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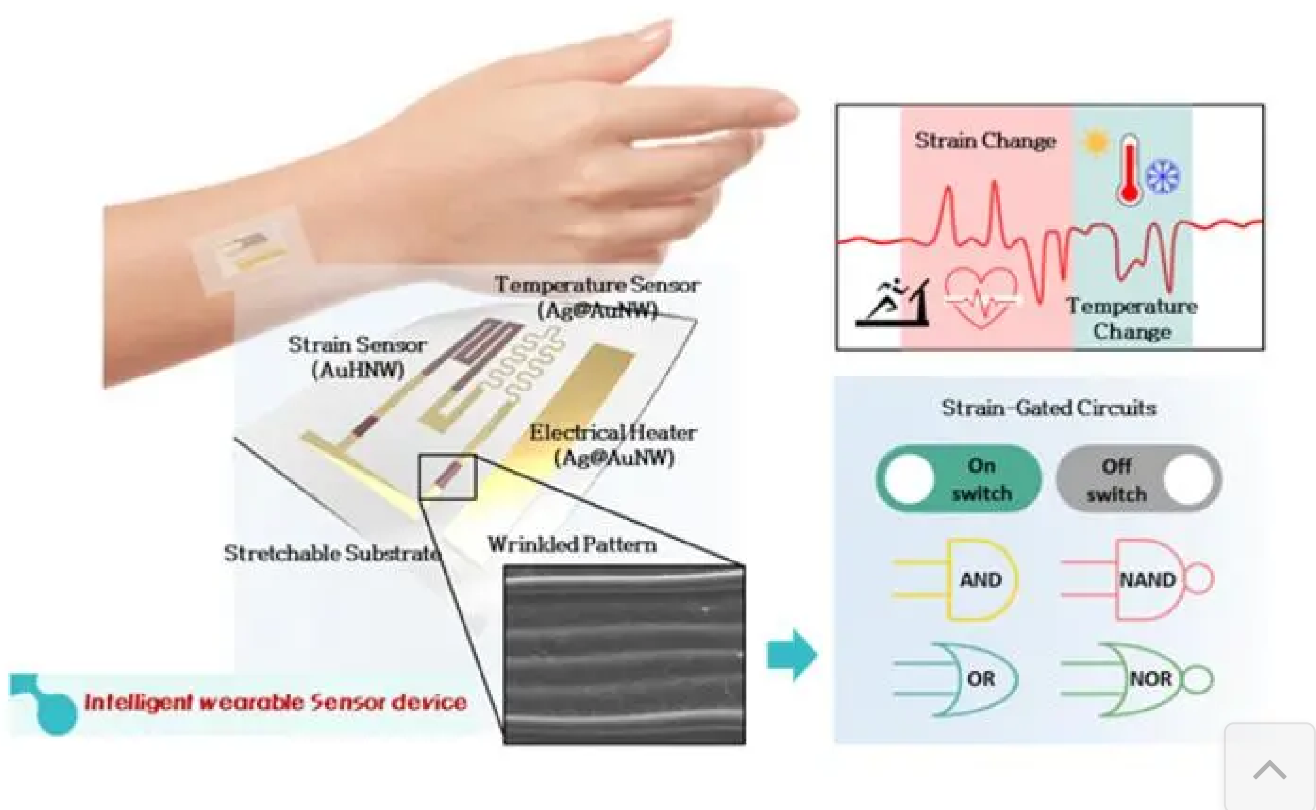
Gold now has a golden future in revolutionizing wearable devices

BY BIOENGINEER — November 20, 2023 in Science News Reading Time: 5 mins read 0

Top Olympic achievers are awarded the gold medal, a symbol revered for wealth and honor both in the East and the West. This metal also serves as a key element in diverse fields due to its stability in air, exceptional electrical conductivity, and biocompatibility. It's highly favored in medical and energy sectors as the 'preferred catalyst' and is increasingly finding application in cutting-edge wearable technologies.



Credit: POSTECH

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A research team led by Professor Sei Kwang Hahn [illegible]n from the Department of Materials Science and Engineering at Pohang U[illegible]and Technology (POSTECH) developed an integrated wearable sens[illegible]ely measures and processes two bio-signals simultaneously. Their re[illegible]h findings were featured in *Advanced Materials*, an international top journal in the mate[illegible]field.

Wearable devices, available in various forms like attachments and patches, play a pivotal role in detecting physical, chemical, and electrophysiological signals for disease diagnosis and management. Recent strides in research focus on devising wearables capable of measuring multiple bio-signals concurrently. However, a major challenge has been the disparate materials needed for each signal measurement, leading to interface damage, complex fabrication, and reduced device stability. Additionally, these varied signals analysis requires further signal processing systems and algorithms.

The team tackled this challenge using various shapes of gold (Au) nanowires. While silver (Ag) nanowires, known for their extreme thinness, lightness, and conductivity, are commonly used in wearable devices, the team fused them with gold. Initially, they developed bulk gold nanowires by coating the exterior of the silver nanowires, suppressing the galvanic phenomenon. Subsequently, they created hollow gold nanowires by selectively etching the silver from the gold-coated nanowires. The bulk gold nanowires responded sensitively to temperature variations, whereas the hollow gold nanowires showed high sensitivity to minute changes in strain.

These nanowires were then patterned onto a substrate made of styrene-ethylene-butylene-styrene (SEBS) polymer, seamlessly integrated without separations. By leveraging two types of gold nanowires, each with distinct properties, they engineered an integrated sensor capable of measuring both temperature and strain. Additionally, they engineered a logic circuit for signal analysis, utilizing the negative gauge factor resulting from introducing simultaneously, all using a single material of Au.

The team's sensors exhibited remarkable performance in detecting subtle muscle tremors, identifying heartbeat patterns, recognizing speech [illegible] tremors, and monitoring changes in body temperature. Notably, [illegible]tained high stability without causing damage to the material interfaces. Their flexibility and excellent stretchability enabled them to conform to curved [illegible]

Professor Sei Kwang Hahn stated, "This research u[illegible]scores the potential for the development of a futuristic bioelectronics platform capable of analyzing a diverse range of bio-signals." He added, "We envision new prospects across various industries including healthcare and integrated electronic systems."

The research was sponsored by the Basic Research Program and the Biomedical Technology Development Program of the National Research Foundation of Korea, and POSCO Holdings.

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A research team led by Professor Sei Kwang Hahn and Dr. Tae Yeon Kim from the Department of Materials Science and Engineering at Pohang University of Science and Technology (POSTECH) developed an integrated wearable sensor device that effectively measures and processes two bio-signals simultaneously. Their research findings were featured in *Advanced Materials*, an international top journal in the materials field.

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The team's sensors exhibited remarkable performance in detecting subtle muscle tremors, identifying heartbeat patterns, recognizing speech through vocal cord tremors, and monitoring changes in body temperature. Notably, these sensors maintained high stability without causing damage to the material interfaces. Their flexibility and excellent stretchability enabled them to conform to curved skin seamlessly.

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Article Title

Multifunctional Intelligent Wearable Devices Using Logical Circuits of Monolithic Gold Nanowires

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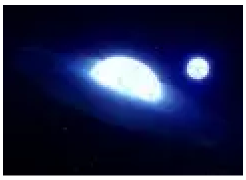

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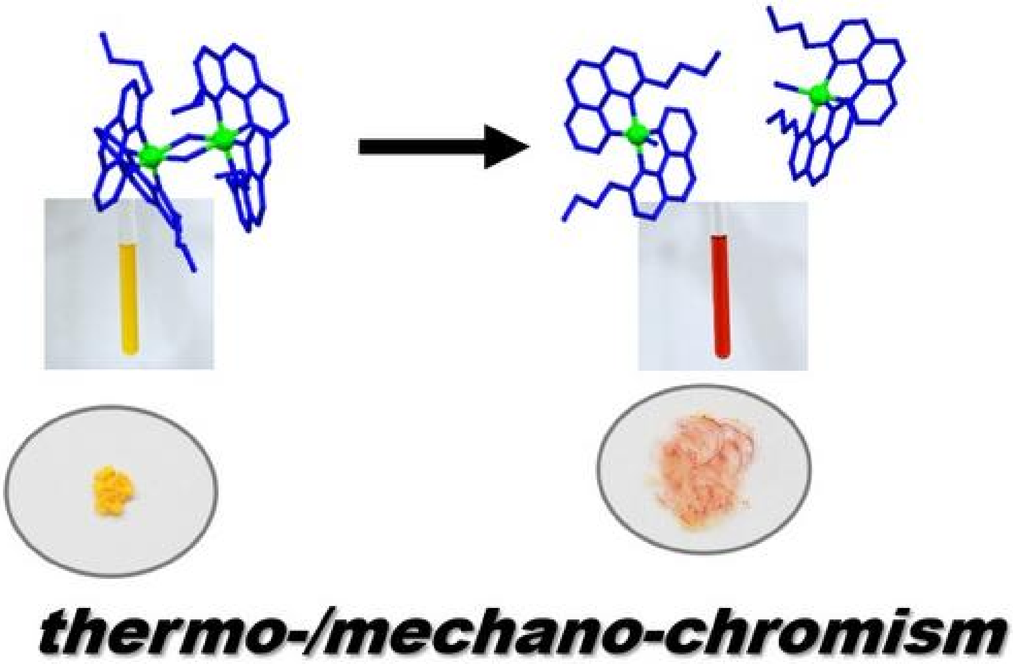
The formation of switchable and metastable discrete structures through chiral self-sorting

BY **BIOENGINEER** — November 20, 2023 in **Chemistry** Reading Time: 2 mins read 0

This paper describes chiral coordination dimers that emerge based on effectively exclusive chiral self-sorting. The complex also exhibits thermo-/mechano-chromism originating from monomer-dimer transformation. The homochiral dimer is comprised of a coordinatively unsaturated iridium(III) complex, which features an n-butyl-substituted benzo[h]quinoline moiety and helical chirality at the metal center. Construction of the appropriate binding model and analysis of the fundamental physical parameters based on spectroscopic data reveal that the strong preference for homochiral dimerization is an entropic-driven effect originating from steric repulsions of alkyl chains in the coordination sphere of the corresponding heterochiral dimer. Furthermore, the metastable nature of dimer crystals allows for color variation (from yellow to red) upon mechanical cleavage of its coordination bonds (i.e., dimer-to-monomer transformation). This feature might be exploited for the dynamic control of coordination geometry and related functionalities, such as catalytic applications. Emergence of strong homochiral self-sorting preference and connected thermo-/mechano-chromic behaviour is based on matched propeller-shaped chirality and subtle steric repulsions of substituents that render particular homochiral dimers switchable systems and its application in the rational design of switchable and metastable dynamic molecular structures with potential as advanced catalysts, sensors, or optoelectronic devices.



Credit: Kazuyoshi Takimoto (Kitasato University)

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This work provides substantial insight into chiral self-sorting in discrete supramolecular systems and its application in the rational design of switchable and metastable dynamic molecular structures with potential as advanced catalysts, sensors, or optoelectronic devices.

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