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Efficiency enhancement of polymer solar cells by random texturing of nanoscale indium tin oxide layer

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The efficiency of polymer solar cells is improved by randomly texturing indium tin oxide (ITO) electrode layer in this work. Light trapping was enhanced with ITO layer texturing for the improvement of power conversion efficiency of polymer solar cells. The random textures of indium tin oxide (ITO) electrode layer is formed with O_2 and Ar plasma sputtering with various step heights of nanoscale range. With this approach, light trapping was enhanced with asymmetric morphology change. The active layer was fabricated with one-to-one ratio of P3HT (poly-3-hexylthiophene) and PCBM ([6,6]-phenyl C61-butyric acid methyl ester) conjugated polymers on the top of the patterned ITO layer. And LiF as electron transfer layer are evaporated at electrode.

It is demonstrated that the process of surface texturing ITO layer with O_2 and Ar plasma improved the efficiency of polymer solar cells depending on the roughness of ITO layer. It is analyzed that changed structure and morphology of polymer solar cells by random texturing ITO layer increased light absorption of semiconducting polymers. Therefore, the increased roughness ITO layer induces light trapping effect resulting in the increase of diffraction and contact area to the electron-collecting electrode.

Keywords: Polymer Solar Cells, Semiconducting polymers, Light trapping, Texturing