

Electrochemical micro-sensors



Direct analysis of soil, water and biological fluids

What is it?

Electrochemical micro-sensor devices offer real-time information on complex environments by coupling a chemically selective layer to an electrochemical transducer. Electrochemical sensors provide a direct conversion of a biological event to an electronic signal. There are four main types of electrochemical sensors: potentiometric or ion-selective electrodes (ISEs), amperometric, impedimetric and transistors (OECT—organic electrochemical transistor, ISFET, etc.)

Electrochemical micro-sensors provide an attractive means to perform rapid and sensitive analysis. This technology also offers a high performance-cost ratio and is user friendly. Devices are now being used with success in clinical chemistry, food industry, and in environmental studies.

Applications

Human and veterinarian healthcare for monitoring purposes:

- wearable devices for noninvasive physiological monitoring,
- point-of-care testing and diagnostics,
- wearable artificial organs,
- post-surgery infection.

Environment and industrial studies for monitoring purposes:

- water and soil quality,
- inline or in bioreactor process.

What's new?

Electrochemical microfluidic-biosensors offers a wide range of improvements for both health practitioners and scientists:

- Compact and low-cost devices
- Real-time and continuous multi-parametric measurement
- Biocompatible, flexible or pitch medium
- Autonomous devices: wireless communication, low energy consumption
- Formulation of sensitive and bio-sensitive layers for specific electrochemical detection
- Form factor, level of robustness depending on the application

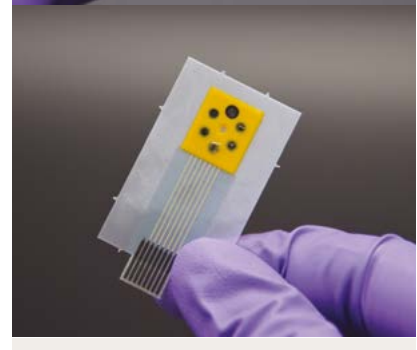
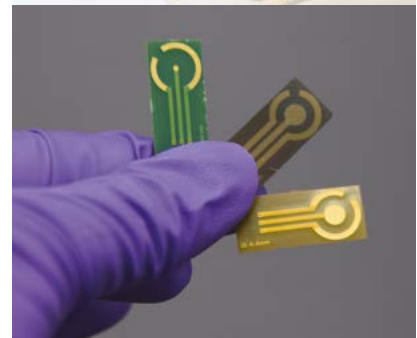
The range of parameters measured covers: pH, Sodium (Na^+), Potassium (K^+), Calcium (Ca^{2+}), Ammonium (NH_4^+), Carbon dioxide (CO_2), Nitrate/nitrite ($\text{NO}_3^-/\text{NO}_2^-$), Nitrogen monoxide (NO), Glucose (H_2O_2), Lactic acid, Creatinine.

What's next?

CEA-Leti's team is currently developing:

- Electrochemical sensors integrated into a microfluidic device—lab on a chip
- Sensor networks for both cell culture and organ-on-chip
- Resorbable sensors
- Sensors on paper
- Liquid gated field effect transistors (LGFET) based on graphene
- Coupling OECT and LGFET for design Boolean electrochemical sensors

Additional parameters are coming soon: Magnesium (Mg^{2+}), Fluorine (F^-), Phosphate (PO_4^-), Urea, heavy metal (Lead, Cadmium, Mercury, etc.), Arsenic.



Interested in this technology?

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