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Professor Jae-Hyung Jang's joint research team develops hybrid flexible thin film solar cell technology that can convert electric energy into the unused ultraviolet region

□ Gwangju Institute of Science and Technology (GIST, President Kiseon Kim) School of Electrical Engineering and Computer Science Professor Jae-Hyung Jang and Korea Photonics Technology Institute (Director Yong-jin Shin) Dr. Ho-Jung Jeong led a joint research team that succeeded in developing a hybrid thin film that can convert all ultraviolet, visible, and infrared sunlight into energy by applying perovskite, a next-generation fluorescent material, to existing CIGS flexible film solar cells.

- CIGS thin film solar cells * have the highest energy conversion efficiency among non-silicon solar cells, and is attracting attention as the next generation solar cell because of its light and flexible characteristics. Perovskite, the next generation fluorescent material, is a semiconductor material that combines metals and halogens (fluorine, chlorine, bromine, iodine) and has a light emitting property that converts ultraviolet light into visible light, and thus has been widely used as an optical material for LEDs, displays, and solar cells.

* CIGS thin film solar cell: A compound consisting of four elements of copper (Cu), indium (In), gallium (Ga), and selenium (Se) that has a greater light absorption coefficient than silicon while being chemically stable and durable. If this layer is used as a layer for light absorption, it can achieve high efficiency by using only a small amount of material and has a simplified manufacturing process for solar cells.

- Conventional CIGS Flexible Thin Film Solar Cells have the limits of being unable to convert solar energy from a short wavelength band (300-390 nanometers) containing ultraviolet areas into electricity by absorbing solar from a transparent electrode * at the top of the solar cell. Therefore, it is necessary to develop new CIGS's flexible film solar cell technology that can effectively utilize solar energy from a short wavelength band.

* transparent electrode: a functional thin film electrode that transmits light in the visible light region and has electrical conductivity, and it is widely used as an electrode substrate for flat panel displays, touch panels, and solar cells.

- The GIST-Korea Photonics Technology Institute's joint research team succeeded in developing CsPbBr₃ perovskite high-efficiency nanocrystals that absorb light in the ultraviolet region and emit light in the visible band, and the applied it to the transparent electrode layer of CIGS solar cells.

- As a result, CIGS/perovskite hybrid flexible thin film solar cell capable of converting a wide range of sunlight, including visible, infrared, and ultraviolet rays, into electrical energy has been developed. In addition to solving the loss of the ultraviolet band generated on top of the existing CIGS thin film solar cells, it is designed to maximize efficiency by minimizing the reflection on the device surface by controlling the thickness of the perovskite.

- Professor Jae-Hyung Jang said, "The high efficiency flexible solar cell developed through this research result will be applicable to various fields such as building integrated solar cell, electric vehicles, and drones. The research on perovskite application, which is simpler in manufacturing process and superior in price competitiveness and light conversion efficiency, is expected to play a major role in mass production of next generation hybrid solar cells."

- The research was led by Professor Jae-Hyung Jang and conducted by Ph.D. candidate Ye-Chan Kim (co-first author) and Korea Photonics Technology Institute Dr. Ho-Jung (co-first author) and was supported by the Korea Electric Power Corporation, the Korea Institute of Energy Technology Evaluation and Planning (KETEP), the Ministry of Trade, Industry & Energy (MOTIE) of the Republic of Korea, and the Korea Institute for Advancement of Technology (KIAT) and was published on November 28, 2019, and selected as the cover paper by *Nanoscale*, the leading international journal of nanotechnology published by the Royal Society of England.

