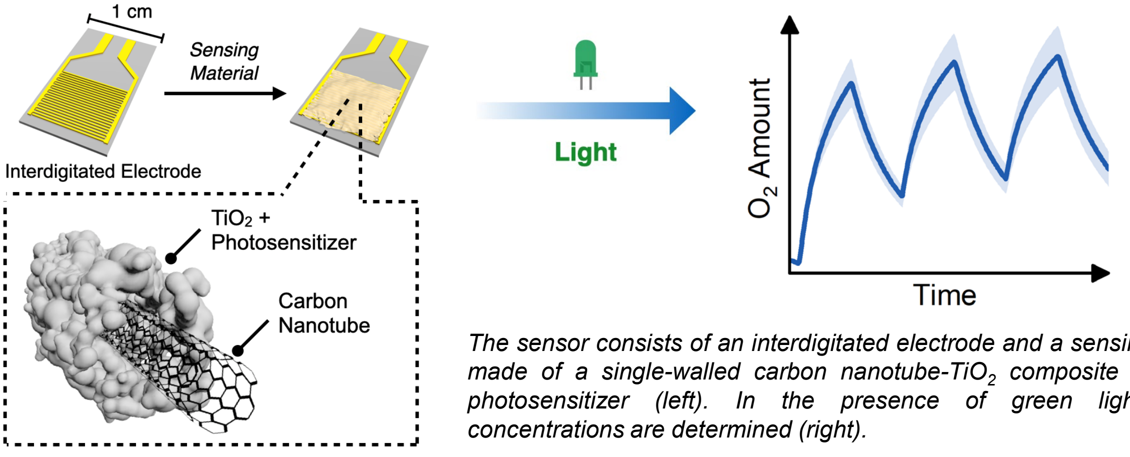
ETH zürich

Licensing Opportunity

Chemiresistive sensor for broad-range oxygen monitoring



The sensor consists of an interdigitated electrode and a sensing material, made of a single-walled carbon nanotube-TiO_2 composite featuring a photosensitizer (left). In the presence of green light, oxygen concentrations are determined (right).

Application

This light-activated sensor monitors oxygen levels across a broad range of environmental conditions. It tolerates high humidity and interferant gases. Its low power consumption (< 0.6 Watt) and miniature design make it ideal for remote, in-field applications such as exhaust gas analysis, water and air quality measurements, early detection of food spoilage, or breath monitoring.

Features & Benefits

- High selectivity
- Broad sensitivity over several orders of magnitude, lower detection limit < 1 ppm
- Low-cost and low power consumption
- Robust design

Publication

- "A Dye-Sensitized Sensor for Oxygen Detection under Visible Light", *Adv. Sci.* **2024**, 2405694 https://doi.org/10.1002/advs.202405694
- Patent pending

ETH transfer
transfer@sl.ethz.ch
www.ethz.ch/transfer
Reference 2024-034

Invented by D-CHAB: M. J. Bezdek, L. Wettstein

Technology Readiness Level

Background

State-of-the-art oxygen sensors suffer from various drawbacks. To achieve high sensitivity, trade-offs are made regarding power consumption (high-temperature resistive sensors), complexity of analytical instrumentation (spectrometer) or single-use colorimetric sensing probes.

Invention

A chemiresistive sensor provides a digital signal in the form of a resistance change upon exposure to oxygen. The sensor material is based on a composite of carbon nanotubes and titania (TiO_2) (see fig. above). An additional photosensitizer is applied to the surface of the composite. The photosensitizer harvests light which results in a charge-transfer to the titania/nanotube composite. In the presence of oxygen, the overall resistance of the device changes.

A prototype has been built and tested in the lab. The device resistance is linearly proportional to the oxygen concentration in a broad range. Other gases do not cause any interference. The sensor is also tolerant to humidity and benchtop stable over several months. Operating temperatures from –50°C to 200°C are conceivable. The overall design is low-cost and compact.

The invention comprises the possibility to adapt the nanostructured sensors to the monitoring of other gases.