Palomares Research Group

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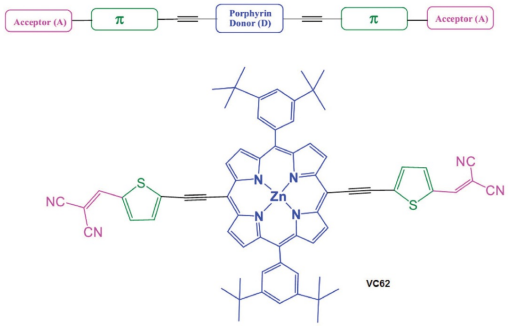
Abstract

The research on materials for energy and bio-applications are at the central core of our research. Since the group formation in 2006, our particular interest has been the development of third generation solar cells (DSSC, OPV, QDSC and Perovskite materials) and the detailed study of the interfacial charge transfer reactions that limit the efficiency on these novel generation of solar cells.
On the other hand, we are devoted also to the development and study of novel fluorescence semiconductor materials for biomedical applications that advance on the application of nano-science to medicine.

During 2015 our group has focussed on the synthesis and characterization of organic semiconductor molecules that have been used as electron donor in solution processed organic solar cells using the fullerene derivative PCBM-C70 as electron acceptor moiety. **Scheme 1** illustrates the general A-π-Por-π-A of one of the different molecules families that we have synthesised.



Scheme 1: Zn-porphyrin (POR) as central core for efficient electron donor in bulk-heterojunction organic solar cells.

Moreover, we have continued our work on the application of dye sensitized solar cells to reach the 10% light-to-energy conversion target using our porphyrins as part of our deliverable list in our CRYMOSOL (CTQ-2013-47183R) project. **Figure 1.**

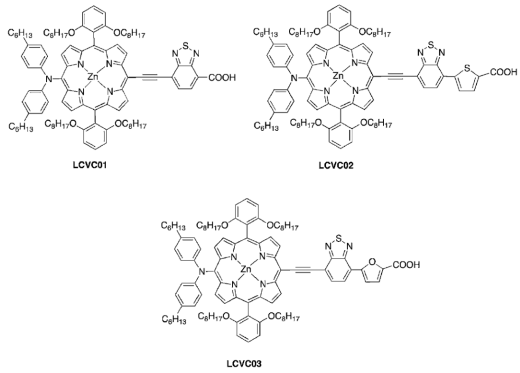


Figure 1. The set of asymmetric porphyrins synthetized as target molecules in CRYMOSOL. The LCVC02 achieved efficiencies over 10% at 1 sun.

Palomares group has also achieved within CRYMOSOL record efficiencies for methyl ammonium lead iodide (MAPI) perovskite solar cells. The MAPI, when processed either from solution leads to a solid with perovskite structure; for this reason these novel type of solar cells are known as perovskite solar cells.

The group has focused not only on making the most efficiency devices (14% under sun-simulated conditions of 100mW/cm^2@ 1.5 AM G) but also to characterize for the first time the interfacial charge transfer recombination reactions that prevent the MAPI perovskite solar cell to reach its maximum theoretical efficiency of 25%. **Figure 2** illustrated several current vs voltage curves for MAPI perovskite solar cells and Al_2O_3 /m-TiO_2 modified MAPI solar cells.

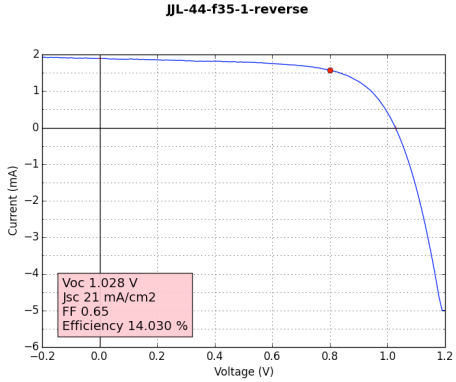


Figure 2. Current density vs voltage curve at 1 sun (100mW/cm^2@ 1.5 AM G) and in the dark for a perovskite solar cell fabricated at ICIQ from solution processed methods.

Group Competitive Research Projects.

1. AGAUR-SGR-2014-763
2. MICINN CTQ-2013-47183R
3. EU-ERC-POC (2NanoSi)
4. SGR-project-207 2009

Group Industrial Research Projects.

1. HYPRINT-Torrecid
2. Perovskite materials. EURECAT.

Articles

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