Improved Efficiency and Stability of Organic Solar Cells by Interface Modification Using Atomic Layer Deposition of Ultrathin Aluminum Oxide

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Abstract

The interfacial contacts between the electron transporting layers (ETLs) and the photoactive layers are crucial to device performance and stability for OSCs with inverted architecture. Herein, atomic layer deposition (ALD) fabricated ultrathin Al2O3 layers are applied to modify the ETLs/active blends (PM6:BTP-BO-4F) interfaces of OSCs, thus improving device performance. The ALD-Al2O3 thin layers on ZnO significantly improved its surface morphology, which led to the decreased work function of ZnO and reduced recombination losses in devices. The simultaneous increase in open-circuit voltage (), short-circuit current density () and fill factor (FF) were achieved for the OSCs incorporated with ALD-Al2O3 interlayers of a certain thickness, which produced a maximum PCE of 16.61%. Moreover, the ALD-Al2O3 interlayers had significantly enhanced device stability by suppressing degradation of the photoactive layers induced by the photocatalytic activity of ZnO and passivating surface defects of ZnO that may play the role of active sites for the adsorption of oxygen and moisture.

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