Article

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ZnO-PCBM bilayers as electron transport layers in low-temperature fabricated perovskite solar cells

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Abstract

We investigate an electron transport bilayer fabricated at < 110 °C to form all low-temperature processed, thermally stable, efficient perovskite solar cells with negligible hysteresis. The components of the bilayer create a symbiosis that results in improved devices compared with either of the components being used in isolation. A sol-gel derived ZnO layer facilitates improved energy level alignment and enhanced charge carrier extraction and a [6,6]-phenyl-C_{61}-butyric acid methyl ester (PCBM) layer to reduce hysteresis and enhance perovskite thermal stability. The creation of a bilayer structure allows materials that are inherently unsuitable to be in contact with the perovskite active layer to be used in efficient devices through simple surface modification strategies.

Keyword

Hybrid perovskite; Solar cell; Electron transport layer; Metal oxide

1 Introduction

The emergence of perovskite solar cells has had a tremendous impact of the field of photovoltaics. Its low-temperature deposition route brings the possibility of large volume processing. The highest reported power conversion efficiency (PCE) at present exceeds 22% [1,2], which remarks the rapid progress of this new class of hybrid materials [3]. Many properties of the hybrid perovskite make it suitable for photovoltaic applications, including high carrier mobilities, suitable and direct band gap, low trap densities, and etc. [4–8].

It is likely that perovskite photovoltaics will have impact in many emerging technical areas, such as wearable electronics and remote/isolated power generation systems. The fabrications of these devices benefit from low-cost, large-area routes such as roll-to-roll