New-material Professor Jang Hwan Kim develops multifunctional semiconductor fiber sensors that detect pressure and light

A joint research team, including Professor Jang Hwan Kim from our school's Department of Materials Science and Engineering, has developed a multifunctional sensor based on semiconductor fibers that can detect pressure, smell, light, and taste, similar to the human senses. It is expected to be utilized in advanced technology fields, such as electronic devices for wearable gadgets or soft robots.

Professor Jang Hwan Kim (Department of Materials Science and Engineering, photo) and Professor Bong-Hoon Kim (Department of Robotics and Mechatronics Engineering) from DGIST, Professor Sang-Ouk Kim (Department of Materials Science and Engineering) from KAIST, and Professor Jiwoong Kim (Department of Materials

Science and Engineering) from Soongsil University announced that they had developed a multifunctional sensor based on semiconductor fibers that mimic the five senses of humans through collaborative research.

The study was published as the cover article in the December issue of Advanced Fiber Materials, a global journal in the field of fibers and new materials, under the title "2D MoS_2 Helical Liquid Crystalline Fibers for Multifunctional Wearable Sensors." Professor Jang Hwan Kim from our university participated as the first author.

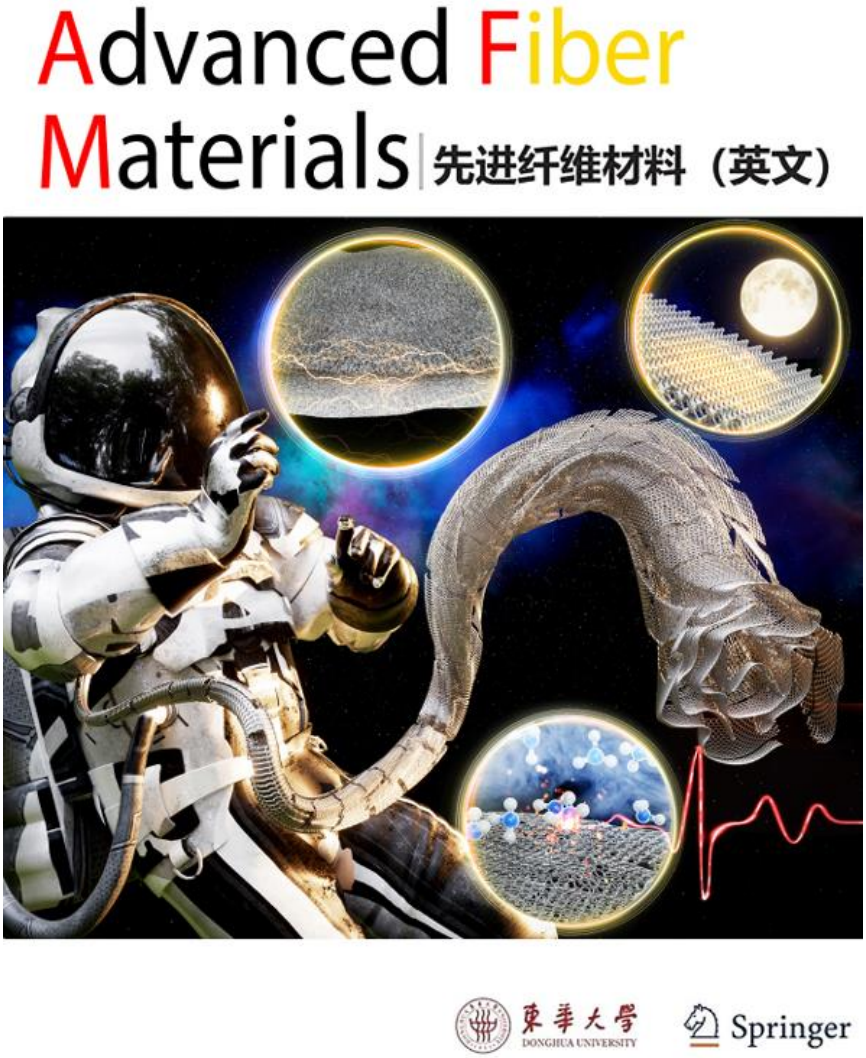
Fiber-based material systems are gaining attention as key elements of next-generation wearable devices due to their high mechanical deformability, breathability, and durability. Recently, the introduction of atomic-level two-dimensional materials has significantly enhanced the mechanical stability of functional fiber systems.

The semiconductor fiber sensor developed by the joint research team can detect and process multiple signals simultaneously, similar to human senses. It is more sophisticated and versatile than existing one-dimensional fiber sensors, and its unique structure allows it to respond sensitively to changes in the external environment. Consequently, it can simultaneously measure and monitor various environmental information, such as light, chemicals, pressure, pH (acidity), ammonia gas, and mechanical deformation.

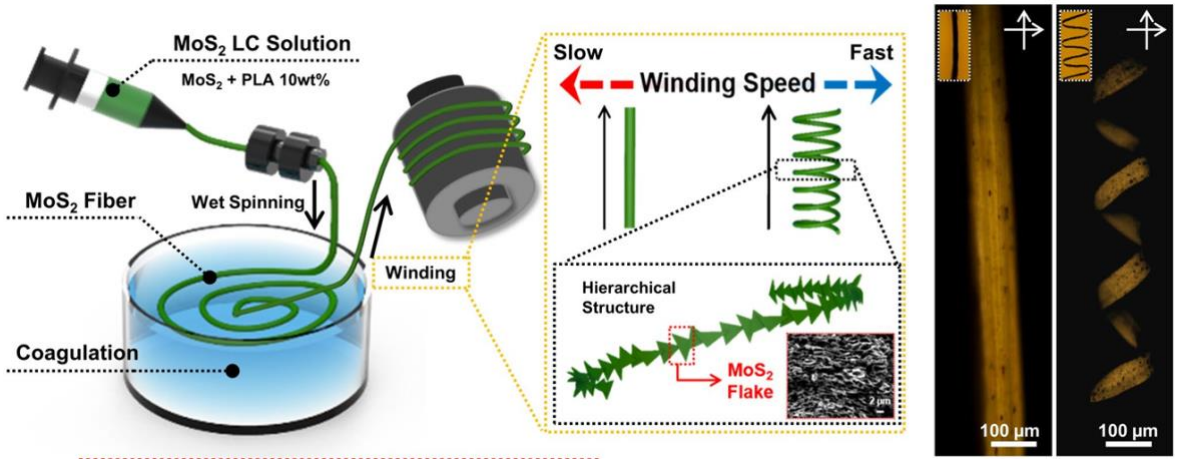
The research team has developed a fiber that allows for free adjustment of its three-dimensional shape through a special manufacturing process utilizing MoS_2. The naturally formed three-dimensional helical structure during the process of drawing the fiber into a ribbon shape enables precise adjustment of the curvature of the fiber. These fibers achieve high performance due to the excellent electrical and mechanical properties of MoS_2 and the aligned structure within the fiber.

The developed sensor is expected to be utilized in various applications, such as wearable Internet of Things (IoT) devices and soft robotics. It can measure body

movements or changes in the hydrogen ion concentration of sweat in real-time, usable for health monitoring and analyzing harmful gases or structural deformation states in real-time.



Cover of the December issue of Advanced Fiber Materials, introducing the research results of the joint research team



Schematic diagram of the wet spinning process for the manufacture of three-dimensional liquid crystalline fiber