Researchers increase efficiency of solar cell light-absorption capacity

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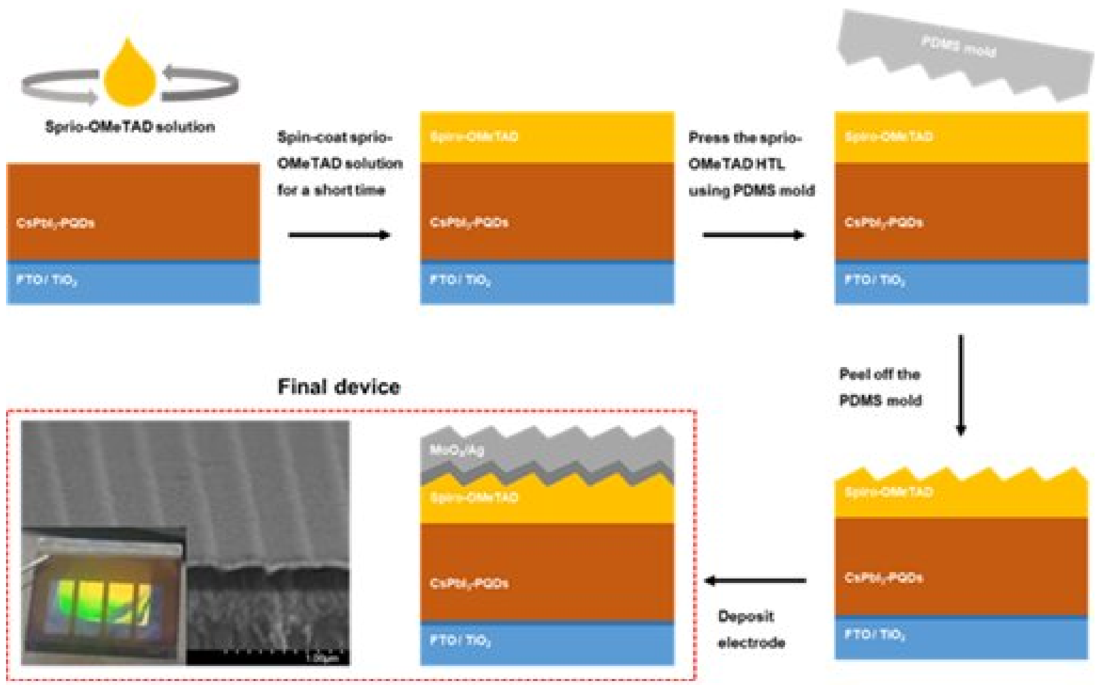

Credit: DGIST (Daegu Gyeongbuk Institute of Science and Technology)

DGIST has announced that the research team led by Professor Choi Jong-min of the Department of Energy Engineering at DGIST enhanced the light absorption capacity and photocurrent generation of solar cells by implementing a nano-structured electrode on the back of a perovskite quantum-dot solar cell, a next-generation solar cell material. In addition, the team systematically verified the correlation between the shape of the nanostructure and the efficiency of the solar cell and the optimized conditions for the formation of nanopatterns in organic materials.

Perovskite quantum dot solar cells have recently been in the spotlight as a next-generation solar cell because energy generation efficiency is rapidly increasing. The efficiency of a solar cell is mainly determined by its ability to absorb light and transmit electric charges generated by light to the electrode. Although perovskite quantum dots have excellent photoelectric properties, they have limitations in generating photocurrent as they do not form a thick light absorption layer when manufacturing a solar cell.

Meanwhile, the research team led by Professor Choi Jong-min of the Department of Energy Engineering at DGIST enhanced the light absorption and photocurrent while maintaining the thickness that optimizes the amount of charge extraction by forming the rear electrode of the perovskite quantum dot solar cell into a nanostructure. The research team successfully embodied a rear nanostructure electrode by forming a nanopattern on the hole transport layer of a perovskite quantum-dot solar cell through a nanoimprint lithography and uniformly depositing an electrode material on top of it along the curves of the hole transport layer nanopattern.

In addition, the research team formed nanostructured rear electrodes of various heights and cycles to verify the relationship among the shape of the nanostructure, the light absorption ability, and the electrical loss of the solar cell due to nanostructure. Afterward, the team designed optically and electrically effective nanostructured rear electrodes and optically enhanced the light absorption capacity of the solar cell and maximized the efficiency of the solar cell without electrical loss.

The team also verified the optimal conditions for nanoimprint lithography based on the relationship between the glass transition temperature and flexibility of organic materials, which are widely used as charge transfer materials for photoelectric devices including solar cells. These achievements are expected to contribute to research on the formation of nanopatterns of various photoelectric devices using organic materials as charge transport layers in the future.

Provided by Daegu Gyeongbuk Institute of Science and Technology