Incorporation of graphitic carbon nitride as ETL for highly efficient perovskite solar cells

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Abstract

Perovskite solar cells (PSCs) have attracted great research interest in scientific community due to their extraordinary optoelectronic properties. Their power conversion efficiency (PCE) has increased rapidly in recent years, surpassing other 3rd generation photovoltaic (PV) technologies [1]. However, important issues (including further efficiency increase and device stability) have not been effectively addressed yet, depending on the materials involved (inorganic, organic) and the degree of technological maturity. Recently, graphitic carbon nitride (g-C_3N_4) has been used as a novel material in PSCs due to its excellent optical properties, high thermal physical–chemical stability, and environmentally friendly nature [2]. Significant performance and stability increase is achieved when g-C_3N_4 is applied at the PSC interfaces. The observed improvement is attributed to its wetting (hydrophobic/hydrophilic) nature and the fine tuning of the corresponding interface energetics.

In this contribution we present the results of a systematic study on the synthesis and characterization of innovative graphitic carbon nitride materials and their application as electron transport mediators in planar perovskite solar cells. Specifically, we have prepared nanostructured derivatives of g-C_3N_4 which were used to modify the electron transporting layer (ETL) of planar PSCs, resulting in robust devices with high power conversion efficiency (PCE). The investigation of the photoelectrochemical properties confirmed that the g-C_3N_4–based PSCs present enhanced short-circuit photocurrent density and greater stability. The obtained results are attributed to the particular structure and the morphology of the graphitic carbon nitride materials and open new perspectives in the field of perovskite PVs.

References

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