

Lateral Junctions Reaching 1.8 cm for Organic Solar Cells

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Recently, we reported a lateral alternating multilayered junction using a high mobility organic semiconductor¹. In this study, we fabricated lateral junction cells having distance reaching cm order (Fig. 1). A donor [C8-BTBT ($\mu_h = 43 \text{ cm}^2\text{V}^{-1}\text{s}^{-1}$)] – acceptor [PTCDI-C8 ($\mu_e = 1.7 \text{ cm}^2\text{V}^{-1}\text{s}^{-1}$)] combination was used. Buffer layers of BCP and MoO₃ were used for the selective carrier collection of electrons and holes, respectively (Fig. 1). It is surprising that even lateral cells with $L=1.8 \text{ cm}$ showed clear photovoltaic behavior (Fig. 2, red curve) although the photocurrent of lateral cell decreased with L . Slopes of light intensity vs. photocurrent (J_{sc}) plots are close to unity even at $L = 1.8 \text{ cm}$ (Fig. 3). This means that little bimolecular recombination occurs in the cells. We assume that trap-assisted recombination is the main reason for photocurrent decrease (Fig. 4)². Hence, identifying and removing the defects acting as traps would improve the cell performance.

1) M. Kikuchi, et al, *ACS Appl. Energy Mater.*, **2**, 2087 (2019).

2) N. Shintaku, S. Izawa, et al, *Org. Electron.*, **55**, 69 (2018).

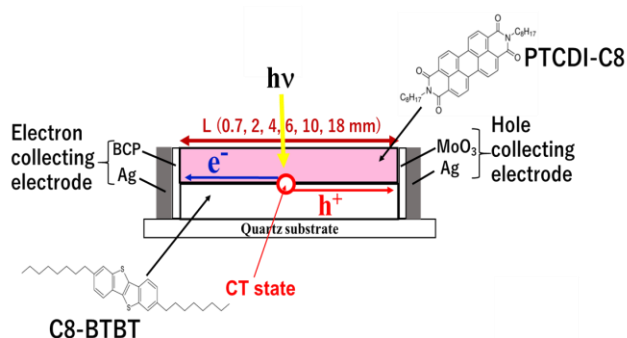


Fig. 1 Device structure.

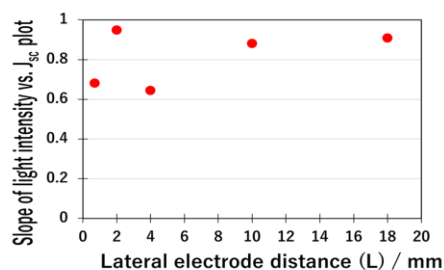


Fig. 3 Dependence of slope of light intensity vs. J_{sc} plot on L .

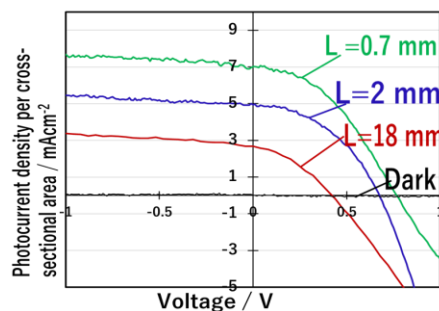


Fig. 2 J - V curves of cells with $L = 0.7, 2$ and 18 mm .

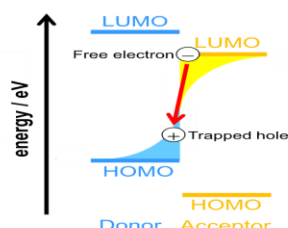


Fig. 4 Schematics of the trap assisted recombination.