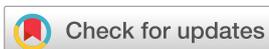




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A flexible perovskite homojunction with metallic ion doping for large-scale and high sensitivity X-ray detection †



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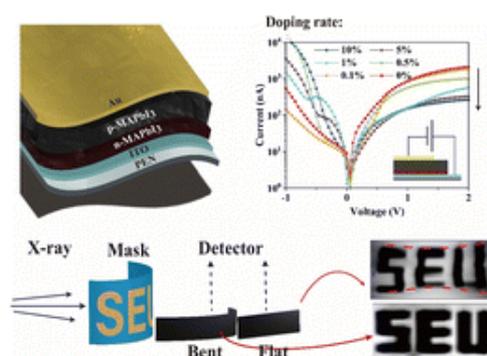
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Abstract

High-sensitivity, large-scale, and low-cost flexible X-ray detectors are useful in many applications, such as medical and nondestructive imaging. MAPbX₃ (MA = CH₃NH₂; X = Cl, Br, and I) are promising materials because of their extraordinary optoelectronic properties and simple processing methods. Herein, we propose a novel perovskite-based p–n homojunction for large-scale and high-sensitivity flexible X-ray detectors, whose potential barrier can block electron injection transport, affording a low dark current. Incorporating Bi³⁺ in MAPbI₃ induces n-type doping without introducing lattice mismatch, minimizing photogenerated carrier losses. The doping concentration of the n-type layer was controlled to find a compromise between photo and dark

currents of the X-ray detector, realizing a device with a high sensitivity of $1969.75 \mu\text{C Gy}^{-1} \text{cm}^{-2}$ and a low detection limit of 147 nGy s^{-1} . The fabrication process and storage were realized under ambient conditions, and no performance degradation was observed after our device was stored for one month under ambient conditions with 30–50% humidity. Finally, a 100 cm^2 flexible X-ray detector was fabricated to verify its ability for large-scale X-ray imaging. This study provides new insight into reducing noise in large-scale and flexible perovskite-based devices.



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