Novel organic-inorganic materials in opto-electronic systems for the monitoring and control of bio-processes

Results in Brief

Sensors for the harshest of environments

Researchers from the EU-funded MATINOES project investigated the development of rapid, affordable sensors for biotechnological production processes. The focus was placed in particular on optical sensors for monitoring harsh reaction environments.

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Optical fibres are used to transmit electromagnetic radiation from the sensing region that is in direct contact with the sample under analysis. All important are the immobilised reagents in the coating material that help to measure the chemical changes under scrutiny.

The MATINOES consortium developed sensitive coatings for enzyme-based intrinsic and extrinsic optical sensors. The chemical foundation for the new coating material was a hybrid organic-inorganic polymer. Its different components gave a variety of options during the final design of the sensors.

The incorporation of enzymes for catalysis of the oxidative reactions demanded certain biochemical design features. First, rapid film curing can be achieved with

ultraviolet light as opposed to heat to prevent the denaturation of the enzymes. Furthermore, hydrophilic groups were incorporated into the polymer as enzyme solutions are water-based.

Secondly, the sensor's detection of reactants is based on the consumption of oxygen. Ruthenium complexes to measure this process were therefore integrated into the coating. Also, hydrophobic groups included facilitate the migration of oxygen, increasing sensitivity to the gas.

The range of coating materials that can be derived from the starter compounds gave two options for the final assembly of the sensor. This was built up as either a single or a double layer structure. In the double layer, the primary coating contains the ruthenium complex and the secondary layer houses the enzyme. The single coating contains both the oxygen sensor and the enzyme.

Optical sensors developed can be used to achieve continuous real time monitoring in many kinds of analytical sciences. Detection of pollution, biotechnological processes, water analysis, clinical chemistry and invasive medical techniques are all areas that stand to benefit from advances in this technology.

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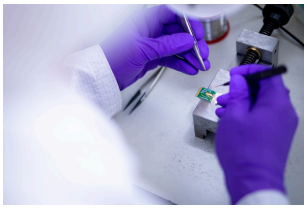

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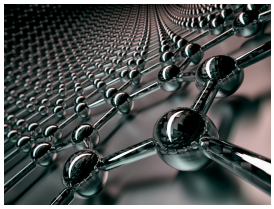

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MATINOES

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