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The Role of CsBr in Crystal Orientation and Optoelectronic Properties of MAPbI3-based devices

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Orientations of crystal planes impact on the behavior of photogenerated charge carriers and are vital for developing electronic properties of the corresponding devices. Herein, we propose a facile approach to reveal the effect of crystal stacking on the charge carrier kinetics by doping CsBr to enable the formation of a mix-cations perovskite phase. We use grazing-incidence wide-angle X-ray scattering to probe the crystal structure and crystal orientation of the mixed perovskite thin films revealing the effect of the extrinsic CsBr doping on the stacking of the crystal planes. TPV, TPC and tDOS are also used to detect the recombination of the photo-generated charge carriers and the trap-state density. It is demonstrated that CsBr compositional engineering can effectively tune the crystallization orientation of crystal planes, reduce trap-state density and facilitate photocarriers transport across the absorber and pertaining interface simultaneously. This strategy provides a unique insight into the underlying relationship among the stacking pattern of crystal planes, the photo-generated charge carrier transport and the optoelectronic properties of solar cells.

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