

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

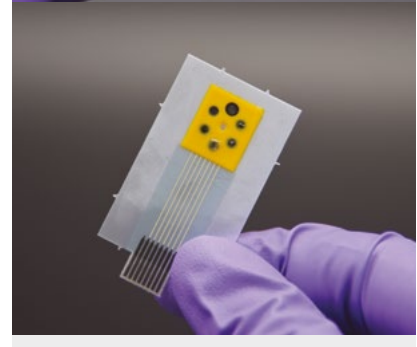
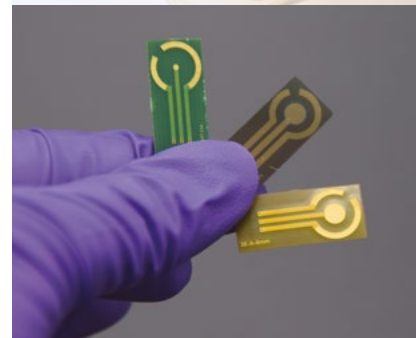
The range of parameters measured covers: pH, Sodium (Na^+), Potassium (K^+), Calcium (Ca^{2+}), Ammonium (NH_4^+), Carbon dioxide (CO_2), Nitrate/nitrite ($\text{NO}_3^-/\text{NO}_2^-$), Nitrogen monoxide (NO), Glucose (H_2O_2), Lactic acid, Creatinine.

+ 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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