Optical, electronic, and photovoltaic properties of octahexyl tetrabenzoazaporphyrin

はじめに：Mesogenic phthalocyanine has been demonstrated as promising small molecules for use in bulk heterojunction (BHJ) organic solar cells (OSCs). Nevertheless, hybrid structures of phthalocyanine such as tetrabenzoazaporphyrins, 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 tetrabenzoazaporphyrin (C6TBTAPH2), as shown in Fig. 1, was demonstrated for use in solution-processed BHJ OSCs.

実験：MoO3 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-diodooctane was spin-cast onto a MoO3 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%. 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. These results indicate that C6TBTAPH2 are potential donors for solution processable BHJ OSCs.

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