

Molecular engineering of a conjugated polymer as hole transporting layer for versatile p-i-n perovskite solar cells

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Along with the development of perovskite materials which have enormous potentials for the optoelectronics. However, the hydrophobicity nature of the polymer HTL makes it difficult to form sequentially deposited perovskite thin film. Here, we present non-destructive polymer HTL formation process via molecular engineering with simple solvent process. When we used various solvents having different volatility, successful perovskite film formation was obtained on polymer thin films which were formed from highly volatile solvents. In addition, we have elucidated the structure and orientation of molecules in the films, and revealed that the molecule structure of face-on orientation possessing the horizontally aligned hydrophobic alkyl groups induced the lower surface energy of the film by GIWAXS measurement. Furthermore, the tilt angle of the molecules which was calculated from the quantitative NEXAFS analysis, are successfully correlated plotted with the surface energy. This result would be a guide for polymer orientation and surface energy studies, and the perovskite solar cells based on the polymer HTL demonstrated good durability and flexibility.