

Hybrid polymer-quantum dot based single active layer structured multi-functional device (Organic Bistable Device, LED and Photovoltaic Cell)

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We demonstrate the hybrid polymer-quantum dot based multi-functional device (Organic bistable devices, Light-emitting diode, and Photovoltaic cell) with a single active-layer structure consisting of CdSe/ZnS semiconductor quantum-dots (QDs) dispersed in a poly N-vinylcarbazole (PVK) and 1,3,5-tirs- (N-phenylbenzimidazol-2-yl) benzene (TPBi) fabricated on indium-tin-oxide (ITO)/glass substrate by using a simple spin coating technique. The multi-functionality of the device as Organic bistable device (OBD), Light Emitting Diode (LED), and Photovoltaic cell can be successfully achieved by adding an electron transport layer (ETL) TPBi to OBD for attaining the functions of LED and Photovoltaic cell in which the lowest unoccupied molecular orbital (LUMO) level of TPBi is positioned at the energy level between the conduction band of CdSe/ZnS and LiF/Al electrode (band-gap engineering).

Through transmission electron microscopy (TEM) study, the active layer of the device has a p-i-n structure of a consolidated core-shell structure in which semiconductor QDs are uniformly and isotropically adsorbed on the surface of a p-type polymer core and the n-type small molecular organic materials surround the semiconductor QDs.