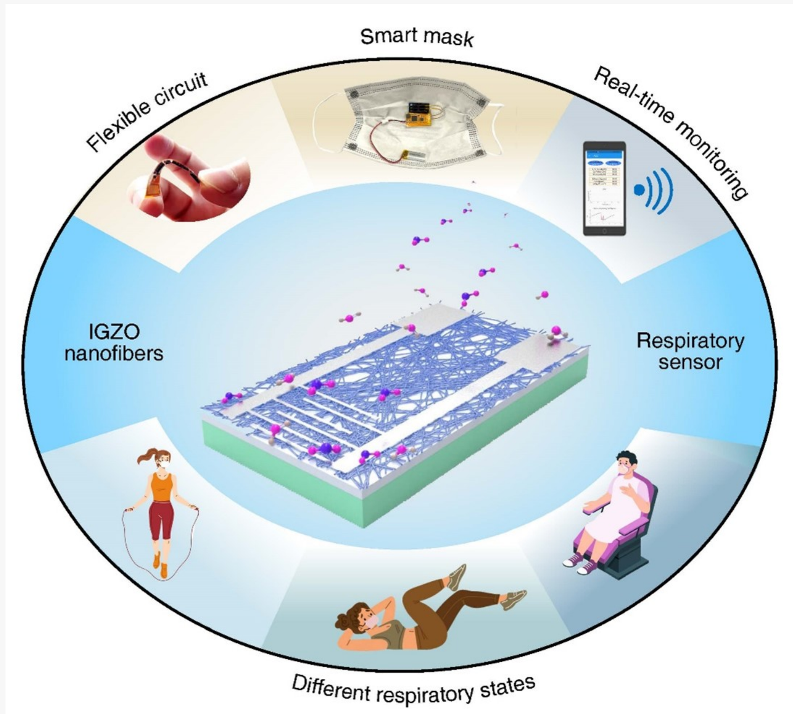
# Nanofibrous metal oxide semiconductor for sensory face masks

GA, UNITED STATES, November 15, 2024 /EINPresswire.com/ -- This study introduces a fibrous amorphous indium gallium zinc oxide material (IGZO) integrated into sensory face masks, providing real-time respiratory monitoring via a wireless flexible circuit. Enhanced surface area promotes gas diffusion, enabling precise detection of respiratory states. This innovation in wearable health monitoring highlights a promising direction for continuous physiological assessment.



Igzo nanofibre-based sensors are integrated with a flexible circuit to create a sensory face mask, thus featuring wireless and real-time monitoring capabilities

Room-temperature (RT) gas sensors with high sensitivity are essential in low-power Internet-of-Things (IoT) applications, such as smart sensors, wearable devices and mobile robots. Among these, metal oxide semiconductor-based gas sensors are valued for their low production cost, high sensitivity and ease of use, making them suitable for detecting flammable, explosive, toxic, and exhaled gases. However, further fiber diameter reduction and real-time monitoring integration remain underexplored.

In a study published in the KeAi journal Wearable Electronics, a group of researchers from China and South Korea described a new sensor they have developed — ultrathin (~88 nm) amorphous indium gallium zinc oxide (IGZO) nanofibres for wireless and real-time human breath monitoring.

"IGZO nanofibres were created as the charge transport layer to enhance the surface area for gas diffusion using an electrospinning approach," explains the study's lead author, Qing Ma, a post-doctoral fellow at the School of Electronic Science and Engineering at Southeast University. “The resulting field-effect properties demonstrated an average mobility of 2.2 $cm^2/V \cdot s$ and an on/off ratio of $10^5$."

Notably, the team successfully recorded human breath in fast, normal and deep states, showing the sensor's fast response and recovery times and stable operation. "By integrating the sensor with a flexible circuit board and mounting them on a face mask, we achieved wireless and real-time monitoring of respiratory status, highlighting its potential for practical applications in health monitoring," says Ma.

The researchers also found that electrical transport in IGZO nanofibres is driven by oxygen vacancies, water vapor and temperature significantly affect its conductivity. When a voltage is applied, the sensor's current significantly decreases and quickly recovers during a breath cycle, with a fast response and recovery time of approximately 0.7 seconds.

According to senior and co-corresponding author Binghao Wang, this is a promising solution in the field of personalised healthcare and pandemic prevention.

"An IGZO NF-based sensor integrated into a flexible circuit achieved a compact size of 15 × 35 $mm^2$, marking significant progress in the miniaturisation efforts for smart mask technology," says Wang. "The recorded electrical signals can be visualised via a smartphone equipped with a customised mobile app, underscoring the potential for the widespread adoption of IGZO TFT-based sensors in wearable technology."

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