Photovoltaic Devices from Fullerene-Oligophenyleneethynylene Conjugates

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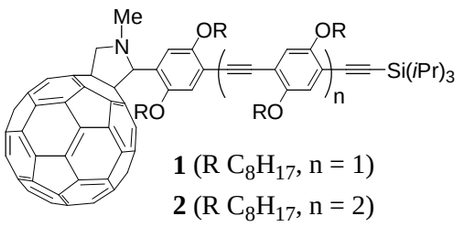
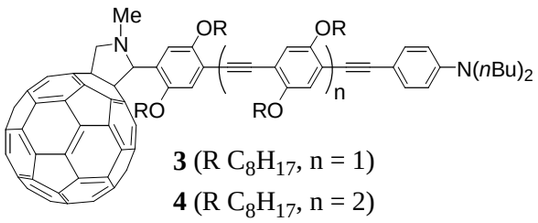
Exploitation of the particular electronic properties of fullerenes for solar energy conversion has become a field of intensive investigation.[1] The modification of semi-conductor or metal electrodes with fullerene thin films has revealed promising photoelectrochemical properties.[2] Good solar energy conversion efficiencies have also been obtained with sandwich-type π-conjugated polymer/ fullerene heterojunctions.[3] As part of this research, we have recently shown that fullerene derivatives in which an oligophenylenevinylene (OPV) group is attached to C_{60} can be incorporated into photovoltaic cells.[4] This molecular approach for solar energy conversion appears to be particularly interesting since the bicontinuous network obtained by chemically linking the hole-conducting OPV moiety to the electron-conducting fullerene subunit prevents any problem arising from bad contacts at the junction, as observed for polymer/C_{60} blends. Furthermore, this new synthetic approach also offers great versatility for design tuning the photovoltaic system. We now report the preparation of plastic solar cells from fullerene-oligophenyleneethynylene (OPE) derivatives **1**-**4**.[5]



1 (R C_8H_{17}, n = 1)
2 (R C_8H_{17}, n = 2)



3 (R C_8H_{17}, n = 1)
4 (R C_8H_{17}, n = 2)

For compounds **1** and **2**, the efficiency of the resulting photovoltaic devices is similar to those prepared from corresponding fullerene-OPV conjugates.[4] Interestingly, by increasing the donating ability of the conjugated oligomer substituents in **3** and **4** owing to the presence of the aniline group, the efficiency and the sensitivity of the photovoltaic devices are increased by one order of magnitude.[6] The latter observation shows clearly the advantage of our molecular approach allowing structure/activity relationships.

Acknowledgements

This work was supported by the CNRS and the French Ministry of Research.

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