

Optical, electronic, and photovoltaic properties of octahexyl tetrabenzotriazaporphyrin

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はじめに : Mesogenic phthalocyanine has been demonstrated as promising small molecules for use in bulk heterojunction (BHJ) organic solar cells (OSCs).^[1-3] Nevertheless, hybrid structures of phthalocyanine such as tetrabenzotriazaporphyrins, tetrabenzodiazaporphyrins, and tetrabenzomonoazaporphyrins have been relatively little studied due to the synthetic challenge inherent in the selective incorporation of specified combinations of the aza and methine groups. Herein, the transition phase and optical, electronic, and photovoltaic characterization of a discotic liquid crystalline donor, non-peripherally substituted octahexyl tetrabenzotriazaporphyrin (C6TBTAPH₂), as shown in Fig. 1, was demonstrated for use in solution-processed BHJ OSCs.

実験 : MoO_x films were thermally evaporated onto ITO substrates. A solution containing a mixture of C6TBTAPH₂:[70]PCBM (3:2) in chloroform with an addition of 0.2 v/v 1,8-diiodooctane was spin-cast onto a MoO_x layer. Finally, aluminum layer was deposited through a shadow mask by thermal evaporation.

結果 : As shown in Fig. 2(a), the C6TBTAPH₂:[70]PCBM BHJ OSCs with the optimum active layer thickness of 140 nm exhibited high EQE of 50% and 54% at the B-band and Q-band, respectively. As a result, a high short-circuit current density of 10.1 mA/cm² was achieved, as shown in Fig. 2(b). With an open-circuit voltage of 0.73 V and a fill factor (*FF*) of 0.66, the PCE was estimated to be 4.9%.^[4] The high *FF* of 0.66 were explained by the balance of the electron and hole mobility, which were measured by time-of-flight technique.^[4] These results indicate that C6TBTAPH₂ are potential donors for solution processable BHJ OSCs.

謝辞 : 本研究は JST 先端的低炭素化技術開発(ALCA)の援助の基に行われた。 Quang-Duy Dao was supported by JSPS Postdoctoral Fellowship Program for Foreign Researchers (No. P14051).

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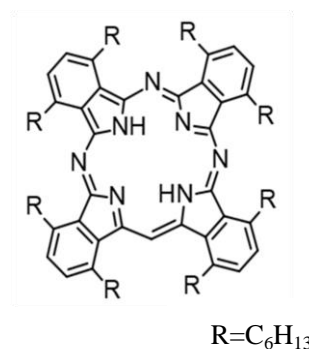


Fig. 1: Molecular structure of C6TBTAPH₂.

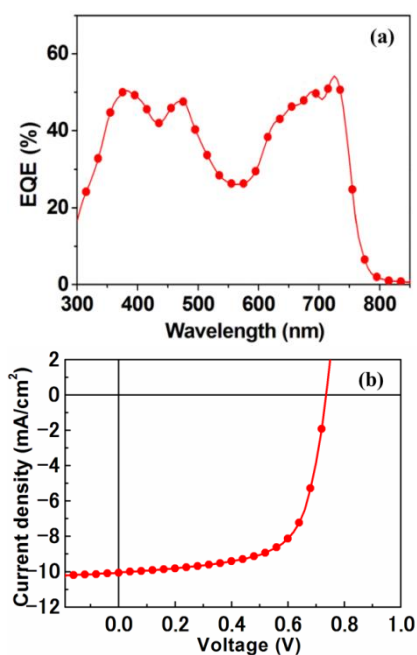


Fig. 2: (a) EQE spectrum and (b) J-V characteristics of C6TBTAPH₂:[70]PCBM BHJ OSCs