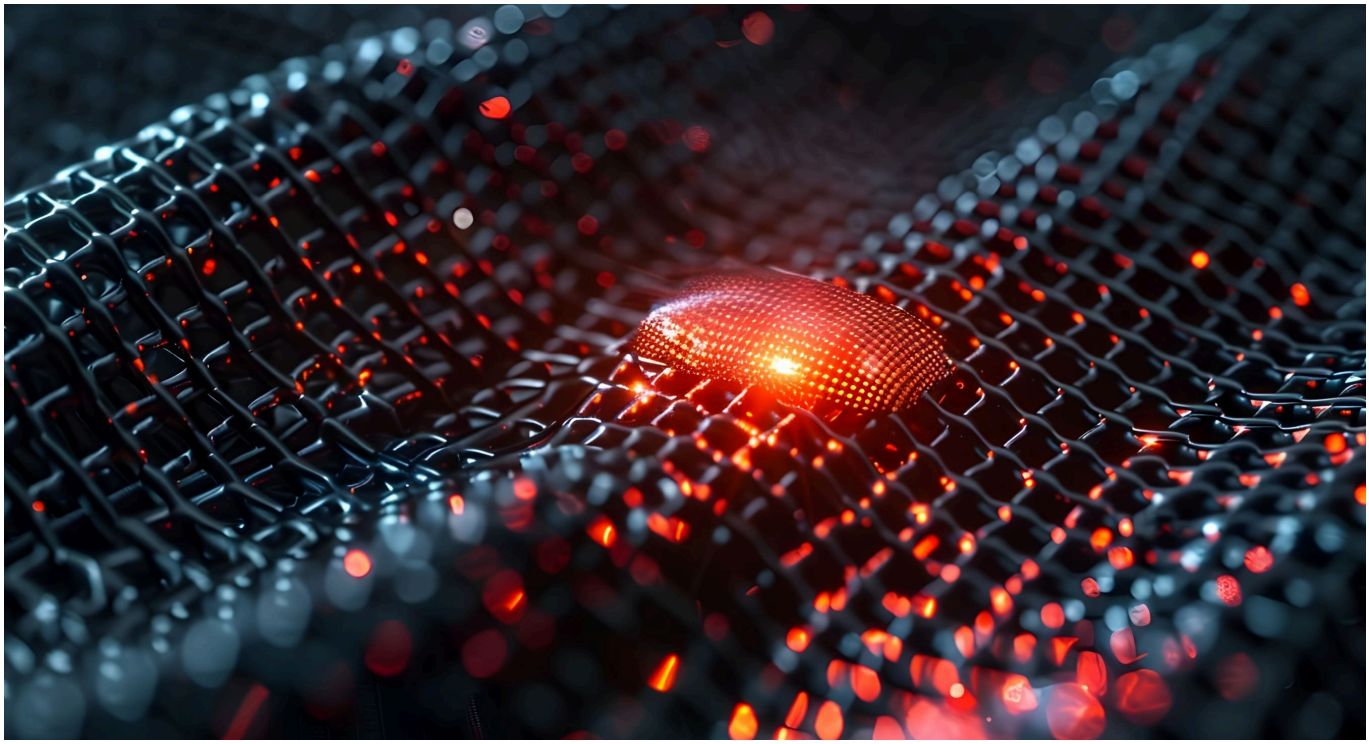
TECH OFFER

A Multianalyte Metabolite Sensing Bandage



KEY INFORMATION

TECHNOLOGY CATEGORY:
Healthcare - Diagnostics
Healthcare - Medical Devices
Materials - Nano Materials
Electronics - Lasers, Optics & Photonics

TECHNOLOGY READINESS LEVEL (TRL): TRL4
COUNTRY: SINGAPORE
ID NUMBER: TO175254

OVERVIEW

Singapore is ranked second highest among developed countries for incidence of diabetes. Previously, glucose monitoring is performed through a needle prick test or capillary blood glucose test. Compared with blood testing, sweat testing offers the advantages of non-invasiveness, portability, and persistence. Analysis and detection of biomarkers in sweat can assist in the prevention, diagnosis, and especially monitoring of chronic diseases.

Wearable devices have been extensively explored in the last decade owing to their lightweight, bendability, stretchability, and ease of integration with human interfaces. Optical wearables are also known for their potential capability to perform remote sensing and detection of multi-parameters at the same time. Despite the rapid advancement in wearable optical sensors, one of the greatest challenges is the capability of multiplexed detection or multifunctionality on a single device.

For more information, contact techscout@ipi-singapore.org

www.ipi-singapore.org

To overcome this limitation, micro-lasers offer unique advantages in terms of signal amplification and narrow linewidth. Strong light interactions between optical microcavities and biomolecules would therefore lead to distinctive lasing signals for sensing. However, there are no laser emitting based device which have been invented for physiological and clinical sensing applications on human before. This technology has developed the first laser emitting bandage for multiplexed detection through a non-invasive wearable laser device. The smart bandage can quickly detect metabolites in 2 minutes through sweat secreted on human skin.

The technology owner is seeking collaborations with medical institutions to extend this technology to patients health monitoring or daily monitoring.

TECHNOLOGY FEATURES & SPECIFICATIONS

This new technology is formed by embedding tiny laser sensors in a hydrogel patch. The bandage uses laser light emitted from the bandage to identify tiny fluctuations of glucose level in sweat and can offer a record low Limit of Detection (LOD). In addition, the device can detect multiple metabolites at the same time to help monitor health conditions more precisely.

To obtain an active microlaser with biochemical sensing functions, a wearable thin film laser is developed by encapsulating cholesteric liquid crystal (CLC) droplets in a flexible hydrogel thin film. Each single CLC microdroplet serves as a WGM microresonator. The three-dimensional cross-linked hydrophilic polymer serves as the adhesive layer to allow small molecules to penetrate from human tissue to the surface of droplet laser resonators. Due to the high-quality factor of the whispering gallery mode (WGM) resonator, subtle changes in the liquid crystal droplets will be amplified, resulting in a wavelength shift in the laser emission spectra, which can then be applied for sensing and monitoring metabolite.

POTENTIAL APPLICATIONS

Using a laser emitting technology, the flexible bandage is able to perform multianalyte sensing and detection of metabolites.

MARKET TRENDS & OPPORTUNITIES

The market potential is substantial, with hundreds of millions of patients requiring daily glucose monitoring. Additionally, the device can be adapted to track multiple metabolites, further broadening its market scope. There are two primary factors that contribute to the appeal of this device. Firstly, it enables monitoring through sweat, eliminating the need for blood samples. Secondly, the technology is both cost-effective and affordable.

UNIQUE VALUE PROPOSITION

Previous studies have investigated the possibility of using surface-enhanced Raman scattering, photonic crystals-based structural color, and polarized microscope for sweat sensing. This technology offers several advantages:

1. This device fulfils the required dynamic range, envisioned to be applied to daily health monitoring for low-cost and disposable usage.

2. This device is able to detect any desired target metabolites by simply modifying the CLC microdroplets. By embedding modified CLC microdroplets within a PAAm hydrogel film, both flexibility and physiological sensing capabilities on human skin was achieved, including lactate, glucose, and urea. The testing results has successfully attained remarkable levels of sensitivity

and minimal limits of lactate, glucose, and urea detection.

3. This platform is very versatile. By altering the components of the droplets or the hydrogel substrate itself, the structure of microdroplets in the hydrogel film can be adjusted to any lasing wavelengths.