Enhancement of photovoltaic properties of polymer solar cells by modifying a structure of PEDOT:PSS layer

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Demand for developing robust renewable energy systems is increasing due to expiring fossil fuel deposits and ecological issues caused by using traditional energy sources. Among different renewable energy resources, solar energy is more attractive due to it can be transformed directly to heat, electricity or chemical energy. Photovoltaic devices are rapidly developing technology and have attracted attention of researchers and engineers from different fields. Polymer solar cells (PSCs) are very promising photovoltaic devices owing to facile fabrication method and cost-effectiveness of photoactive and semiconducting polymer materials [1].

PEDOT:PSS is semiconducting polymer materials with p-type conductivity which has become key components of PSCs [2]. The main role of PEDOT:PSS layer in PSCs is to extract photogenerated holes from photoactive layer and transport them to an external electrode [3]. The efficiency of hole extraction and transport depends on the quality of interface between PEDOT:PSS and photoactive layer and crystallinity of PEDOT:PSS. Here, we modified PEDOT:PSS layers obtaining by a spin-coating method from aqueous solution by adding 2-proponal. The improvement of structure and surface morphology was investigated by atomic force microscopy. Also, impedance spectroscopy technique was used to analyze charge transfer and transport. The modified PEDOT:PSS layers revealed better structure and surface morphology, and showed improved hole extraction and transport in comparison to an unmodified layer. PSCs with modified PEDOT:PSS layer have improved photovoltaic performance, which leads to enhancing the short circuit current density by 1.7 times, and power conversion efficiency and quantum efficiency of cells by 1.6 times.

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