Molecular and supramolecular engineering of π-conjugated systems for photovoltaic conversion

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Résumé en anglais	Various series of conjugated systems have been used as donor in hetero-junction solar cells. The results obtained with EDOT-containing π-conjugated oligomers show that besides their direct effect on the electronic properties of the conjugated chain, the number and position of the EDOT units control to a large extent the orientation of the molecules on the substrate and hence the performances of the derived solar cells. The characteristics of the cells based on oligothienylenevinylenes donors show that in this case structural control of orientation can be achieved by means of substitution of the conjugated structure by alkyl chains. Donors based on star-shaped oligothiophenes provide another example of control of horizontal molecular orientation by design. The photovoltaic characteristics of bi-layer hetero-junctions show that the combined effects of controlled molecular orientation and planarization of the structure by the use of a fused tri-thienobenzene central core lead to power conversion efficiencies approaching 1%. In order to avoid the need to control molecular orientation first examples of bulk hetero-junctions based on PCBM and three-dimensional conjugated systems with isotropic electronic properties have been realized. A power conversion efficiency of 0.30% has been obtained under 79 mW cm− 2 white light illumination. This result obtained with a 3D donor based on a terthiophene conjugated chain with very limited absorption of the visible spectrum demonstrates the large potentialities of this novel concept.
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