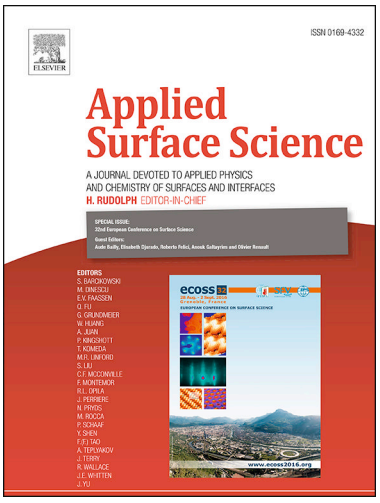
Accepted Manuscript



Full Length Article

Enhanced Hole Transfer in Hole-Conductor-Free Perovskite Solar Cells *via* Incorporating CuS into Carbon Electrodes

Ruiyuan Hu, Rui Zhang, Yuhui Ma, Wei Liu, Liang Chu, Weiwei Mao, Jian Zhang, Jianping Yang, Yong Pu, Xing'ao Li

PII: S0169-4332(18)32215-3
DOI: https://doi.org/10.1016/j.apsusc.2018.08.078
Reference: APSUSC 40115

To appear in: *Applied Surface Science*

Received Date: 17 May 2018
Revised Date: 3 August 2018
Accepted Date: 7 August 2018

Please cite this article as: R. Hu, R. Zhang, Y. Ma, W. Liu, L. Chu, W. Mao, J. Zhang, J. Yang, Y. Pu, X. Li, Enhanced Hole Transfer in Hole-Conductor-Free Perovskite Solar Cells *via* Incorporating CuS into Carbon Electrodes, *Applied Surface Science* (2018), doi: https://doi.org/10.1016/j.apsusc.2018.08.078

Enhanced Hole Transfer in Hole-Conductor-Free Perovskite Solar Cells *via* Incorporating CuS into Carbon Electrodes

Ruiyuan Hu [1], Rui Zhang [1], Yuhui Ma [1], Wei Liu [1], Liang Chu [1, 2 *], Weiwei Mao [2], Jian Zhang [2], Jianping Yang [2], Yong Pu [2], Xing'ao Li [1, 2 *]

[1] Key Laboratory for Organic Electronics and Information Displays & Institute of Advanced Materials (IAM), Jiangsu National Synergetic Innovation Center for Advanced Materials (SICAM), School of Materials Science and Engineering, Nanjing University of Posts and Telecommunications, 9 Wenyuan Road, Nanjing 210023, P. R. China.

[2] New Energy Technology Engineering Laboratory of Jiangsu Provence, School of Science, Nanjing University of Posts and Telecommunications, Nanjing 210023, P. R. China.

Abstract

Hole conductor-free perovskite solar cells (PSCs) based on carbon electrodes have drawn much attention on account of low cost, long-term stability, simple manufacture technology. In the devices, the carbon electrodes not only play as charge transfer channels, but also as hole extracting layers, thus the conductivity and hole mobility are critical for the performance. However, the hole mobility of carbon layers is relatively low. Here, low-temperature carbon layers were incorporated with CuS nanostructures, in which the hole mobility was improved. After adding 1 wt.% CuS, the PSCs yielded to the best power conversion efficiency of 11.28% with a V_{OC} of 0.98 V and J_{SC} of 18.26 mA cm^{-2}, while the pure carbon electrode based PSCs attained the best power conversion efficiency of 9.36% with a V_{OC} of 0.93V and J_{SC} of 16.14 mA cm^{-2} which is slightly higher than that of the PSCs based on pure carbon counter electrode. This study demonstrates that it is an effective way to improve the hole transport property of carbon counter electrode by combining p-type CuS with high hole mobility.

* Corresponding author:

E-mail addresses: iamxali@njupt.edu.cn (X. Li), chuliang@njupt.edu.cn (L. Chu) Tel: +86 25 85866608