

Synthesis and Photovoltaic Properties of p-Conjugated-C₆₀ Ensembles - F. Giacalone, R. Gomez, J. Segura, N. Martin (Universidad Complutense), C. Winder, and N.S. Sariciftci (Johannes Kepler University)

Guided by the concepts of semiconductor technology, the design of molecules with electronic/photonic functions is one viable route toward organic photovoltaic applications.¹ As far as the performance of organic photovoltaic devices (*i.e.*, a conjugated polymer/fullerene blend) is concerned, the overriding principle is an intermolecular electron transfer from the photoexcited polymer to the electron accepting fullerene. A major shortcoming is the tendency, especially that of pristine C₆₀, to phase-separate and subsequently to crystallize. This imposes important limitations on the solubility of C₆₀ within a conjugated polymer matrix. Uniformity and high quality of conjugated polymer/fullerene thin films are, however, essential requisites for device fabrication. Thus, different synthetic strategies have been refined to overcome the problem of phase separation. From an energy to an electron-transfer scenario; and third, to exploit the photovoltaic properties of these new donor-acceptor structures.

In this communication we will focus on the two different synthetic approaches followed by our group in order to prevent phase separation with the aim of enhancing device performances: (i) The first approach involves the synthesis of donor-acceptor systems in which both moieties are covalently linked.² A systematic change in the nature of the π -conjugated component allows (a) tailoring the light absorption of the chromophore and (b) varying the oxidation potential of the donor. The resulting electro- and photoactive dyads were examined by electrochemical and photophysical means. Some of them have been tested in photovoltaic devices. (ii) The second approach involves the synthesis of C₆₀ derivatives with enhanced miscibility with conjugated polymers.³ By appropriate chemical functionalization of the C₆₀ derivatives, an enantiomerically pure highly soluble C₆₀ dimer can be obtained. The CV data show that both C₆₀ are reduced independently to form the respective anionic species. This finding is in agreement with that previously observed for other dimeric systems in which the covalently connected C₆₀ units are not in close proximity. The behavior of this new material in photovoltaic devices in blends with conjugated polymers have been also investigated.

References

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