Researchers develop high-performance, stretchable solar cells

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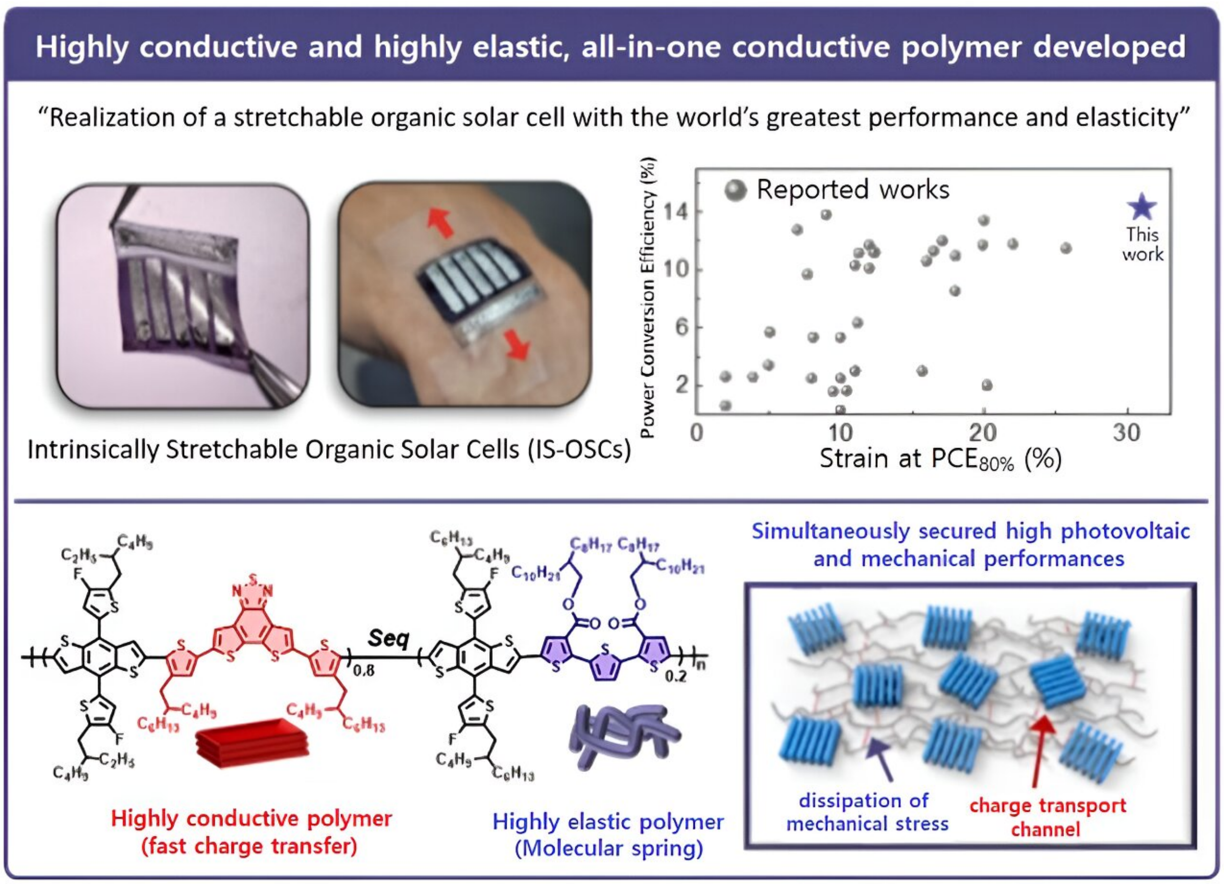


Chemical structure of the newly developed conductive polymer and performance of stretchable organic solar cells using the material. Credit: *Joule* (2023). DOI: 10.1016/j.joule.2023.11.005

With the market for wearable electric devices growing rapidly, stretchable solar cells that can function under strain have received considerable attention as an energy source. To build such solar cells, it is necessary that their photoactive layer, which converts light into electricity, shows high electrical performance while possessing mechanical elasticity. However, satisfying both of these two requirements is challenging, making stretchable solar cells difficult to develop.

On December 26, a KAIST research team from the Department of Chemical and Biomolecular Engineering (CBE) led by Professor Bumjoon Kim announced the development of a new conductive polymer material that achieved both high electrical performance and elasticity while introducing the world's highest-performing stretchable organic solar cell.

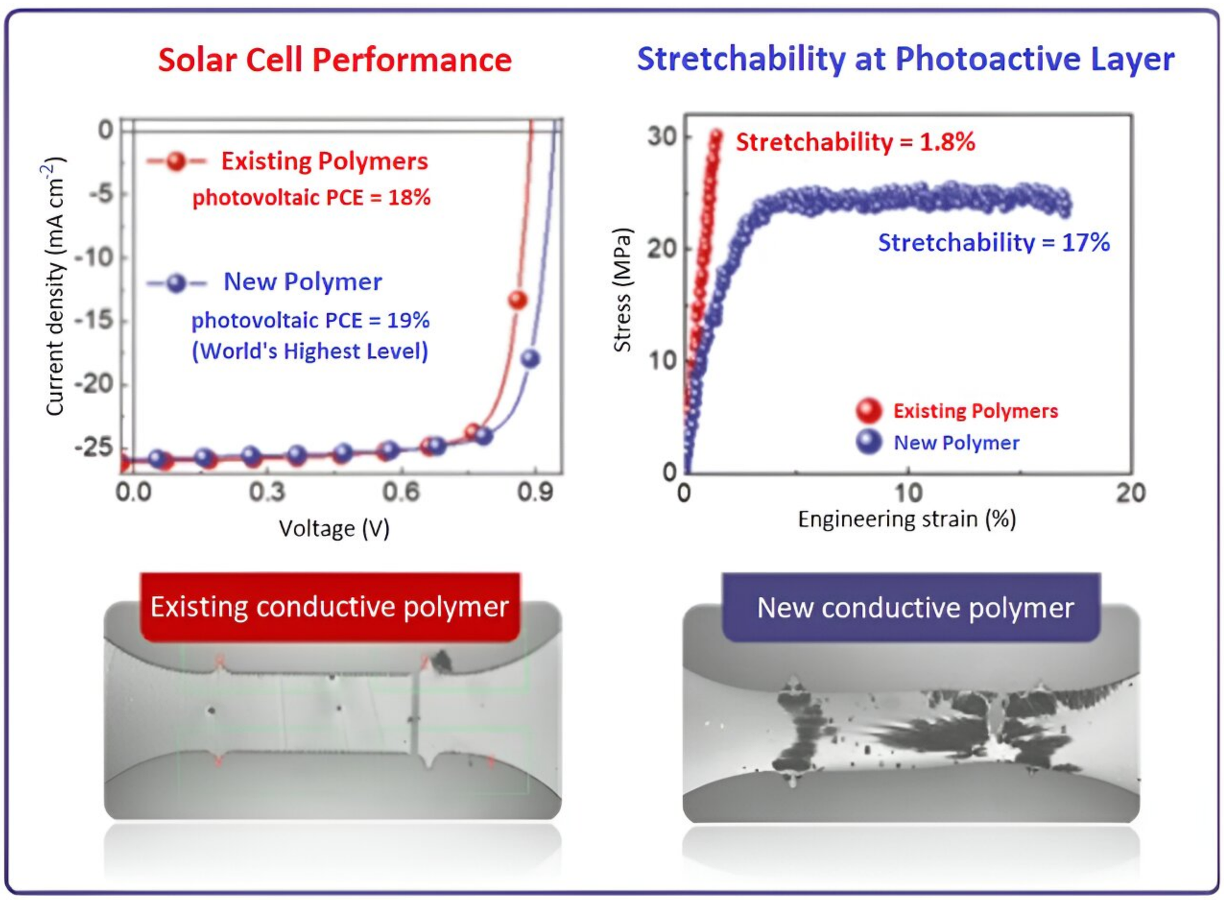
The paper, titled "Rigid- and soft-block-copolymerized conjugated polymers enable high-performance intrinsically stretchable organic solar cells," was published in *Joule* on December 1.

Organic solar cells are devices whose photoactive layer, which is responsible for the conversion of light into electricity, is composed of organic materials. Compared to existing non-organic material-based solar cells, they are lighter and flexible, making them highly applicable for wearable electrical devices.

Solar cells as an energy source are particularly important for building electrical devices, but high-efficiency solar cells often lack flexibility, and their application in wearable devices have therefore been limited to this point.

The team led by Professor Kim conjugated a highly stretchable polymer to an electrically conductive polymer with excellent electrical properties through chemical bonding, and developed a new conductive polymer with both electrical conductivity and mechanical stretchability. This polymer meets the highest reported level of photovoltaic conversion efficiency (19%) using organic solar cells, while also showing 10 times the stretchability of existing devices.

The team thereby built the world's highest performing stretchable solar cell that can be stretched up to 40% during operation, and demonstrated its applicability for wearable devices.



Photovoltaic efficiency and mechanical stretchability of newly developed polymers compared to existing polymers. Credit: *Joule* (2023). DOI: 10.1016/j.joule.2023.11.005

Professor Kim said, "Through this research, we not only developed the world's best performing stretchable organic solar cell, but it is also significant that we developed a new polymer that can be applicable as a base material for various electronic devices that needs to be malleable and/or elastic."

More information: Jin-Woo Lee et al, Rigid- and soft-block-copolymerized conjugated polymers enable high-performance intrinsically stretchable organic solar cells, *Joule* (2023). [DOI: 10.1016/j.joule.2023.11.005](https://dx.doi.org/10.1016/j.joule.2023.11.005)

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