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Bulk Heterojunction Organic Solar Cell Devices With ZnO Nanoparticles Buffer Layer for Improved Efficiency

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Today, the third generation photovoltaic (solar) cells dominate modern age research in renewable energy. In recent developments, the ultimate goal is to improve the general performance of the bulk heterojunction organic solar cells to enable them to compete on an equal footing basis with conventional silicon photovoltaic cells. In this presentation, we review the fundamental parameters that have been reported to improve the general performance of the bulk-heterojunction (BHJ) organic solar cell (OSC) devices. These parameters include, among other things, the use of ZnO nanoparticles buffer layer inserted between the top electrode and the photoactive layer, annealing procedure and device geometry.

ZnO nanoparticles with relatively high electron mobility can play the role of electron transporting layer while at the same time they prevent holes from reaching the top electrode and they can also act to prevent diffusion of the top electrode metal ions into the photoactive layer. The BHJ-OSC devices constructed in this study comprised of successive (bottom up) layers of (3,4ethylenedioxythiophene):poly(styrenesulfonate) (PEDOT:PSS), a blend of poly(3-hexylthiophene) (P3HT) and [6,6]-phenyl butyric acid methyl ester (PCBM) layer, zinc oxide (ZnO) nanoparticles and aluminum (Al) metal top electrode. These layers were deposited on indium tin oxide (ITO) coated glass substrates. The devices were annealed at 155 ^{o}C either before or after depositing Al top electrode, and the geometry was inverted.

Keywords: Photovoltaic; organic; bulk-heterojunction, nanoparticles