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Perspective

Boron nitride-incorporated NiO_x as a hole transport material for high-performance p-i-n planar perovskite solar cells

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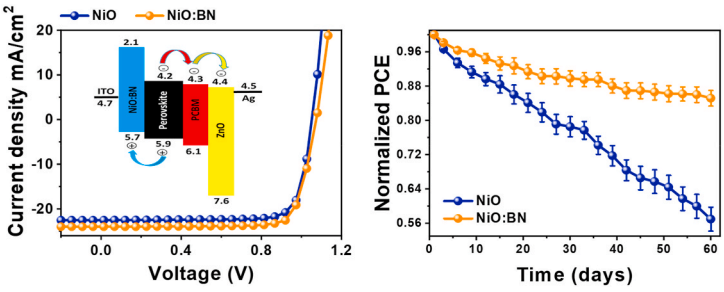
HIGHLIGHTS

- NiO:BN is introduced as a hole transport layer in perovskite solar cells (PSCs).
- NiO:BN helps to form batter energy level alignment and large grain of perovskite.
- NiO:BN provide enhanced charge transportation and extraction ability.
- NiO:BN based PSCs shows over 20% cell-efficiency and better stability.

GRAPHICAL ABSTRACT



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ABSTRACT

In recent years, organo-metal halide perovskite and p-i-n planar perovskite solar cells (PSCs) based on it have received tremendous attention due to their high efficiency close to silicon, low temperature process, and ease of cost-effective large-scale manufacturing. However, p-i-n planar PSCs have low fill factor and low current density due to poor interface properties, resulting in low performance. In this work, to solve these problems, we introduce boron nitride (BN) as an interface modifier and demonstrate that the BN incorporated NiO_x (NiO:BN) is effectively working as hole transport layer of p-i-n planar PSCs. The NiO:BN hole transport layer (HTL) has a deep energy level of highest occupied molecular orbital (HOMO) and smooth surface compared to pristine NiO_x, which provide the better energy level alignment and better interface contact between NiO:BN HTL and perovskite, improving charge extraction and transportation and inhibiting recombination of charge. As a result, NiO:BN based p-i-n planar PSCs represent an improved power conversion efficiency of 20.74% and long-term stability in ambient air for 60 days (maintained over 84% of their initial PCE). Therefore, it can be suggested that the NiO:BN HTL is a promising alternative HTL for high performance p-i-n planar PSCs.

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