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Enhancing functionalities of blended 3D hybrid perovskite films detectors

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Hybrid organic/inorganic lead halide perovskites represent a breakthrough in the direct detection of ionizing radiation thanks to their solution processability, and their scalability over large areas on flexible plastic substrates. Flexible perovskite X-ray detectors are lightweight devices that can be operated at low-voltages and strongly limit the use of toxic materials and precursors. Polycrystalline films are thus preferred to foresee the implementation of the technology. In this work we present two approaches based on perovskite/polymer mixture, in order to enhance the detection performance of 3D hybrid halide perovskites, targeting the development of flexible and printed detectors employing micrometer thick perovskite active layer. First, we employed methylammonium lead triiodide (MAPbI3) nanocrystals blended with phenyl-C61-butyric acid methyl ester (PCBM) semiconducting polymer, leading to the realization of thick bendable detectors with good ionizing radiation absorption and high quantum efficiency. We performed X-ray nanoanalysis to demonstrate the polymer passivation effect for the traps intrinsically present in perovskite film, boosting its electrical and detection performance. Second, the addition of starch as a polymeric template for the fabrication of perovskite films, is an interesting strategy to confers to the film very high stability in ambient conditions, high homogeneity of the micrometer-thick film, enhanced mechanical flexibility and robustness.

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