Design of Semi-Transparent, Transparent, Stacked or Top-Illuminated Organic Photovoltaic Devices

Tech ID: 27210 / UC Case 2012-792-0

SUMMARY

UCLA researchers in the Department of Materials Science and Engineering have developed novel tandem transparent and semi-transparent organic photovoltaic (OPV) devices.

BACKGROUND

Solar cell technologies are the most effective method to produce clean energy at a low cost with minimal pollution. Transparent or semi-transparent solar cells are of interest for use in building-integrated OPVs, simultaneously serving both as a building material and a clean energy source. Conductive conjugated polymers are attractive absorbing materials for building-integrated devices because of their low cost, ease of processing, mechanical flexibility, and transparency. Current technologies that achieve high visible transparency from 400 nm – 650 nm have low power conversion efficiencies (<4%) and poor device performance. Improvements to the efficiencies (>5%) and to the visible transmission (>30%) of transparent and semi-transparent OPV devices are in high demand for next generation solar cells.

INNOVATION

Professor Yang Yang and his research team have developed novel tandem solar cell devices that are visibly transparent or semi-transparent with efficiencies of 6.4% or 7%, respectively. At 550 nm, these solar cells have a maximum transmission of 51% for transparent OPVs and 30% for semi-transparent OPV devices. These unique solar cells are fabricated in a low temperature, solution processable, and cost-effective manner and results in mechanically flexible and lightweight devices. This technology will have applications as building materials and power generators, while maintaining an attractive building exterior or adding structural accents in future architectural designs.

APPLICATIONS

- Solar cells
- Building-integrated OPV devices
- Power-generating windows, roof covers, and exterior wall materials
- Privacy screens

ADVANTAGES

- Transparent and semi-transparent
- 6.4% – 7% power conversion efficiency
- Top-illuminated or stacked solar cells
- Lightweight and flexible
- Low temperature and solution processable
- Low cost fabrication and materials

STATE OF DEVELOPMENT

Prototype devices with efficiencies of 6.4% and 7.3% for transparent and semi-transparent OPVs, respectively, have been fabricated and extensively tested.

RELATED MATERIALS

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INVENTORS

- Yang, Yang

OTHER INFORMATION

KEYWORDS

Semi-transparent, visibly transparent, stacked, tandem, top-illuminated, organic photovoltaic devices, building-integrated photovoltaics, power-generating windows, power-generating roof covers, privacy screens

CATEGORIZED AS

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

RELATED CASES

2012-792-0

▶ C. C. Chen, L. Dou, J. Gao, W. H. Chang, G. Li, and Y. Yang. High-Performance Semi-Transparent Polymer Solar Cells Possessing Tandem Structures. Energy & Environmental Science. 2013.

OTHER INFORMATION

Transparent PV Portfolio

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	8,993,998	03/31/2015	2012-792

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- ▶ Two-Step Processing With Vapor Treatment Of Thin Films Of Organic-Inorganic Perovskite Materials
- ▶ Efficient and Stable Perovskite Solar Cells with All Solution Processed Metal Oxide Transporting Layers
- ▶ High Performance and Flexible Chemical And Bio Sensors Using Metal Oxide Semiconductors

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