Efficient and Stable Perovskite Solar Cells with All Solution Processed Metal Oxide Transporting Layers

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SUMMARY

UCLA researchers in the Department of Materials Science and Engineering have developed a novel lead halide perovskite solar cell with a metal oxide charge transport layer.

BACKGROUND

Lead halide perovskite solar cells offer excellent photovoltaic efficiencies (up to 15%), but both the perovskite material and the charge transport layers have poor stability, where the device degrades within days under normal conditions. Specifically, organic charge transport layers are important for energy level matching and charge transport, but their use is limited because they have poor device stability and are costly to fabricate. The use of inorganic materials to replace the organic transport layers offers a promising avenue to circumvent the disadvantages of these layers for solar cell applications.

INNOVATION

Professor Yang Yang and his research team have developed a unique perovskite solar cell that uses metal oxide films for the charge transport layer. Metal oxides offer the advantage of higher carrier mobility and superior stability than typical organic materials and they can be processed easily via solution. This unique lead halide perovskite solar cell has achieved a ~16% efficiency and improved stability of 60 days under normal operating conditions.

APPLICATIONS

- Solar cells
- Opto-electronic devices
- Radiation detector
- LEDs
- Lasers
- Memory devices

ADVANTAGES

- ~16% power conversion efficiency
- 60 day stability under normal conditions
- Metal oxide charge transport layer
- Solution processable

RELATED MATERIALS

- J. You, L. Meng, T. B. Song, T. F. Guo, Y. M. Yang, W. H. Chang, Z. Hong, H. Chen, H. Zhou, Q. Chen, Y. Liu, N. D. Marco, & Y. Yang. Improved Air Stability of Perovskite Solar Cells via Solution-Processed Metal Oxide Transport Layers. Nature Nanotechnology. 2015.

OTHER INFORMATION

Full Perovskite Portfolio

PATENT STATUS

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INVENTORS

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OTHER INFORMATION

KEYWORDS

Perovskite solar cell, metal oxide transporting, solution processable, high stability, solar cells, photovoltaic devices, opto-electronics, radiation detector, LEDs, memory devices

CATEGORIZED AS

- **Energy**
  - Solar
- **Engineering**
  - Engineering
  - Other
- **Materials & Chemicals**
  - Electronics Packaging
  - Nanomaterials
  - Other
  - Polymers
  - Thin Films

RELATED CASES

2015-556-0

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	10,693,071	06/23/2020	2015-556

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Titanium Oxide as the Window Layer for Metal Chalcogenide Photovoltaic Devices
- Two-Step Processing With Vapor Treatment Of Thin Films Of Organic-Inorganic Perovskite Materials
- High Performance and Flexible Chemical And Bio Sensors Using Metal Oxide Semiconductors
- Design of Semi-Transparent, Transparent, Stacked or Top-Illuminated Organic Photovoltaic Devices
- Novel Polymers for Polymer Solar Cells, Transistors, and Sensors

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