

Phototransistors Based on CsPbBr₃ Perovskite Quantum Dots and Small Molecules Blending Semiconductors through Solution-Shearing under Ambient Air

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Abstract

Perovskite quantum dots have been used in photoelectronic device because of some advantages, such as high pure color emission and solution processability. However, due to the poor intrinsic property of charge transfer, the development of perovskite quantum dots in phototransistors is in limitation. In this study, all-inorganic CsPbBr₃ perovskite quantum dots blended with dithienothiophenoquinoid (DTTQ) small molecule were used as the semiconductor layer of phototransistors. Even if the concentration of perovskite quantum dots increased, we could still get the good crystalline film of small molecule. This result could be attributed to using the solution-shearing method instead of spin-coating method.

The all-inorganic perovskite quantum dots/small molecules semiconductor blends phototransistors with bottom-gate-top-contact architecture showed the elastic performance. Through the turnable precursor concentration and gate voltage, we could get the best device performance, such as photoresponsivity (716.15 A W⁻¹), photosensitivity(1.10 x10⁴) and detectivity(2.98x10¹¹ Jones), which was tested under the 365 nm UV light illumination. In addition, the good crystallinity of DTTQ semiconductor also played an important role in these results due to superior charge transfer. These findings give a potential of developing high performance phototransistors with simple solution process.

Keywords – *solution process, organic semiconductors, perovskite quantum dots, blends, phototransistors.*

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