塗布型有機太陽電池のためのディスコティック液晶材料の２成分混合系のキャリヤ移動特性と相転移

Charge Transport Characteristics and Phase Behavior in a Binary Blend of Discotic Liquid Crystalline Materials for Solution-Processed Organic Solar Cells

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Organic solar cells (OSCs) are drawing considerable interest for the great promise as a next-generation clean and renewable energy source. Especially, solution-processed OSCs based on low bandgap π-conjugated molecule as a donor and fullerene derivatives as an acceptor blend in bulk hetero-junction (BHJ) structure have attracted growing attention due to their advantages of low cost, simple fabrication process, light weight, and flexible application. With the rapid advancements in both π-conjugated molecules and device structures, surprising high device performances near 10% have been reported for polymer and small-molecules BHJ OSCs. Recently, liquid-crystalline (LC) materials-based BHJ OSCs have been emerging as an attractive to study, offering several promising advantages such as well-defined structure for electronic charge migration as forming one-dimentional path and the homeotropic alignment could be easily realized by surface modifications of substrate. Indeed, the inevitable result close to 10% of performance has been accomplished from LC molecular BHJ OSCs.

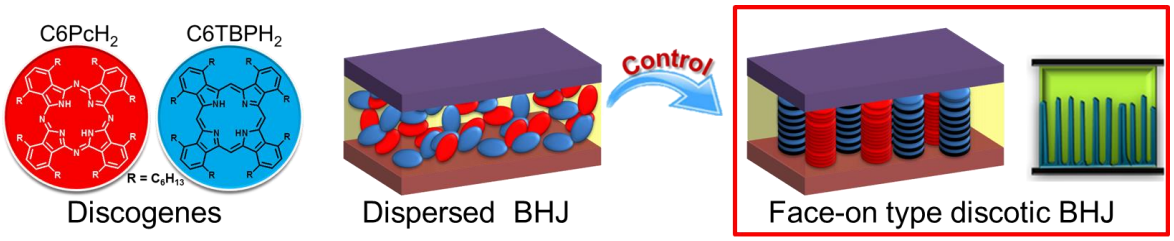

Fig. 1 Schematic representation of desired arrangement of discotic molecules for bulk hetero-junction organic solar cells.

Toward the higher performance as OSCs, widening the photo-absorption range is an important strategy and the miscibility in mesophase is an interesting technique to give a favorable structure for charge transport and it should be formed in segregation for hole and electron transport paths. The miscibility of mesophase, thus, would be good for enhancing the light harvesting property. Recently, we found that C10PcH$_2$/C10PcZn binary system show stepwise recovering of carrier mobility which was decreased by mixing the two compounds on repetitive heating and cooling cycles at the clearing point. In this communication, two analogues in molecular shape and size, C6PcH$_2$ and C6TBPH$_2$ were selected to study the mesomorphic phase transition behavior and charge transport properties of the binary blend.