Perovskite-organic hybrid multifunctional optoelectronic logic gate via bipolar photo-response

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The explosive demand for a multispectral information collection has sparked interest towards a new visible-near infrared (Vis-NIR) photodetector as the existing multi-color photodetector always rely on complex optical components and integrated circuits. Accordingly, bipolar photodetector (PD) composed of perovskite and organic active layer is a good strategy to realize multispectral detection without any optical filter. However, complex configuration, low detectivity, and unclear mechanism issues are still inherent in bipolar PDs. Herein, we present a novel Vis-NIR photodetector with multispectral responsivity based on perovskite and organic active layer. By optimizing the thickness of the perovskite and active layers, a balance between two different directional photocurrents is achieved. A bipolar PD exceeding 40% of quantum efficiency at low bias (±0.2 V), bipolar responsivity of +0.28 A/W at +0.2 V and -0.40 A/W at -0.2 V, and a 10^{12} Jones detectivity from 400 to 900 nm. Finally, we fabricate an optoelectronic logic gate based on a single bipolar PD, which can execute four basic logics by adjusting the wavelength and intensity of the incident light.

Keywords: sensing, optoelectronic, logic gate, bipolar photodetector