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Professor Sukwon Hong's research develops a new material to improve the performance of non-fullerene organic solar cells

□ GIST (Gwangju Institute of Science and Technology) Department of Chemistry Professor Sukwon Hong and Imperial College London (ICL) Professor Ji-Seon Kim's research team improved the performance and stability of non-fullerene organic solar cells*, which are in the spotlight as next-generation solar cells, by developing a new cathode interface layer material**.

* non-fullerene organic solar cell: solar cells containing photoactive materials that lack a fullerene structure

** cathode interface layer material: selectively transfers negatively charged electrons

◦ As a next-generation solar cell, the non-fullerene organic solar cell is attracting attention for its energy conversion efficiency close to 20%. Nevertheless, the material of the existing cathode interface layer is hindering the development of a high-functional solar cell such as an organic solar cell because it is difficult to process at a low temperature or has a problem in stability.

- The research team succeeded in simultaneously improving the performance and stability of the non-fullerene organic solar cell by discovering the cause of instability for existing cathode interface layer materials and by developing a new cathode interface layer material in order to overcome the limitations of the existing cathode interface layer material.

  - The chemical reaction between polyethyleneimine and non-fullerene acceptor, known as a representative cathode interface material, was clearly identified through two-dimensional nuclear magnetic resonance and isotope labeling experiments. Through this, it was confirmed that the amine group of polyethyleneimine interfered with the role of the non-fullerene acceptor used as a photoactive material.

- The research team developed the cathode interface layer after taking advantage of polyethyleneimine, which is capable of low-temperature solution processing, and replacing the highly reactive amine group with an imine group to eliminate the reactivity with the non-fullerene acceptor and to strengthen the dipole moment.

  - The newly developed cathode interface layer material was applied to solar cells with various photoactive materials, demonstrating high energy conversion efficiency of over 15% and high stability that almost maintains initial performance for more than 360 hours in harsh environments over 100°C.

- Professor Sukwon Hong and Professor Ji-Seon Kim said, "Through the development of a new cathode interface layer material, the energy conversion efficiency and stability of the non-fullerene organic solar cell could be improved at the same time. In the future, it is expected that it will be able to make a great contribution to the development of high-functional solar cells such as solar cells that are bent by the development of cathode interface layer materials through the introduction of various substituents."

- This international joint research was led by GIST Professor Sukwon Hong, Dr. Minkyu Kyeong, ICL Professor Ji-Seon Kim, and Dr. Jinho Lee with suport from the GIST GRI Project and the Climate Change Response Technology

Development Project and was published online on April 15, 2021, as the cover of the *Journal of Materials Chemistry A*, a world-renowned scientific journal in the field of materials chemistry and energy materials.

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