

Influence of donors units in organic photosensitizers based on heterocyclic derivatives for dye-sensitized solar cells

Hyo Jeong Jo, Jung Eun Nam, Dae-Hwan Kim, Jin-Kyu Kang*
Division of Advanced Convergence Research Center, DGIST, Daegu, Korea
Tel.:82-53-785-3730, E-mail: apollon@dgist.ac.kr

Dye-sensitized solar cells (DSSCs) based on Ru-complexes have been achieved fairly high solar energy-to-conversion efficiencies above 11 %. However, the Ru-complexes have some problems such as manufacturing costs and environmental issues. Recently, organic dye molecules have been employed as promising alternatives to the Ru-complexes because of potential advantages (high molar extinction coefficient, convenient, customized molecular design) for photophysical and photochemical properties, as well as low-cost production. In this paper, we synthesized organic photosensitizing dyes have a push-pull structure and are composed of a donor, conjugated bridge, and acceptor. This work reports a metal-free sensitizer using a phenothiazine unit as the donor, thiophene and 3,4-ethylenedioxythiophene unit as the π -conjugated bridge and a cyanoacetic acid that acts as the anchoring group for attachment on the metal oxide and as the electron acceptor. Although their structures are almost identical, we found that this originates from the diverse position of the HOMO energy levels, leading to different driving forces for regeneration. Their photovoltaic properties were measured I-V curves, incident photon-to-current (IPCE) efficiencies, impedance analysis, electron lifetimes (τ) by comparison with that of ruthenium dye in same manufacturing condition.

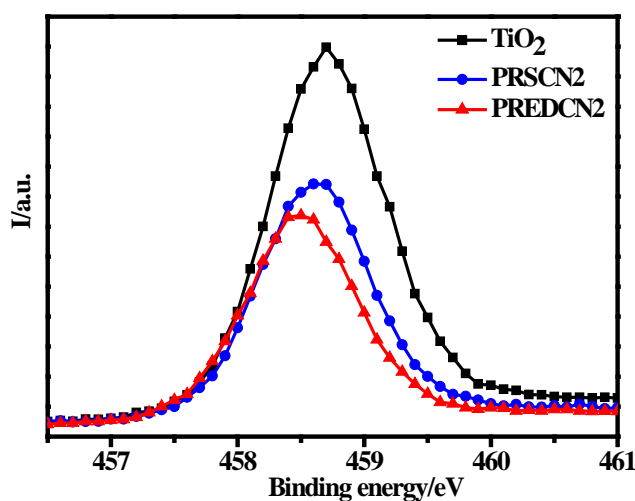


Fig. 1. $Ti2p_{3/2}$ photoelectron signal originating from the titania substrate.

Acknowledgment

This work was supported by the DGIST R&D Programs of the Ministry of Science, ICT & Future Planning of Korea (15-BD-05) and This research was supported by a grant from the Fundamental R&D program for Core Technology of Materials (10050966) funded by the Ministry of Knowledge Economy, Republic of Korea.

References

1. O'Regan B, Grätzel M, *Nature.*, 353,737 (2000)