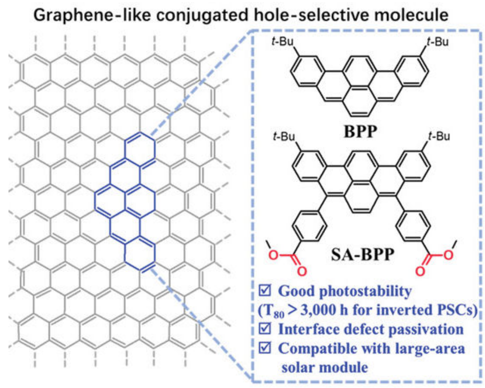
OIST | Innovation

Self-Anchoring Hole-Selective Contact for Operationally Stable Inverted Perovskite Solar Cells

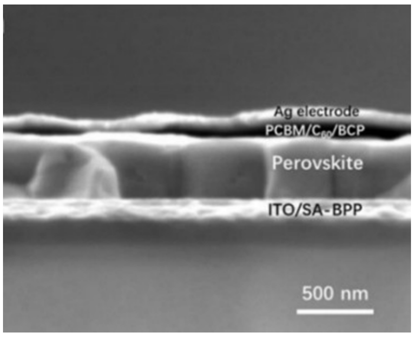
Summary

Inverted perovskite solar cells (IPSCs) have emerged as a promising photovoltaic technology due to their reliable operational stability, negligible hysteresis, and reduced sensitivity to moisture and oxygen. However, their operational lifetime is constrained by several factors. In particular, the composition of the hole-selective contact plays a crucial role in determining the stability of IPSCs. Conventional IPSCs use compounds such as triphenylamines and carbazones as the hole-selective contact, however these materials negatively affect the cells' lifetime. Therefore, the commercial viability of IPSCs relies on the design of new hole-selective contacts that enhance operational stability and extend lifetime.

A team of researchers led by Profs. Yabing Qi and Akimitsu Narita has developed a new type of hole-selective contact based on polycyclic aromatic hydrocarbons, a class of compounds not traditionally employed in this field. This technology offers a novel, interdisciplinary approach for further improving the stability of perovskite cells.



Chemical structures of *tert*-butyl derivatives of the benzo[rst]pentaphene (BPP) and self-anchoring BPP (SA-BPP) molecules



Cross-section SEM image of the SA-BPP-based inverted PSC

Technology

This technology uses polycyclic aromatic hydrocarbons, or PAHs, as the hole-selective contact between the conductive oxide substrate and the perovskite layer. Also referred to as graphene-like conjugated molecules or graphenoids, PAHs have higher photostability and mobility than conventional materials. They link up with the other layers using anchoring groups, which promote spontaneous formation of a large-scale uniform hole contact layer, thereby passivating the perovskite interface. These PAHs can also be substituted with solubility enhancing groups for better processability. Overall, this new design leads to solar cells that last longer and convert sunlight to electricity more efficiently.

Applications

- Inverted perovskite solar cells
- Perovskite-based sensors

Advantages

- Longer lifetime (T_{80} lifetime of 3,175 hours)
- Power conversion efficiency of 23%

Category	Lead Researcher	Intellectual Property
Chemistry & Materials Science	Prof. Yabing Qi	Patent Pending

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