Naphthobisthiadiazole-based semiconducting polymers for non-fullerene solar cell

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Introduction

Semiconducting polymers have received great attention in the field of organic electronics because of their potential of solution processability and mechanical properties. Organic solar cells that used semiconducting polymers have shown great advances during the past few decades. The strategy of constructing semiconducting polymers based on the donor (D) and acceptor (A) units has been widely adopted to tune the structures and optoelectronic properties. We have reported that semiconducting polymers based on naphthobisthiadiazole (NTz) electron-accepting unit show high efficiencies in fullerene solar cells.[1-3)] In this study, new NTz-based semiconducting polymers incorporating benzodithiophene (BDT) electron-donating units were designed and synthesized and applied to non-fullerene solar cells blended with a non-fullerene acceptor Y6 (Figure 1). The impact of introducing fluorine or chlorine atoms on the thienyl side chain of the BDT moiety on the energetics, film structures, and photovoltaic performances in the solar cells are also investigated.

Results

The polymers showed absorption spectra in the range of 500–800 nm, thus gave optical bandgaps of ~1.60 eV. Halogenated polymers had slightly red-shifted absorption spectra and down-shifted energy levels compared to a non-halogenated polymer. We fabricated the solar cells with the conventional structure, in which Y6 was used as the acceptor. The fluorinated polymer showed the highest PCEs of over 12% among the polymers synthesized here. We will discuss the structure-property relationships in more details.

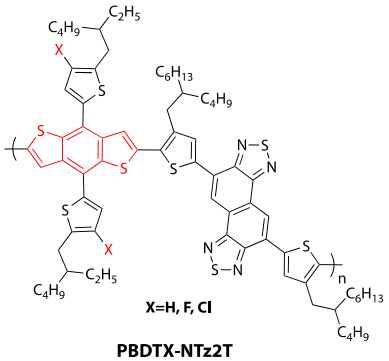

Figure 1. Chemical structure of naphthobisthiadiazole-based semiconducting polymers.

References

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