Improvement of Inverted Organic Thin-film Solar Cells by Incorporation of Gold Quantum Dots/Plasmonic Systems

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In this work, we studied the enhancement of inverted organic thin-film solar cells (OSCs) by incorporating gold quantum dots (AuQDs) with plasmonic systems. [1-3]. Three types of AuQDs with different emission wavelengths: blue (B-AuQDs); green (G-AuQDs); and red (R-AuQDs) were loaded into a poly(3,4-ethylenedioxythiophene):poly(styrenesulfonate) thin-film layer of inverted OSCs. The grating structures were fabricated on P3HT:PCBM layers by nanoimprinting technique. The fabricated the solar cell devices consisted of ITO/TiO_2/P3HT:PCBM/PEDOT:PSS:AuQDs/silver structure, as shown in Fig.1. The fabricated devices were studied by UV-vis spectroscopy, atomic force microscopy (AFM) images, J-V characteristic, and impedance spectroscopy. We also studied the effect of AuQDs concentrations in PEDOT:PSS with different concentrations 0-7.00 µM. AuQDs were used as photosensitizers to develop photoelectric conversion properties of solar cells. The power conversion efficiency of the inverted OSCs with AuQDs was higher than that of a reference cell without AuQDs, as shown in Fig.2. Furthermore, AuQDs-OSCs were combined with plasmonic systems (e.g. AuNPs and grating-coupled surface plasmons) on metallic gratings for increasing efficiency of inverted OSCs.

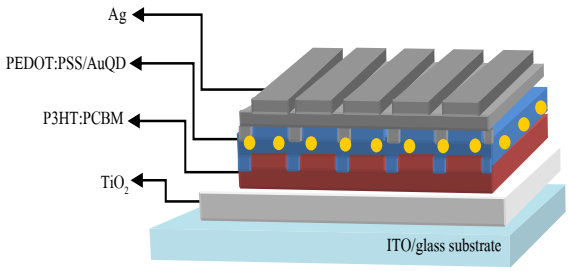

Fig. 1. A schematic of fabricated Inverted OSCs

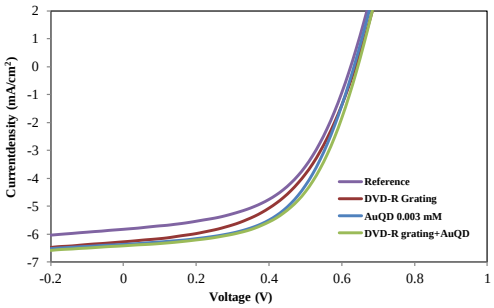

Fig. 2. J-V curves of inverted OSCs

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