Phthalocyanine-fullerene dyads: photophysics and device application

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Photoinduced electron transfer in organic molecules is an intensively investigated phenomenon not only because of fundamental interest in the nature of the process, but also for the tentation to mimic synthetically the solar energy conversion as occuring in biological systems. Moreover, charge collection after charge separation may open a possibility to use such electron transfer systems in organic photovoltaic applications.

Dyads composed of electron acceptor molecules covalently linked to photoactive donors are candidates to perform photoinduced electron transfer. Due to their outstanding electronic and optical properties, fullerenes as strong electron accepting units in combination with phthalocyanines as electron donors appear particularly promising.

We report on the photophysical properties of dyad molecules having as antenna/donor phthalocyanine derivatives and as acceptor a fullerene derivative covalently attached. We found evidences for long living photoinduced electron transfer in solid state, a necessary requisite for solar energy conversion in molecular materials. Photovoltaic devices using films of fulleropyrrolidine-phthalocyanine dyads were built and characterized.

Fulleropyrrolidine-phthalocyanine dyad molecules were also incorporated into conjugated polymer/fullerene blends as used in bulk heterojunction plastic solar cells. With the participation of different energy and/or electron transfer processes an enlargement of the spectral response compared to conjugated polymer/fullerene blend devices and a better matching to the solar emission spectrum was obtained.

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