**Supporting Information**

**Effect of Bromine Doping on Charge Transfer, Ion Migration and Stability of the Single Crystalline MAPb(BrxI1−x)3 Photodetector**

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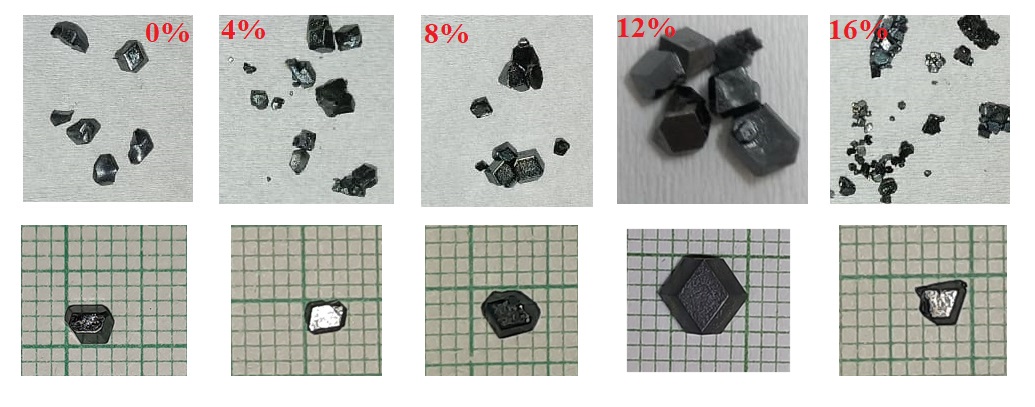
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**Fig. S1.** Photographs of the resulting MAPb(BrxI1−x)3 ( x = 0, 0.4, 0.8, 0.12, 0.16) SCs.

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**Fig. S2.** EDX data for MAPb(BrxI1−x)3 ( x = 0.4, 0.8, 0.12, 0.16) SCs grounded powders.

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**Fig. S3.** EDX mapping of Br doped SCs. SEM images of (a) surface (c) crushed to powder. Overall mapping elements on the same spot of (b) surface (d) crushed powder corresponding to iodide (red) and bromide (green). The scale bar is 10 μm.

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**Fig. S4.** (a) Enlarged view of the XRD peak at around 28o. (b) XRD patterns of the 365 days aged MAPbI3 and MAPb(BrxI1−x)3 grounded powders.

**C:\Users\NITR\Desktop\fig 1.tifFig. S5.** Intensity comparison of XRD patterns of the fresh and 365 days aged MAPbI3 and MAPb(BrxI1−x)3 SC grounded powders.

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**Fig. S6.** Analysis of the full width at half maxima (FWHM) for the pXRD peak of fresh and aged MAPbI3 and MAPb(I1-xBrx)3 grounded powders.

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**Fig. S7.** Temperature-dependent EIS data of(a) MAPbI3 and (b-e) MAPb(BrxI1−x)3 SCs in the frequency range of 1MHz to 1Hz. (f) Arrhenius plots of the try to escape frequency (f0) *vs*. 1000/T of MAPbI3 and MAPb(BrxI1−x)3 SCs (decreasing cycle).

C:\Users\NITR\Desktop\fig sss.tif**Fig. S8.** The temperature-dependent conductivity of MAPbI3 and MAPb(BrxI1−x)3 SCs. Ea is the activation energy of ions (Arrhenius plot).



**Fig. S9.** I–V hysteresis plots of MAPbI3 and MAPb(I1-xBrx)3 SCs.



**Fig. S10.** Dielectric constant (εr) of MAPbI3 and MAPb(BrxI1-x)3 SCs in the frequency range of 10 kHz to 1 MHz.

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**Fig. S11.** Current-voltage curves of (a) MAPbI3 and (b-e) MAPb(BrxI1−x)3 SCs based planar-type PDs.

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**Fig. S12.** Intensity-dependent photoresponse of (a) MAPbI3 and (b-e) MAPb(BrxI1−x)3 SCs based planar-type PDs.

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**Fig. S13.** Photocurents of MAPbI3 and MAPb(I1-xBrx)3 SC based planar PDs at different wavelengths as a function of light intensity.

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**Fig. S14.** External quantum efficiency (EQE) of MAPbI3 and MAPb(BrxI1-x)3 SC based planar PDs at different wavelengths as a function of light intensity.

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**Fig. S15.** Photocurents of MAPbI3 and MAPb(BrxI1-x)3 SC based planar PDs at different wavelength as a function of light intensity.

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**Fig. S16.** Normalized photocurrent under (a) red light (630 nm) and (b) white light at 10 mW cm-2 as a function of time.

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**Fig. S17.** Long term photocurrent of MAPbI3 and MAPb(BrxI1-x)3 SC based planar PDs at different wavelength.

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**Fig. S18.** Photoresponse of (a) MAPbI3 and (b-e) MAPb(BrxI1−x)3 SCs based planar-type PDs under continuous operation.

**Table S1.** Halide percentage calculation incide crystals using EDX data.

|  |  |  |  |
| --- | --- | --- | --- |
| Crystal Composition | Iodine (Atomic %) | Bromide (Atomic %) | Avarage Br percenrage (Atomic %) |
| MAPb(Br0.04I0.96)3 | **95.76** | **4.24** | **4.01%** |
| **96.07** | **3.93** |
| **96.13** | **3.87** |
| MAPb(Br0.08I0.92)3 | **92.09** | **7.91** | **7.92%** |
| **92.33** | **7.77** |
| **91.91** | **8.09** |
| MAPb(Br0.12I0.88)3 | **87.87** | **12.13** | **12.04%** |
| **88.20** | **11.80** |
| **87.82** | **12.18** |
| MAPb(Br0.16I0.84)3 | **83.63** | **16.37** | **15.97%** |
| **84.22** | **15.88** |
| **84.34** | **15.66** |

**Table S2.** The calculated activation energies for MAPbI3 and (b-e) MAPb(BrxI1−x)3 SCs.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Crystal Composition | From Conductivity | | | | From EIS (decresing cycle) | | |
| **Incresing cycle** | | **Decresing cycle** | | | **Ea**  **(cubic)**  **(eV)** | **Ea**  **(tetragonal)**  **(eV)** |
| **Ea**  **(cubic)**  **(eV)** | **Ea**  **(tetragonal)**  **(eV)** | **Ea**  **(cubic)**  **(eV)** | **Ea**  **(tetragonal)**  **(eV)** | |
| MAPbI3 | 0.52±0.012 | 0.35±0.011 | 0.53±0.007 | 0.34±0.012 | | 0.52±0.008 | 0.34±0.007 |
| MAPb(Br0.04I0.96)3 | 0.55±0.013 | 0.36±0.012 | 0.55±0.013 | 0.34±0.013 | | 0.54±0.013 | 0.35±0.020 |
| MAPb(Br0.08I0.92)3 | 0.58±0.016 | 0.37±0.018 | 0.57±0.010 | 0.38±0.016 | | 0.57±0.009 | 0.39±0.038 |
| MAPb(Br0.12I0.88)3 | 0.62±0.011 | \* | 0.62±0.011 | \* | | 0.59±0.011 | \* |
| MAPb(Br0.16I0.84)3 | 0.61±0.015 | \* | 0.61±0.015 | \* | | 0.59±0.012 | \* |