Photoconductive Properties of Polyimides having Triphenylamine Structure in the Main Chain

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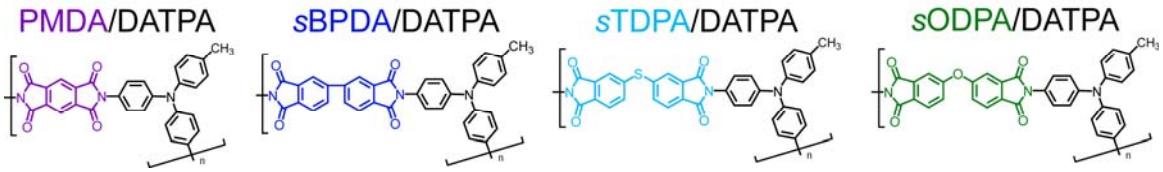
ABSTRACT

Since polyimides (PIs) are well known for their high thermal and chemical stability, enhancing quantum effiency for photocurrent generatioin would promote their use as photoconductors. To clarify relationships between the molecular structures and photoconductive properties of fully aromatic PIs, photocurrent spectra of PIs having a triphenylamine structure (Scheme 1) in the main chain were analyzed. As shown in Fig.1, the optical absorption of ca. 2 μm-thick PI films increased with increasing the electron affinity of the dianhydride moiety (*s*ODPA < *s*TDPA < *s*BPDA < PMDA), which is attributable to the enhanced charge transfer (CT) interactions. As shown in Fig.2, *s*BPDA/DATPA exhibited higher photocurrent comapred with *s*TPDA/DATPA and *s*OPDA/DATPA, indicating that the CT interaction promotes efficient photocurrent generation. In case of PMDA/DATPA having the strongest CT interaction, its photocurrent was decreased below λ < 420 nm though higher photocurrent was generated at longer wavelengths. Moreover, *s*BPDA/DATPA, *s*TPDA/DATPA and *s*OPDA/DATPA PIs also exhibited smaller photocurrent when exicted at 380 nm compared to 400 nm. These facts are explainable by generation of concentrated photo-carriers at irradiated surface of PIs because of the very high absorbance at shorter wavelengths, which enhances the carrier recombination.



Scheme 1. Structures of PIs.

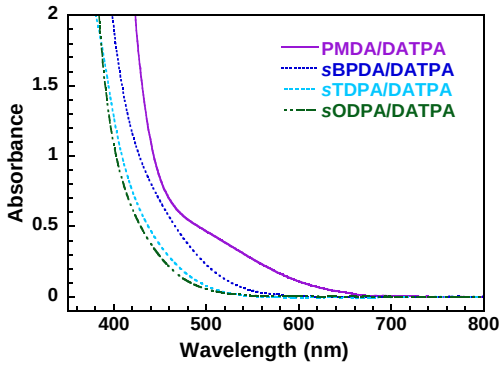


Fig.1 UV/vis absorption spectra of PI films.

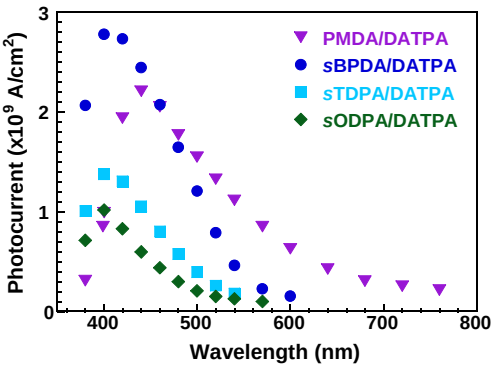


Fig. 2 Photocurrent spectra of PI films (applied voltage : 5 kVcm^{-1}).