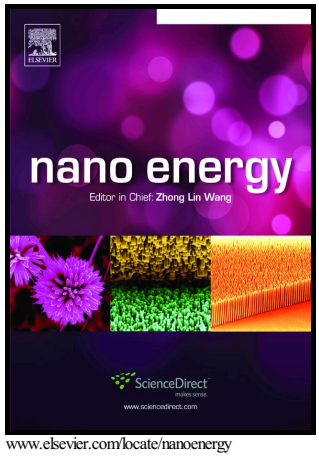
Breakthroughs in NiO_X-HTMs towards stable, low-cost and efficient perovskite solar cells

Sajid Sajid, Ahmed Mourtada Elseman, Hao Huang, Jun Ji, Shangyi Dou, Haoran Jiang, Xin Liu, Dong Wei, Peng Cui, Meicheng Li



www.elsevier.com/locate/nanoenergy

PII: S2211-2855(18)30477-4
DOI: https://doi.org/10.1016/j.nanoen.2018.06.082
Reference: NANOEN2863

To appear in: *Nano Energy*

Received date: 21 May 2018
Revised date: 11 June 2018
Accepted date: 25 June 2018

Cite this article as: Sajid Sajid, Ahmed Mourtada Elseman, Hao Huang, Jun Ji, Shangyi Dou, Haoran Jiang, Xin Liu, Dong Wei, Peng Cui and Meicheng Li, Breakthroughs in NiO_X-HTMs towards stable, low-cost and efficient perovskite solar cells, *Nano Energy,* https://doi.org/10.1016/j.nanoen.2018.06.082

Breakthroughs in NiO_x-HTMs towards stable, low-cost and efficient perovskite solar cells

Sajid Sajid[1], Ahmed Mourtada Elseman[1, 2], Hao Huang[1], Jun Ji[1], Shangyi Dou[1], Haoran Jiang[1], Xin Liu[1], Dong Wei[1], Peng Cui[1], Meicheng Li[1*]

[1]State Key Laboratory of Alternate Electrical Power System with Renewable Energy Sources, School of Renewable Energy, North China Electric Power University, Beijing 102206, China.

[2]Electronic & Magnetic Materials Department, Advanced Materials Division, Central Metallurgical Research and Development Institute (CMRDI), Helwan, P.O.Box 87, Cairo 11421, Egypt.

Abstract

Although revolutionary progress in power conversion efficiencies (PCEs) of perovskite solar cells (PSCs) greater than 22 % has accompanied significant advances in materials engineering, processing, and device architectures, the selection of proper hole transporting materials (HTMs) is still critical for high efficiency, low-cost and long-term stability. The PSCs community is actively investigating a group of HTMs for high efficiency and long-term stability with commercial viability. In this context, inorganic nickel oxide (NiO_x)-HTMs possess the advantages of energetically favorable energy band positions, high hole mobility, superior chemical stability, and low cost manufacturing. Herein, we address the initial breakthroughs and recent progress in NiO_x-HTMs for PSCs. In addition to synthetic routes and deposition techniques used for NiO_x-HTMs in two major device architectures (p-i-n and n-i-p structure), the stability and cost-breakdown of PSCs are evaluated in details. Finally, future directions for further improvements on issues such as high efficiency, stability and low-cost of PSCs based on NiO_x-HTMs are also provided.

Graphical abstract: