Organic Photovoltaics’ Efficiency Enhancement using Reflective and Semitransparent Solution-Processed Silver

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Organic photovoltaics (OPVs) provide an exciting research topic due to the promising features such as the use of abundant materials, low cost and lack of harmful fabrication processes. Their current problem is that they lag behind traditional solar cells in overall efficiency. The purpose of this project is to enhance the efficiency of organic solar cells by replacing common indium tin oxide (ITO), which has a tested efficiency of 3.9%, with a reflective solution-processed silver (Ag) electrode. In order to examine the viability of solution-processing the layers in OPVs, Ag and molybdenum oxide (MoO3) were deposed by evaporation, solution processing and spin coating. The other layers of OPV were kept constant, and 48 solar cell devices were created. All cells were compared in terms of power conversion efficiency (PCE) and fill factor (FF). It was found that the PCE of devices using solution-processed Ag were extremely close to those of evaporated Ag but exceeded the ITO (4.1% vs. 4.6%) respectively. It was also found that devices using evaporated MoO3 performed marginally better than solution-processed MoO3 (8.64% vs. 8.45%). In terms of FF, solution-processed Ag results were close to those of evaporated Ag (44.1% vs. 44.5%). These results highlight the potential for using solution processing as an effective method of deposition for OPV layers. This study shows potential in the fabrication of ITO-free, all-solution processed semitransparent solar cells to be used in worldwide applications such as solar cells, water treatment, emergency power and satellites.

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