Improved Efficiency of Vacuum Free Hybrid Solar Cells by Incorporating Gold Nanoparticles

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Plasmonic gold (Au) nanoparticles (NPs) was synthesized and characterized. The morphological and optical properties of Au NPs was measured using an Transmission Electron Microscope (TEM) and UV-vis and ultra violet. The Au nanospherical particles (NSPs) have a size of ~ 7 nm and the Au nanorods particles (NRPs) have a size of ~7 nm of width and ~23 nm. The Au NPs with different of shape were incorporated to the hole transport layer (HTL) of device lead to improving of light absorption and scattering of photoactive layer lead to increase the device performance. The surface roughness of device's active layer was optimized by deposited of 20 nm of thin of ZnO buffer layer between active layer and electrode. Finally, the device with structure of Glass/ indium tin oxide (ITO)/ (Polyethylene dioxy thiophene doped with polystyrene-sulfonic acid (PEDOT:PSS) + Au NRPs)/ (PBT7+PCBM)/Zinc Oxide (ZnO)/E-GaIn was fabricated. The highest power conversion efficiency (PCE) of ~ 6% % was measured using a solar simulator (Keithley 69911) under AM 1.5 illumination