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Effect of MoO_3 Thickness on the Electrical, Optical, and structural Properties of MoO_3 Graded ITO Anodes for PEDOT:PSS-free Organic Solar Cells

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We investigated MoO_3 graded ITO electrodes for organic solar cells (OSCs) without PEDOT:PSS buffer layer. The effect of MoO_3 thickness on the electrical, optical, and structural properties of MoO_3 graded ITO anodes prepared by RF/DC magnetron co-sputtering system using MoO_3 and ITO targets was investigated. At optimized conditions, we obtained MoO_3 graded ITO electrodes with a low sheet resistance of 13 Ohm/square, a high optical transmittance of 83% and a work function of 4.92 eV, comparable to conventional ITO films. Due to the existence of MoO_3 on the ITO electrodes, OSCs fabricated on MoO_3 graded ITO electrode without buffer layer successfully operated. Although OSCs fabricated on ITO anode without buffer layer showed a low power conversion efficiency of 1.249%, OSCs fabricated on MoO_3 graded ITO electrode without buffer layer showed a outstanding cell performance of 2.545%. OSCs fabricated on the MoO_3 graded ITO electrodes exhibited a fill factor of 61.275%, a short circuit current of 7.439 mA/cm2, an open circuit voltage of 0.554 V, and a power conversion efficiency of 2.545%. Therefore, MoO_3 graded ITO electrodes can be considered a promising transparent electrode for cost efficient and reliable OSCs because it could eliminate the use of acidic PEDOT:PSS buffer layer.

Keywords: TCO, PEDOT:PSS-free OSCs

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Application of Atomic Layer Deposition to Solid Oxide Fuel Cells

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Atomic layer deposition (ALD) provides self-limiting processes based on chemisorption-based reactions. Such unique features allow for superior step coverage, atomic-scale control in thickness, and surface-dependent reaction controls. Furthermore, the surface-limited deposition enables the artificial deposition of oxide and/or metallic materials onto the porous systems as long as the supply is guaranteed in terms of time in providing reactant species and removing the byproducts and redundant reactants. The unique feature of atomic layer deposition is applied to solid oxide fuel cells whose incorporates two porous cathode and anode compartments in addition to the ionic electrolyte. Specific materials are deposited to the surface sites of porous electrodes, with the aim to controlling the triple phase boundaries crucial for the optimized SOFC performances. The effect of ALD on the SOFC performance is characterized using current-voltage characteristics in addition to frequency-dependent impedance spectroscopy. The pros and cons of ALD-controlled SOFCs are discussed toward high-performance SOFC systems.

Keywords: ALD, SOFCs