Electronic Supplementary Information (ESI)

Nanoscale

Efficient ternary organic photovoltaics incorporating graphene-based porphyrin molecule as a universal electron cascade material

M. M. Stylianakis,[a,b*] D. Konios,[a,b] G. Kakavelakis,[a,c] G. Charalambidis,[d] E. Stratakis,[c,e] A. G. Coutsolelos,[d*] E. Kymakis[a*] and S. H. Anastasiadis[b,e]

[a]Center of Materials Technology and Photonics & Electrical Engineering Department, School of Applied Technology, Technological Educational Institute (TEI) of Crete, Heraklion, 71004, Crete, Greece.

[b]Dept. of Chemistry, Univ. of Crete, Heraklion, 71003 Crete, Greece.

[c]Dept. of Materials Science and Technology, Univ. of Crete, Heraklion, 71003 Crete, Greece.

[d]Laboratory of Bioinorganic Chemistry, Chemistry Department, University of Crete, Voutes Campus, 71003 Heraklion, Greece

[e]Institute of Electronic Structure and Laser (IESL), Foundation for Research and Technology-Hellas (FORTH).

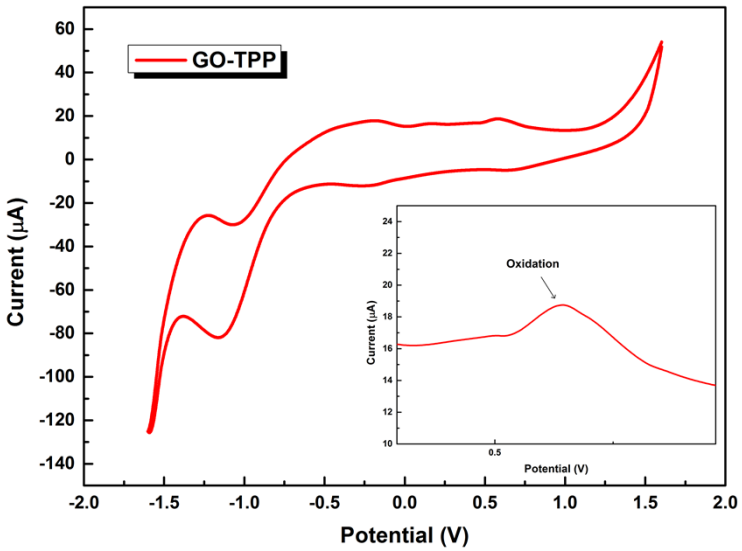


Fig. S1 Cyclic voltammetry curve of GO-TPP, synthesized after 72 h, in CH_3CN using 0.1 M Tetrabutylammonium hexafluorophosphate (TBAPF6) as the electrolyte, at a scan rate of 10 mV s^{-1} (Inset: Oxidation peak of GO-TPP).

Table S1 HOMO and LUMO values for different GO-TPP samples as measured by CV.

Reaction Time	HOMO (eV)	LUMO (eV)
24	-5.17	-4.74
48	-5.38	-4.42
60	-5.51	-4.34
72	-5.63	-4.25
96	-6.07	-4.12

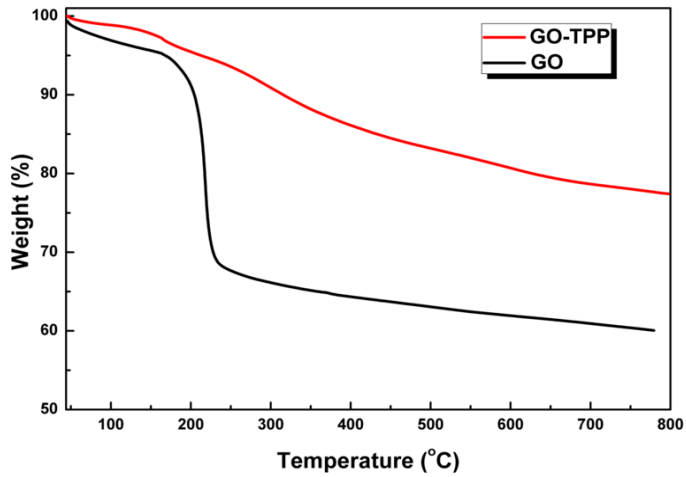


Fig. S2 Thermogravimetric Analysis. TGA curves of GO (black) and GO-TPP (red)

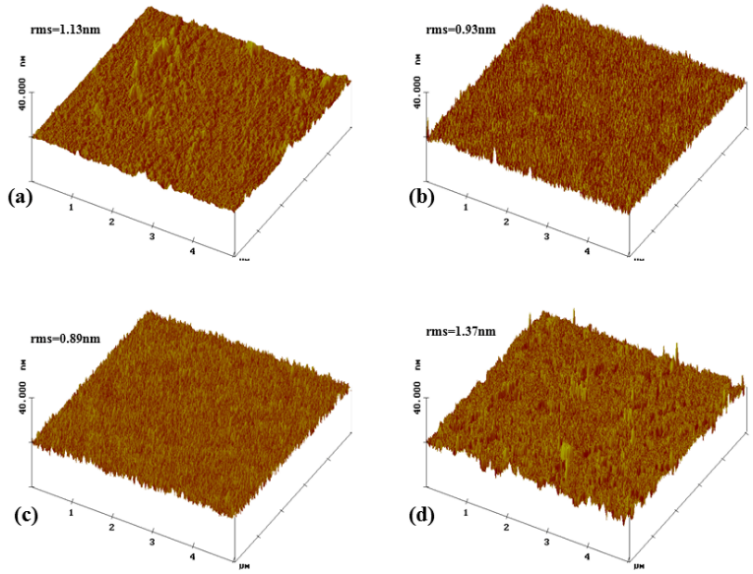
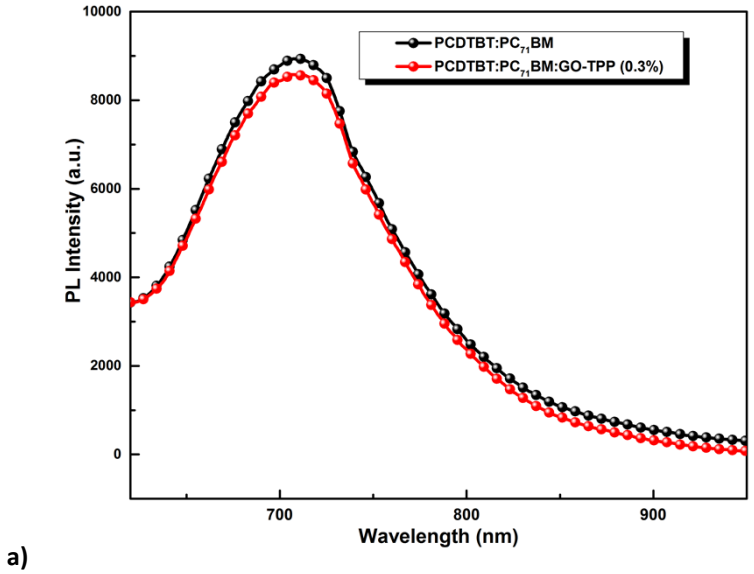
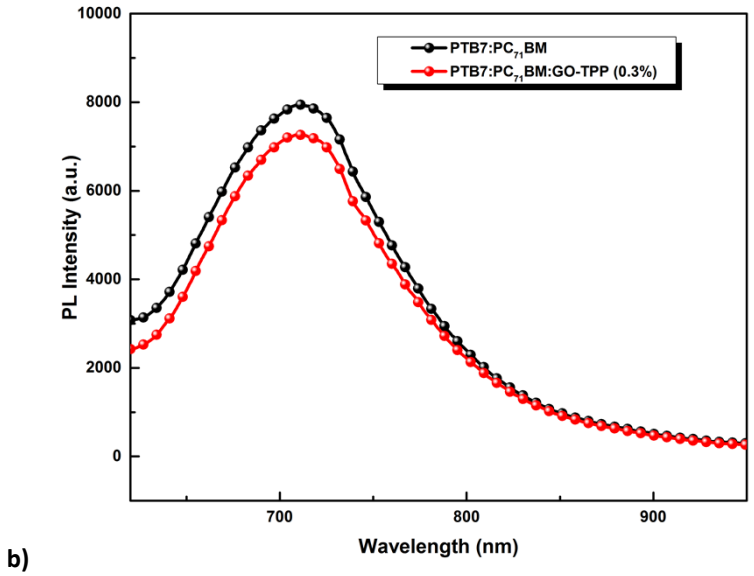


Fig. S3 AFM micrographs and rms values of PCDTBT:$PC_{71}BM$ active layer (a) without and with (b) 0.1%, (c) 0.3%, (d) 0.5% GO-TPP content.



a)



b)

Fig. S4 Photoluminescence (PL) spectra of the active layer based on a) PCDTBT:GO-TPP:$PC_{71}BM$ (0.3%) and b) PTB7:GO-TPP:$PC_{71}BM$ (0.3%).