

Author's Accepted Manuscript

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PII: S2211-2855(18)30451-8
DOI: <https://doi.org/10.1016/j.nanoen.2018.06.057>
Reference: NANOEN2838

To appear in: *Nano Energy*

Received date: 26 March 2018
Revised date: 16 June 2018
Accepted date: 16 June 2018

Cite this article as: Ivy M. Asuo, Dawit Gedamu, Ibrahima Ka, Luis Felipe Gerlein, François-Xavier Fortier, Alain Pignolet, Sylvain G. Cloutier and Riad Nechache, High-Performance Pseudo-halide Perovskite Nanowire Networks for Stable and Fast-response Photodetector, *Nano Energy*, <https://doi.org/10.1016/j.nanoen.2018.06.057>

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High-Performance Pseudo-halide Perovskite Nanowire Networks for Stable and Fast-response Photodetector

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ABSTRACT

Perovskite-based photodetectors show a great promise thanks to the material's excellent photogeneration and broadband device operation. Amongst the fundamental limitations of halide perovskites, humidity-induced degradation arises as the main impediment towards viable commercial-grade perovskite-based technologies. Here, we report a stable, reproducible and reliable pseudo halide perovskite nanowire network-based photodetector with superior performances. The perovskite nanowire network is deposited using a two-step spin-coating process atop patterned substrates under ambient conditions with relative humidity (RH%), higher than 50 %. Because of the particular 1D perovskite nanowire morphology, our devices require no charge collectors, which reduces fabrication steps and costs. Most importantly, we demonstrate that incorporation of lead thiocyanate ($\text{Pb}(\text{SCN})_2$) directly in the precursor solution promotes the synthesis of stable hybrid perovskite nanowire networks in ambient conditions. These devices exhibit response time as fast as 50 μs and responsivities up-to $\sim 0.23 \text{ A}\cdot\text{W}^{-1}$ at 2 V bias. Also, the optimum photodetector exhibited high specific detectivity of $7.1 \times 10^{11} \text{ cm}\cdot\text{Hz}^{1/2}\cdot\text{W}^{-1}$. This novel and yet simple device architecture

¹ I. M. Asuo and D. Gedamu contributed equally to this work.

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