OBSERVATION OF SINGLET-TRIPLET TRANSITIONS IN CAPACITIVE PHOTOCURRENT SPECTROSCOPY OF ORGANIC SOLAR CELLS

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Fullerene derivatives such as [6,6]-phenyl-C_{61}-butyric acid methyl ester ($PC_{60}BM$) and [6,6]-phenyl-C_{71}-butyric acid methyl ester ($PC_{70}BM$) are promising electron acceptors for use in efficient organic solar cells. Capacitive photocurrent spectra of both $PC_{60}BM$ and $PC_{70}BM$ in conjunction with indium tin oxide (ITO) reveal peaks with wavelengths longer than the $S_1 \leftarrow S_0$ transitions.[a] The energies of low-lying triplet states of both molecules calculated using the ZINDO/S method agree with the experimentally observed transition frequencies. An excitation mechanism that involves collisions between the photoinduced free electrons in ITO and the organic molecules on the interface is proposed to explain the experimental observation. Tests on other organic solar cells are in process. Possibilities of improving the conversion efficiency of organic solar cells utilizing this mechanism will be discussed.

[a] Hemant M. Shah and Bruce W. Alphenaar, unpublished result.