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2020.10.08

Professor Dong-Seon Lee's research team significantly improves the performance of the next- generation solar cell with a long lifespan and low cost by identifying the charge transport principle

- A technology for improving the performance of next-generation solar cells based on inorganic materials for a future carbon-neutral society has been developed by Korean researchers. GIST (Gwangju Institute of Science and Technology, President Kiseon Kim) School of Electrical Engineering and Computer Science Professor Dong-Seon Lee's research team developed a next-generation thin-film solar cell with significantly improved charging rate* and investigated its charge transport principle.

* fill factor: As one of the solar cell characteristic evaluation parameters, it depends on the series resistance, parallel resistance and diode characteristics inside the solar cell.

- Solar cells are devices that absorb solar energy from space and generate electrical energy. To date, various research on solar cells using silicon, thin films, and organic materials has been attempted.
 - Single-crystal silicon solar cells have high performance but are difficult to apply to flexible electronic devices due to their thicknesses. Conventional thin film solar cells have the disadvantage of using expensive and rare elements such as indium and gallium. Finally, organic solar cells can be produced in low-

cost quantities using printing technology, but its short life span and low stability are considered disadvantages.

- Therefore, the development of a next-generation solar cell in which all of these shortcomings are improved is essential for the realization of a carbon-neutral society and is expected to overturn the market for solar cells in the future.
- The next-generation CZTSSe (copper-zinc-tin-sulfur-selenium) solar cell is composed of elements that are abundant and inexpensive on the earth, and it has a thinness that can be applied to flexible electronic devices. In addition, because it is an inorganic solar cell, it has a sufficient lifespan and durability that can be commercialized.
- Professor Dong-Seon Lee's research team used a sodium doping method to create next-generation solar cells with a significantly improved solar cell charging rate and performance, and they investigated the transport principle of charge carriers for the sodium doping of CZTSSe solar cell. As a result, the charging rate of the solar cell was greatly improved, and a CZTSSe next-generation solar cell having a charging rate of 62.6% was developed beyond the existing limit of 50%.
- GIST School of Electrical Engineering and Computer Science Professor Dong-Seon Lee said, "This study has identified the principles of charge transfer of next-generation solar cells with a long lifespan and low prices, greatly improving their performance and suggesting solutions to overcome the shortcomings of existing commercial solar cells. In the future, we will continue to conduct research and development so that it can be used in various fields such as large-area building-integrated solar cells, automobile solar roofs, and flexible electronic devices."
- This research was led by GIST Professor Dong-Seon Lee (corresponding author) and conducted by Dr. Woo-Lim Jeong (co-first author) and Ph.D. student Kyung-Pil Kim (co-first author) and was supported by the GIST Research Institute (GRI), the Korea Institute of Energy Technology Evaluation and Planning (KETEP), the Ministry of Trade, Industry and Energy (MOTIE) of the Republic of Korea, and Basic Science Research Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Education and was published on September 27, 2020, in *Advanced Science*, a renowned international academic journal in the field of materials science, and was selected as the cover paper for the October issue.

