

Improving the performance of solution-processed organic solar cells by incorporating small molecule acceptors into a ternary bulk heterojunction based on DH6T:Mq3:PCBM (M = Ga, Al)



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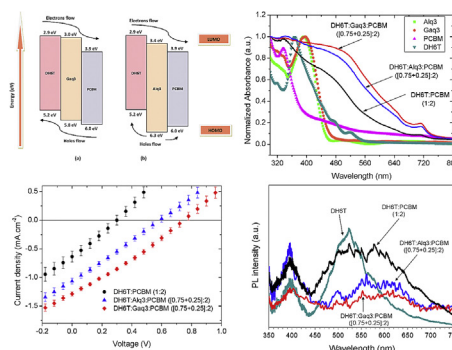
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HIGHLIGHTS

- Ternary solution-processed OSCs including Gaq3 and Alq3 acceptors were realized.
- The power and efficiency of the devices were increased by an order of 5.8.
- Broadened absorption and improved crystallinity were achieved for the active layers.

GRAPHICAL ABSTRACT



ARTICLE INFO

Article history:

Received 7 April 2016

Received in revised form

21 November 2016

Accepted 23 November 2016

Available online 24 November 2016

Keywords:

Composite materials

Organometallic compounds

Coatings

TEM

ABSTRACT

Improvement in the overall performance of solution-processed organic solar cells based on a ternary heterostructure was realized by means of incorporating small molecules of tris(8-hydroxyquinoline) gallium (Gaq3) or Alq3 electron acceptors. The donor host polymer was α,ω -dihexyl-sexithiophene (DH6T), while the ultimate acceptor was fullerene (PC₆₁BM). The results showed that short circuit current (I_{sc}), open circuit voltage (V_{oc}), and fill factor (FF) of the devices were pronouncedly enhanced by the inclusion of Gaq3 or Alq3. The maximum output power and conversion efficiency of the ternary devices were increased by an order of 5.8 times compared to that of the control devices. These improvements were ascribed to the broadened light absorption, energy levels alignment between the donor-acceptor components, a balanced charge transfer, and increased crystallinity of the devices active layer. The results were ascertained and analyzed by means of UV–Vis, PL, XRD, IV and TEM investigations.

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Please access the full article at:

<http://dx.doi.org/10.1016/j.matchemphys.2016.11.048>