

Section of Public Affairs	Hyo Jung Kim Section Chief (+82) 62-715-2061	Nayeong Lee Senior Administrator (+82) 62-715-2062
Contact Person for this Article	Professor Young Min Song School of Electrical Engineering and Computer Science (+82) 62-715-2655	
Release Date	2019.09.19	

Professor Young Min Song's collaborative research team develops a diffraction grating film for improving solar cell efficiency

- Korean researchers have confirmed the improvement of light to electric conversion efficiency of multi-junction solar cells by designing a polymer with diffraction grating.
 - GIST (President Kiseon Kim) School of Electrical Engineering and Computer Science Professor Young Min Song and Dr. Il Suk Kang of the National Nanofab Center (Director Jo-won Lee) have succeeded in collecting extra unused light that is not used in a solar cell by attaching a flexible diffraction grating * , which is best suited for efficient light-electric efficiency conversion.

* diffraction grating: an optical component with a periodic structure that splits and diffracts light into several beams traveling in different directions depending on the arrangement and shape of the grid and the wavelength of the light

- Solar cells are a power generation method that produces electricity by converting sunlight into electricity. When light is irradiated on a solar cell, particles with a negative and positive charge are formed, which moves to a positive electrode to generate electric power. Although initial solar cells using selenium (Se) were only 1 to 2% efficient, the efficiency has increased in recent years to 47% with the development of new solar cells. In addition, thin and flexible solar cells can increase the uses of solar cells in different environments.

- To fabricate a flexible solar cell, it is unavoidable to make an array * of solar cells, and gaps occur between solar cells when the array is formed. The spacing between the cells decreases the efficiency relative to the area. Therefore, efficient light-to-electrical conversion requires reallocation of light to take advantage of the gaps in spacing. To solve this problem, it is possible to design an optical structure capable of collecting light efficiently by introducing nano or micro sized diffraction grating onto a solar cell.

* array: Also known as an array of data structures, each element can be identified by naming a collection of data of the same kind. In the case of solar cells, for example, large power generation systems, these systems are called arrays, where multiple solar cell elements are fanned (assembly circuits) in series or parallel.

- In this study, triple junction solar cells of materials with different energy bands were used. It is possible to absorb solar energy in a wide area of wavelength, taking into account solar absorption spectra from short wavelengths to long wavelengths. Because the produced polymer has a thickness of several tens of microns, it can maintain the weight of the existing module and greatly increase the efficiency of the solar cell, thereby greatly improving the power produced per unit weight. Simulations confirmed that the absorption rate of the solar cell with the diffraction grating was higher and that the photocurrent * density was increased by 10% compared with the existing solar cell modules.

* photocurrent: electric current through a photosensitive device as the result of exposure to light

- Professor Young Min Song said, "Optical structures have been designed and constructed to address gaps between cells that inevitably occur in the formation of solar cell arrays, and a flexible and attachable diffraction grating film can be applied to flexible solar cells to generate more power in the future."
- This research was led by GIST Professor Young Min Song (corresponding author) and National Nanofab Center Dr. Il Suk Kang (corresponding author) with the participation of GIST School of Electrical Engineering and Computer Science Professor Hyuk Jae Jang and Ph.D. student Yeong Jae Kim (first author). The research was supported by the Korea Institute of Energy Technology Evaluation and Planning (KETEP) and the Ministry of Trade, Industry & Energy (MOTIE) of the Republic of Korea , the National Research Foundation of Korea (NRF), and the GIST Research Institute (GRI). The findings were published on September 6, 2019, in *ACS Applied Materials and Interfaces* (IF = 8.456), the world's leading international journal of materials and interfaces.

