

Electric-field induced Dynamic Electronic Junctions in Hybrid Organic-Inorganic Perovskites for Optoelectronic Applications

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Abstract

Organic-inorganic metal halide perovskites have attracted great attention as optoelectronic materials due to their low-cost, relatively insensitive to defects and solution-processible properties. However, some of their properties, such as thermal instability, toxicity and current-voltage hysteresis still remain elusive. Ion-migration, which has been proved to be a thermal-activated process, is regarded as one of the major origins of the hysteresis and thus detrimental to the long-term stability of the optoelectronic devices. Nevertheless, by using the external electric field to pole the perovskite, ion-migration would be possible to be utilized to create dynamic electronic junctions. In this paper, electric-field induced dynamic electronic junctions have been manipulated for photodetection and energy harvesting through the ion-migration under external electric field. Ion-migration induced p-n or n-p junction has been created successfully via tuning the polarity of the external applied voltage, which is used for photodetection with a relative fast response. By frozen out of the non-uniformly distributed ions after migration at low temperature, we demonstrate that the ion-migration induced dynamic junctions can function as an energy harvesting device with an external quantum efficiency of 20 %.

Keywords: Electric field, dynamic electronic junction, photodetection, energy harvesting