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*Nontoxic (CH<sub>3</sub>NH<sub>3</sub>)<sub>3</sub>Bi<sub>2</sub>I<sub>9</sub> Bismuth based perovskite solar cells : Improved device performance and stability through morphological tailoring*

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# Nontoxic (CH<sub>3</sub>NH<sub>3</sub>)<sub>3</sub>Bi<sub>2</sub>I<sub>9</sub> Bismuth based perovskite solar cells : Improved device performance and stability through morphological tailoring

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International Conference on Hybrid and Organic Photovoltaics (/hybrid-and-organic-photovoltaics-international-conference)

Proceedings of International Conference on Hybrid and Organic Photovoltaics (HOPV18) (/HOPV18)

Benidorm, Spain, 2018 May 28th - 31st

Organizers: Emilio Palomares and Rene Janssen



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Oral presentation 001

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Perovskite solar cells have shown remarkable improvement in certified power conversion efficiency (PCE) [1] of >22%. Nevertheless, many challenges regarding the stability and toxicity of the lead based perovskite material remains at the forefront of current research. The toxicity of lead which is present in a rather water-soluble form in perovskite solar cells remains an environmental concern, that is yet to be resolved. The bismuth based zero-dimensional perovskite shows a high band gap ( $E_g$ )  $\approx$  1.8 eV [2], [3 - 6] which makes it a suitable candidate for application in tandem solar cells. Recently, layered bismuth triiodide (BiI<sub>3</sub>) has also been used in solar cells as photoactive materials. [7-8] with the highest reported efficiency of 0.3%. [8] However, there are very few attempts to make pure bismuth triiodide based solar cells and also lack in systematic investigation on morphological tailoring, a viable route to fully utilize the potential of this material is to fine-tune the desired composition and properties for CH<sub>3</sub>NH<sub>3</sub>BiI<sub>3</sub> material without any doping. In this direction, we report the vapor assisted solution process (VASP) two-step method to prepare bismuth perovskite samples at different reaction time The samples prepared at an optimum reaction time of 25 minutes exposure of MAI(v) give reproducible power conversion efficiency upto 2 %, (FF = 0.75%, Jsc = 2.9 mA/cm<sup>2</sup>, Voc = 0.91 V), highest so far reported for methyl amine based bismuth perovskite devices. This work demonstrates the efficacy of the VASP process in producing highly compact films that give improved optoelectronic performance.

(1) <https://www.nrel.gov/pv/assets/images/efficiency-chart.png>

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renewable energy, photovoltaics, lighting, semiconductor quantum dots, 2-D materials synthesis, charge carriers dynamics, microscopy and spectroscopy semiconductors fundamentals, etc.

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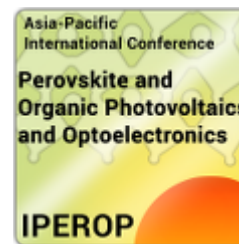
conference)International Conference on Hybrid and Organic Photovoltaics (/hybrid-and-organic-photovoltaics-international-conference)

International Conference on Hybrid and Organic Photovoltaics (HOPV) is celebrated yearly in May. The main topics are the development, function and modeling of materials and devices for hybrid and organic solar cells. The field is now dominated by perovskite solar cells but also other hybrid technologies, as organic solar cells, quantum dot solar cells, and dye-sensitized solar cells and their integration into devices for photoelectrochemical solar fuel production.

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optoelectronics-conferenc)**Asia-Pacific International Conference on Perovskite, Organic Photovoltaics and Optoelectronics (/international-perovskite-and-organic-photovoltaics-and-optoelectronics-conferenc)**

The main topics of the Asia-Pacific International Conference on Perovskite, Organic Photovoltaics and Optoelectronics (IPEROP) are discussed every year in Asia-Pacific for gathering the recent advances in the fields of material preparation, modeling and fabrication of perovskite and hybrid and organic materials. Photovoltaic devices are analyzed from fundamental physics and materials properties to a broad set of applications. The conference also covers the developments of perovskite optoelectronics, including light-emitting diodes, lasers, optical devices, nanophotonics, nonlinear optical properties, colloidal nanostructures, photophysics and light-matter coupling.

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and Optoelectronics (/perovskite-  
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nanoGe Perovskite Conferences on Photovoltaics and Optoelectronics (NPERC) celebrated early every year is a combination of two independent events focused on perovskite research. The International Conference on Perovskite Thin Film Photovoltaics ABXPV is the best place to hear the latest on developments in all aspects perovskite solar cells, from fundamental physics and materials properties to a broad set of applications. The International Conference on Perovskite Photonics and Optoelectronics PEROPTO is focused on recent advances in the fields of perovskite light-emitting diodes, lasers, optical devices, nanophotonics, nonlinear optical

properties, colloidal nanostructures,  
photophysics and light-matter  
coupling.