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ORGANIC PHOTOVOLTAIC DEVICES: /TCO/(PEDOT/PSS)/ZNPC/1,4-DAAQ/AL

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On the basis of our thin film technology we have proceeded to the study of different cell configurations: two-layers D/A organic solar cells deposited by vacuum evaporation and bulk D/A heterojunction material based on a discontinuous D/A network thin film obtained by spin coating. We have also tested different transparent conductive oxides (TCO: ITO, NiO). These TCO films have been used as under or upper electrode. The organic materials were zinc-phthalocyanine (Ni-Pc) or poly vinyl (N-carbazole) (PVK) as electron donor and 1,4-diaminoanthraquinone (1,4-DAAQ) as electron acceptor. A PEDOT/PSS thin film was often intercalated between the organic and the TCO in order to improve the current characteristics. Results can be summarized as follows: ○ The cells efficiency does not depend strongly on the nature of the TCO used in the present work. ○ The performance of the p-n bilayer ZnPc/1,4-DAAQ depends strongly on the surface roughness of the structure. The fill factor (FF) of the current-voltage characteristics varies from 0.2, when the structure is glass/TCO/(PEDOT/PSS)/ZnPc/1,4-DAAQ/Al, to 0.6, when the structure is glass/Al/DAAQ/ZnPc/ PEDOT/PSS/mechanical contact/TCO. It is shown that this behaviour is related to the columnar growth properties of the 1,4-DAAQ films. ○ Best efficiency has been achieved with bulk D/A heterojunction material based on PVK/1,4-DAAQ blend (efficiency = 0.5%). The electrochemical measure of its HOMO (5.7eV) and LUMO (3.8eV), by comparison with PVK (HOMO = 5.7eV, LUMO = 2.2eV), shows that these values should be optimized. Effectively, the electron affinity of the donor should be significantly smaller than that of the acceptor, while the ionization potential of the acceptor should be significantly greater than that of the donor, which is not the case presently.