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Khalid Mahmood, Arshi Khalid

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# Single-step electrospray deposited nitrogen-doped ZnO nanosheets yield hysteresis-free perovskite solar cells

Khalid Mahmood<sup>a,\*</sup>, Arshi Khalid<sup>b</sup>

<sup>a</sup>Department of Chemical & Polymer Engineering, University of Engineering & Technology Lahore, Faisalabad Campus, 3½ Km. Khurrianwala - Makkuana By-Pass, Faisalabad, Pakistan.

<sup>b</sup>Department of Humanities & Basic Sciences, University of Engineering & Technology Lahore, Faisalabad Campus, 3½ Km. Khurrianwala - Makkuana By-Pass, Faisalabad, Pakistan.

E-mail address: [khalid@kaist.ac.kr](mailto:khalid@kaist.ac.kr)

## Abstract

Electrospraying technique has been used for the one-step deposition of electron-rich nitrogen-doped ZnO (N-ZnO) nanosheets (NS,s) as a novel electron transporting layers (ETL,s) for highly efficient and hysteresis-free hybrid perovskite solar cells. The perovskite devices based on NZO NS,s demonstrate the average power conversion efficiency ( $PCE_{avg}$ ) of 14.4% and the maximum power conversion efficiency ( $PCE_{max}$ ) of 15.91%, owing to their better morphology, conductivity and optical transmittance which enhances the faster transfer of electrons and better infiltration of perovskite absorber into the oxide layer.

**Keywords:** Zinc oxide, Thin films, Solar energy materials, Energy storage and conversion

## 1. Introduction

Organolead-halide perovskite based solar cells (PSCs) have emerged as a most promising candidate for next generation photovoltaics because of their superb light-

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