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Toward high performance broad spectral hybrid organic-inorganic photodiodes based on multiple component organic bulk heterojunctions

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Estimation of optimized weight ratio for multiple component organic bulk heterojunctions, leading to uniform and broadband photoabsorption

We have optimized the weight ratio of different bulk heterojunction films. Compared to three-component devices the two-component devices with PTCDA:CuPc (weight ratio 1:1) don’t have an uniform absorption spectra or photo responsivity which has been proved in the Fig. 2, Fig. 5a and Table 2. Especially, the two-component PTCDA:CuPc film has a low absorption in NIR region. Thus, we introduce NIR photosensitive material, PbPc, into PTCDA:CuPc film to form three-component film.

In order to achieve uniform and broadband photoabsorption, we try to determine the optimized weight ratio for three-component PTCDA:CuPc:PbPc film. As a result, we have implemented a series of weight-ratio studies for the three-component bulk heterojunction films. Different weight ratios of 1:1:1, 1:1:1.5 and 2:1:1.5 films and corresponding devices have been prepared here. As for broad spectral photodetection, the three-component devices with weight ratio of 2:1:1.5 achieve a relatively uniform absorption spectra and higher photocurrent for visible-NIR region (Fig. S1 and Fig. S2 below). Consequently, we think that the three-component device with 2:1:1.5 weight-ratio film exhibits better performance than other devices.
Fig. S1. Optical absorption spectra of PTCDA:CuPc:PbPc films on quartz glasses with different weight ratios of 1:1:1, 1:1:1.5 and 2:1:1.5.
Fig. S2. Dependence of photocurrent $I_{ph}$ on the reverse bias voltage for different-wavelength illumination at incident optical power of ~8.5 $\mu$W with different weight ratios of (a) 1:1:1, (b) 1:1:1.5 and (c) 2:1:1.5.