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## ABSTRACTS



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# Enlarging $\pi$ -conjugation length and broadening absorption spectra: fabrication and characterization of organic photovoltaic cells

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Conventional organic photovoltaic cells (OPVCs) composed of P3HT:PCBM were modified by using hydrothermally treated organic perylene NPs. The optical and structural properties of hydrothermally treated perylene NPs were investigated using UV/Vis absorption, PL, SEM, and XRD experiments. The UV/Vis absorption peaks of the perylene NPs could be controlled from 420 nm to 560 nm through the hydrothermal temperatures. We observed the three types of light emission for perylene NPs; free exciton, self-trapped exciton, and partially self-trapped exciton emission. To fabricate OPVCs of P3HT:PCBM, the perylene NPs were blended with hole-transporting PEDOT/PSS solution, and their photovoltaic performance was investigated under LED lamps. The power-conversion efficiency ( $\eta$ ) of the P3HT:PCBM with perylene NPs was strongly correlated with the optical absorption of the NPs. To investigate an effect of  $\pi$ -conjugation length on the solar efficiency, we fabricated star-shaped zinc-porphyrin derivatives including thiophene units and lengthened thiophene chain length step by step. As enlarging the thiophene chain length, zinc-porphyrin derivatives show the broadened UV/Vis absorption spectra. The structural property of the zinc-porphyrin derivatives were investigated by XRD patterns. We fabricated OPVCs composed of p-type zinc-porphyrin derivatives and n-type PCBM. The photoresponsive  $I$ - $V$  characteristics and IPCE spectra were measured. The enlarging  $\pi$ -conjugation length of the thiophene chain had an effect on the  $J_{sc}$  and  $\eta$ .

