Gwangju Institute of Science and Technology

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Dr. Sungjun Park (a graduate of the School of Materials Science and Engineering) develops a self-powered skin-adhering ECG sensor and publishes in *Nature*

□ GIST (President Seung Hyeon Moon) – Dr. Sungjun Park, a graduate of the School of Materials Science and Engineering, developed a self-powered skin-adhering ECG sensor and published the research in Nature.

◦ He received his Ph.D. in 2016 from Bio-Electronics Materials Laboratory at GIST's School of Materials Science and Engineering under Professor Myung-Han Yoon, and his graduation thesis "Sol-Gel Metal Oxide Electronic Materials for Large-area Unconventional Electronics," in which he combined ultra-thin organic solar cells in the same plane with petrochemical transistors. He has now succeeded in developing a 'skin-like ECG measuring device' by developing an ultra-thin sensor, which is applied to the skin.

◦ If a sensor attached to the skin can solve power supply problems, such as replacing batteries, and can monitor and maintain biometric information for a long time, then a wireless internet (IoT)

society that can continuously carry out healthcare management is possible.

□ Flexible, thin organic solar cells can be connected to a microsensor that can be driven with low voltage and can be operated for a long time with stability. Recently, an organic solar cell having close contact with skin and fabric and having durability against thermal stability and physical change has been reported, and it is attracting attention as a power source for a next generation sensor.

◦ However, while it is possible to attach a device with a power source and to the skin, the output of the solar cell may be unstable depending on the deformation of the skin or the incident angle of light. Research in this area has not been actively conducted.

□ Dr. Sungjun Park has collaborated with RIKA and the research team of the University of Tokyo to form a 'nano-irregular structure' on an ultra-thin organic substrate. An electron injection layer is formed on an ultra-thin substrate with a thickness of 1 micrometer and has a height of several tens nanometers.

◦ A 'skin-adhering electrocardiogram measuring device' was made and attached to the skin of the human body. As a result, signal was obtained with high accuracy of driving signal to noise ratio (S/N ratio) of 25.9 decibels (dB) without an external power source.

◦ Periodic nano lattice structures adjust the refractive index of light to reduce the reflection of light on the surface of the solar cell. At the same time, it enhances the light scattering inside the thin film and the surface plasmon resonance effect of the metal electrode. As a result, the energy conversion efficiency (solar energy to electric conversion efficiency) of the manufactured solar cell achieves the world's highest efficiency of 10.5% of all flexible organic solar cell reported so far.

□ Dr. Sungjun Park said, "Through this study, we have realized the required technology to acquire biometric information continuously without worrying about power consumption and the effects of the human body. By integrating circuits for processing acquired biometric information and a wireless transmission system, we expect to be able to provide the base technology of this system."

□ This research was authored by Dr. Sungjun Park (currently Samsung Advanced Institute of Technology, Staff Researcher) and Soo Won Heo, Wonryung Lee, Daishi Inoue, Zhi Jiang, Kilho Yu, Hiroaki Jinno, Daisuke Hashizume, Masaki Sekino, Tomoyuki Yokota, Kenjiro Fukuda, Keisuke Tajima & Takao Someya and was published on September 27, 2018, in *Nature*, a world-renowned academic journal.

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