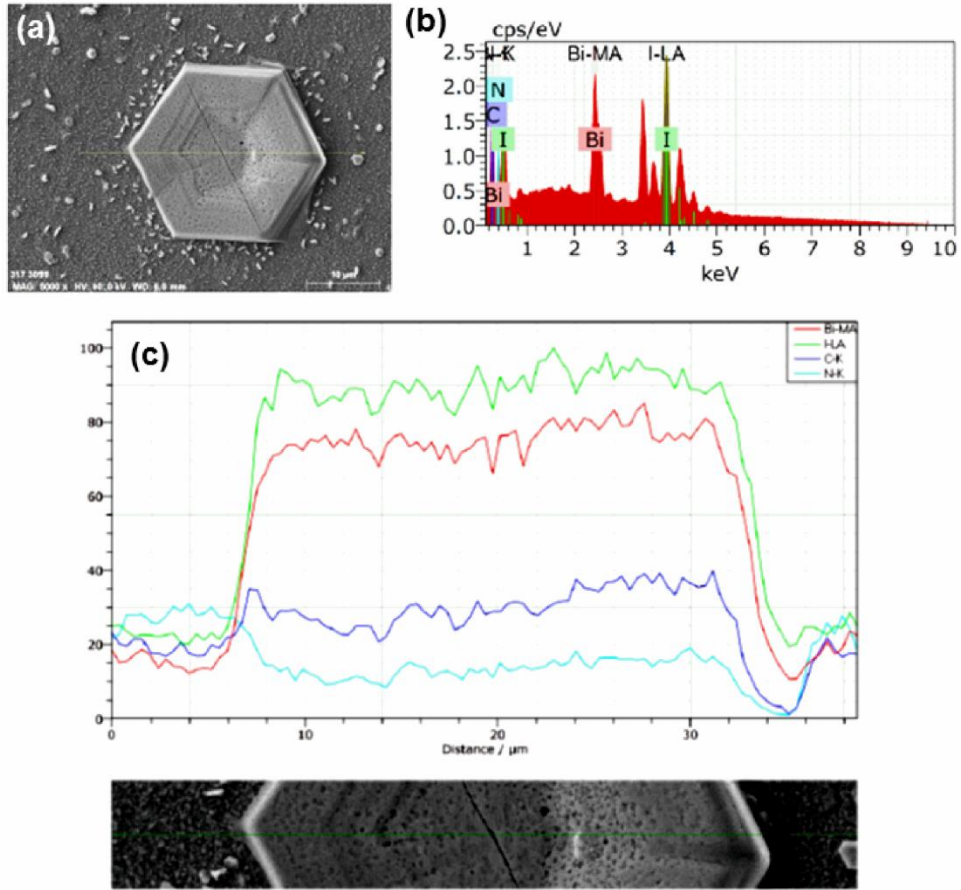
<b>2<math>\theta</math> (degree)</b> <b>As-deposited MABI</b>	<b>2<math>\theta</math> (degree)</b> <b>(CCDC 1433118)<sup>1</sup></b>	<b>h</b>	<b>k</b>	<b>l</b>
11.88	11.89475	1	0	0
12.57	12.57669	1	0	1
14.41	14.43341	1	0	2
16.28	16.33362	0	0	4
17.06	17.09364	1	0	3
22.24	22.25707	2	-1	2
23.70	23.72800	1	0	5
24.58	24.60622	0	0	6
25.30	25.30816	2	0	2
26.46	26.46277	2	-1	4
26.92	26.94912	2	0	3
29.10	29.10239	2	0	4
31.62	31.67397	2	0	5
31.30	31.32599	1	0	7
32.07	32.09452	3	-1	2
34.28	34.29434	3	-1	3
37.74	37.76677	2	0	7
41.15	41.17752	2	0	8
42.06	42.06933	4	-2	0
44.30	44.27955	3	0	6
44.70	44.70218	4	-1	2
62.68	62.72404	5	-1	6



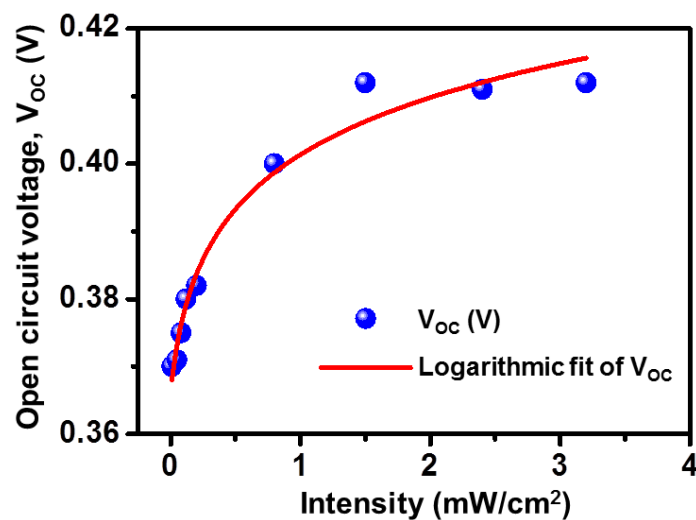
**Fig. S1** (a) Tauc plot of MABI film with an estimated optical bandgap of 2.12 eV. (b) The plot of absorption coefficient ( $\alpha$ ) versus wavelength of MABI film obtained from UV-Visible spectroscopy. (c) Absorbance and PL spectra of MABI film. The excitation wavelength is 500 nm (for PL).



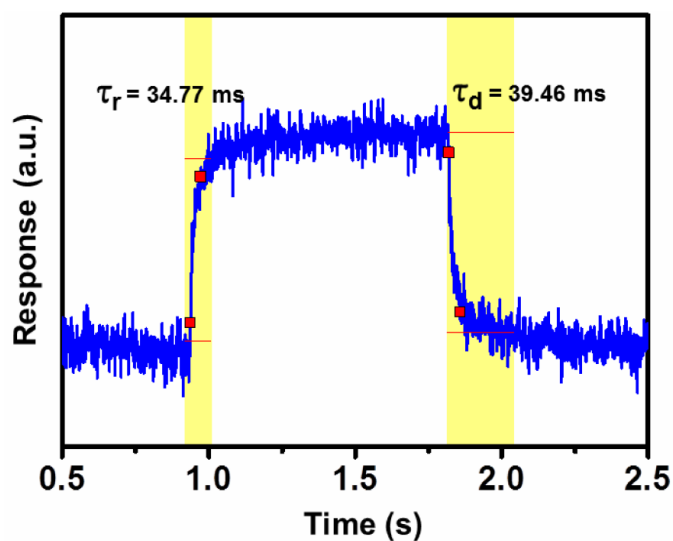
**Fig. S2** XRD pattern of MABI hexagonal crystal, showing the  $c$ -axis orientation.



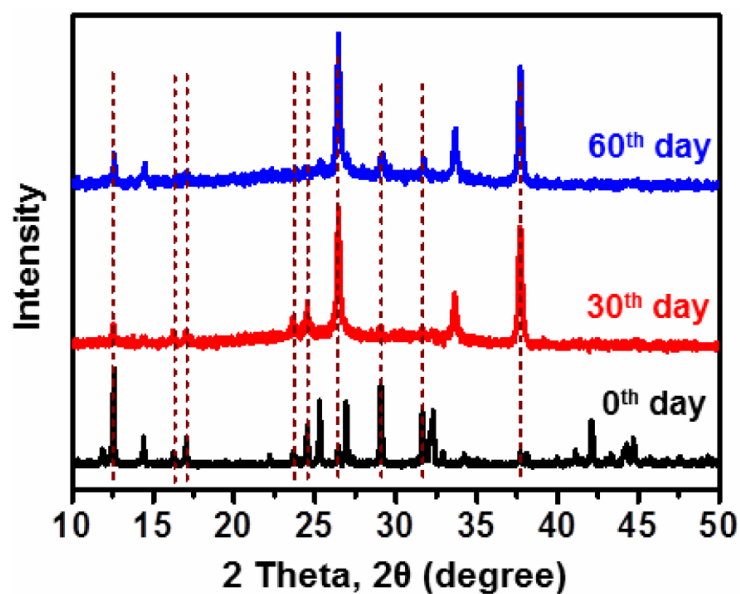
**Fig. S3** (a) FESEM image displaying a single hexagonal MABI crystal. (b) The corresponding elemental distribution within the hexagonal MABI crystal. (c) line profile showing the percentage of the constituents forming the MABI crystal.



**Fig. S4** Open circuit voltage ( $V_{oc}$ ) as a function of light intensity for MABI photodetector



**Fig. S5** Single cycle on-off photo-switching of the MABI photodetector with white light illumination recorded at a fixed bias of 0.8 V.



**Fig. S6** Comparison of XRD patterns of MABI film after storage for two months.

## References

1 K. Eckhardt, V. Bon, J. Getzschmann, J. Grothe, F. M. Wisser and S. Kaskel, *Chem. Commun.* 2016, **52**, 3058–3060.