Metallocomplexes of fullerenes for organic solar cells

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Fullerenes are indispensable components of high-efficient plastic solar cells. The active layer of the best plastic solar cells should contain about 50% of soluble fullerene derivative PCBM. Nevertheless, optimization of the fullerene properties has been paid much less attention than that of the polymer component. Recent work in the field suggests that, in addition to enhancement of solar light absorption by the active layer, one of the main possibilities of improving the plastic solar cell performance is associated with increase of the LUMO energy of the fullerene acceptor that should decrease the energy loss in photoinduced charge transfer from the polymer donor to the fullerene acceptor.

In this work, we study a number of metallocomplexes of fullerenes C_{60} and C_{70} with Os, Pd and Pt as potential acceptors for plastic solar cells. First, these metallocomplexes have essentially stronger optical absorption than pristine C_{60} and C_{70} specifically in the range where conjugated polymers are usually transparent, i.e. below 2 eV. Therefore, more efficient harvesting of solar energy in the photovoltaic cell is possible. Second, as some electron density is transferred from the metal ion to the fullerene moiety, the metallocomplex electron affinity can be essentially decreased by choice of the metal type and ligands. We evaluate the efficiency of photoinduced charge transfer in blends of a model conjugated polymer, MEH-PPV, with metallocomplex $C_{60}OsL_n$. We have observed that $C_{60}OsL_n$ effectively quenches MEH-PPV photoluminescence and results in appearance of long-lived charged states (polarons) at MEH-PPV as follows from our photoinduced absorption spectroscopy data.