

Author's Accepted Manuscript

17.46% efficient and highly stable carbon-based planar perovskite solar cells employing Ni-doped rutile TiO₂ as electron transport layer

Xingyue Liu, Zhiyong Liu, Bo Sun, Xianhua Tan, Haibo Ye, Yuxue Tu, Tielin Shi, Zirong Tang, Guanglan Liao



PII: S2211-2855(18)30344-6
DOI: <https://doi.org/10.1016/j.nanoen.2018.05.031>
Reference: NANOEN2739

To appear in: *Nano Energy*

Received date: 27 January 2018
Revised date: 3 May 2018
Accepted date: 13 May 2018

Cite this article as: Xingyue Liu, Zhiyong Liu, Bo Sun, Xianhua Tan, Haibo Ye, Yuxue Tu, Tielin Shi, Zirong Tang and Guanglan Liao, 17.46% efficient and highly stable carbon-based planar perovskite solar cells employing Ni-doped rutile TiO₂ as electron transport layer, *Nano Energy*, <https://doi.org/10.1016/j.nanoen.2018.05.031>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting galley proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

17.46% efficient and highly stable carbon-based planar perovskite solar cells employing Ni-doped rutile TiO₂ as electron transport layer

Xingyue Liu¹, Zhiyong Liu¹, Bo Sun, Xianhua Tan, Haibo Ye, Yuxue Tu, Tielin Shi, Zirong Tang and Guanglan Liao*

State Key Laboratory of Digital Manufacturing Equipment and Technology, Huazhong University of Science and Technology, Wuhan 430074, China

* Address correspondence to (G. Liao) guanglan.liao@hust.edu.cn.

Abstract

Organometal trihalide perovskite solar cells (PSCs) with carbon counter electrode (CE) have attracted tremendous interest due to their remarkable properties such as low cost and high stability. However, carbon-based PSCs always suffer from much lower power conversion efficiency (PCE) than the counterparts with noble metal cathode. Herein, we demonstrate a carbon-based planar heterojunction PSC using high-crystallinity Ni-doped rutile TiO₂ as electron transport layer (ETL) for the first time, while copper phthalocyanine (CuPc) is introduced as hole transport layer (HTL). It is found that Ni doping can shift the Fermi level of the ETL upward and increase the charge mobility of the TiO₂ film, thus enhancing the charge transport and extraction. An optimized PCE of 17.46% was obtained after 0.01 M Ni doping, comparable to or even better than devices with state-of-the-art doped Spiro-OMeTAD as HTL and Au as CE. To the best of our knowledge, this is the highest efficiency that has been reported for carbon-based PSCs. By contrast, the pristine TiO₂-based device only displayed a PCE of 15.82%. Detailed superior capability of Ni-doped TiO₂ in facilitating charge transfer and suppressing carrier recombination are revealed by Hall effect and photoluminescence (PL) as well as electrochemical impedance spectroscopy (EIS) measurements. Furthermore, the use of highly stable CuPc and commercial carbon makes as-prepared PSCs exhibit excellent stability with no obvious decline in PCE after being stored in ambient air for 1200 h. This work presents an important step forwards to the

¹ Xingyue Liu and Zhiyong Liu contribute equally to this article.

Download English Version:

<https://daneshyari.com/en/article/7952415>

Download Persian Version:

<https://daneshyari.com/article/7952415>

[Daneshyari.com](https://daneshyari.com)