PHOTOVOLTAIC CELLS BASED ON ORGANIC MONOMERIC AND POLYMERIC THIN FILMS

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In the last decades the second and third generations of photovoltaic cells based both on the small molecules organic thin films and polymeric blends, respectively have attracted a great deal of interest among scientists involved in the research efforts to produce efficient and low-cost solar cells. Organic semiconductors can be produced from non-toxic precursors, and the technology needed for producing thin films is cheap. Among the organic semiconductors envisaged to be used in such structures, small molecules like metal-doped phthalocyanines (MePc, with Me=Cu, Mg, Zn, etc.) and polymers are the most studied, due to their peculiar optical properties. Their optical absorption in the visible range of the solar spectrum is strong, but based on an excitonic mechanism. A typical value for the diffusion length of the exciton in organic semiconductors is of 30-80 nm, while in order to achieve the required efficiency in light absorption, the absorber layer has to be at least 100 nm thick.The problem generated by the poor charge extraction, can be avoided by creating a large number of Donor/Acceptor Interfaces, spread in the whole volume of the organic absorber, leading to so call „Bulkheterojunction"cells, belonging to third generation of solar cells.

In this work are summarized the electrical and photoelectrical properties of the organic photovoltaic cells based on the organic monomeric and polymeric thin films. .

In the case of second generation of photovoltaic cells, first the single-layer structures (ITO/CuPc/Al and ITO/TPyP/Al) were been prepared and characterized. The double-layer photovoltaic structures based on the p-n heterojunction present at the interface between two organic layers, like, ITO/CuPc/TPyP/Al and ITO/Chl a/TPyP/Al, exhibits stronger spectral sensitivity and better spectral matching to a solar spectrum than Schottky cells using either CuPc or TPyP layer, having a power conversion efficiency with about two orders of magnitude, higher than those of single-layer structures. Three-layered organic solar cells with an interlayer of codeposited dyes of p-type CuPc and n-type TPyP, between the respective dye layers were also prepared and characterized, showing an increased power conversion efficiency, with respect of double–layer structures.

In the case of third generation of solar cells, the polymer (P3HT, PCBM or MEH-PPV, PCBM and their blend) based photovoltaic cells were produced by spin-coating technique. The structures based on the P3HT: PCBM (1:1) blend shows a promising photovoltaic response, with a power conversion efficiency increased of about two order of degree, with respect of those measured in the case of structures based on P3HT or PCBM polymers. Different design of structures were prepared and characterized trying permanently to improve the performances and the stability of the photovoltaic cells.

Keywords: organic thin films, photovoltaic cells based on small molecules, „Bulk Heterojunction" photovoltaic cells