

ΠΑΝΕΠΙΣΤΗΜΙΟ ΚΡΗΤΗΣ  
ΤΜΗΜΑ ΕΠΙΣΤΗΜΗΣ ΚΑΙ ΤΕΧΝΟΛΟΓΙΑΣ ΥΛΙΚΩΝ  
ΠΑΡΟΥΣΙΑΣΗ ΜΕΤΑΠΤΥΧΙΑΚΟΥ ΔΙΠΛΩΜΑΤΟΣ ΕΙΔΙΚΕΥΣΗΣ

**Τίτλος**

**«Device engineering for enhanced performance & stability of organic photovoltaics»**

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Επιβλέπων Καθηγητής κ. Γ. Κιοσέογλου

**Τρίτη, 28/07/2015,**

**11:00 π.μ.,**

**Αίθουσα Α210,**

**Κτίριο Μαθηματικών και Εφαρμοσμένων Μαθηματικών,**

**Πανεπιστήμιο Κρήτης**

**Abstract**

The effect of metallic (free of surfactants and ligand coated) nanoparticles (NPs) incorporation into different photoactive (P3HT:PCBM, P3HT:ICBA and PCDTBT:PC<sub>71</sub>BM) and interfacial layers (TiO<sub>x</sub>) of bulk heterojunction (BHJ) organic photovoltaic (OPV) devices was systematically studied. It was evidenced that the NPs doping gives rise to photovoltaic (PV) efficiency<sup>1</sup> and enhanced stability<sup>2</sup>, thereby minimizing device degradation rate during prolonged illumination. Spectroscopic analysis combined with photon-to-electron conversion efficiency measurements indicate that the efficiency improvement can be attributed to enhanced light harvesting and subsequent exciton generation rate into the photoactive layer. Therefore, this enhancement is attributed to localized surface plasmon resonant absorption (Au NPs) and scattering effects (Al NPs)<sup>3</sup>. Furthermore, it was demonstrated that the device performance was enhanced only in the case that metal NPs were in direct contact with polymer donor (bare or coated with the same ligand as the donor material)<sup>4</sup>. On the other hand, the introduction of Au nanorods (NRs) inside the TiO<sub>x</sub> back contact interfacial layer acts as a mirror in the device structure, increasing exciton generation through back contact scattering and thus charge collection<sup>5</sup>. The most efficient cells produced in this work incorporating Au NRs into TiO<sub>x</sub> buffer layer of a PTB7:PC<sub>71</sub>BM based photoactive layer, demonstrated power conversion efficiency (PCE) of 8.25 %, with J<sub>sc</sub> of 17.46 mA/cm<sup>2</sup>, Voc of 0.76V and FF of 0.62.

<sup>1</sup> Kakavelakis G., Stratakis E., Kymakis E (2013), RSC Advances, 3 (37), 16288-16291

<sup>2</sup> Maria Sygletou, George Kakavelakis, Barbara Paci, Amanda Generosi, Emmanuel Kymakis, Emmanuel Stratakis, (2015) Submitted

<sup>3</sup> Kakavelakis G., Stratakis E., Kymakis E., (2014), *Chemical Communications*, 50 (40), 5285 - 5287

<sup>4</sup> Kymakis E., Spyropoulos G.D., Fernandes R., Kakavelakis G., Kanaras A.G., Stratakis E., (2015), *ACS Photonics*, 2 (6), 714–72

<sup>5</sup> George Kakavelakis, Ioannis Vaggelidis, Antonios G. Kanaras, Eleferios Lidorikis, Emmanuel Stratakis, Emmanuel Kymakis, (2015) Submitted