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# Processing of Thick Film in Bio-Sensors and Application of Optical Fibre

KEYWORDS

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**ABSTRACT** *Remarkable developments can be seen in the field of optical fibre biosensors in the last decade. More sensors for specific analytes have been reported, novel sensing chemistries or transduction principles have been introduced, and applications in various analytical fields have been realised. This paper discussed the use of thick film technology which is cost effective and robust user friendly. The analyte after interaction with enzyme, antibody or ionophores gives a signal in the form of electrical, optical, thermal or electrochemical. With the help of optical fibre technique we can analyse the optical signal immediately. Response and recovery time is very important parameter for a good sensor.*

## INTRODUCTION:

Biosensor is a device is made up of a transducer and a biological element that may be an enzyme, an antibody or a nucleic acid. The bioelement interacts with the analyte being tested and the biological response is converted into an electrical signal by the transducer. Depending on their particular application, biosensors are also known as immunosensors, resonant mirrors, biochips, glucometers and biocomputers.The present paper describes some of processing techniques to make a biosensor using thick film and also optical methods in detail for application in monitoring biosensors.

Basically, a biosensor is defined as a device which measures selectively, the concentration of one chemical species in a complex analyte mixture and converts it in to a proportional electronic or optical output signal [1].

## PRINCIPLE OF OPERATION:

Biosensor can determine the concentration of one compound in a complex mixture of typical analyte such as drinking water, fermentation broths, food products etc. Three key features are required for identifying particular species:

Selectively,
Proportionality,
Measurability.

Selectively should be high enough to differentiate the desired substrate species from the rest of the analyte mixture. This is based on the specific interaction of the substrate molecule and a biopolymer. This can be specified as molecular recognition. Biological materials like enzymes and antibiotics are the most important and prominent examples. Molecular recognition and selective binding to a single specific substrate is the domain of antibodies and the basis of an immune system. The selectivity of some enzymes is high enough to differentiate even between stereo isomeric compounds i.e. L & C amino acids.

There are also enzymes which have a wide range of substrate specificities but have only a certain chemical structure in common e.g. Proteases specific to the peptide bound. It is understand that biological macromolecules often are sensitive to thermal and chemical degradation and these properties can be utilized for identification of the bio species.

Proportionality of the sensor is due to the biopolymers as well as the transducer properties. Enzymes bind a substrate and catalyse its conversion into a product. Often certain polymers are also needed as cofactor like ATP. Both the appearance of the enzyme product or the consumption of the cofactor can be used as a measure to analyse the substrate concentration. Antibodies are the other important class of biopolymers for biosensors. Their substrate are called antigens since they are not converted into a product. Upon binding the antigen, the resulting antigen-antibody complex can differ in some physical properties for monitoring by the transducer elements. These changes are effectively mass, refractive index and dielectric constant. Only for inorganic ions and some organic ions do both biological and synthetic compounds which show the required selectively.

The beat known example is the selective binding ofby the antibiotic Valinomycin [2]. There is third variety known as ionophores which can be effectively utilized as sensor.

## APPLICATION OF THICK FILM BIOSENSORS AND ITS MANUFACTURING:

This thick films technology can be utilized to develop biosensors. These are electrochemical enzymes and ionosphere based sensors in mixed operation. Glucose sensor is an example of an amperiometric sensor. The proportional consumption of glucose and generation of electrons is the basic principle, and the output signal is current. The characteristics of amperiometric sensors is that the measured current (I) is proportional to the concentration (C) of the substrate. A comprehensive review on these electrical types has been published [3]. In potentiometric detection the ion selective membrane (ISM) contains a compound which interacts with a particular sort of ion in the analyte solution. This leads to the reversible dissociation of groups in the sensitive membrane, thereby there is a change in the charge density. The resultant voltage can be monitored. Thick film technology offers the advantage of producing effectively, at a lower cost the configuration required for electrode in various shapes and sizes as required.

This has many advantages of producing on different shapes of the substrate, therefore, this technology has many applications.

**OPTICAL FIBRE APPLICATIONS:**

Surface Plasmon resonance (SPR) is an effective method to utilize the change in refractive index of biomolecule and is being effectively used. This has a problem that the thin gold film deposited on the glass substrate does not have very good adhesion and the analyte may spoil it. In the present case, a modified method has been developed which can be used as a sensor. U-rod sensor coupled with fibre optic can be utilized for monitoring certain bio-samples.

**MEMBRANE MATERIAL FOR THICK BIOSENSORS:**

Thick film pastes for noble metal electrodes, contoured lines, passive electronic elements and insulating layers are commercial available whereas enzyme or ionosphere containing screen printing inks have not reched a wide acceptance beyond research table. Common procedures for the application and immobilization of biopolymers onto the sensor' s electrodes are absorption, entrapement or covalent binding. Carbon paste is used for such applications [4].

Two different classes of membrane are used. Heterogenous solid state membrane are made from insoluble inorganic salt as electro active sites which are suspended at a high concentration in an electrochemically inert polymer matrix. Ion selective liquid membranes are more often used. A typical membrane composition contains 30% polymer, 1-2% of electro active sites (neutral ionosphere or ion exchanger and 68% to 69% of highly lipophilic liquid plasticizer, which acts as a solvent for the ionosphores. Ionosphore molecules are mobile inside the membrane. Thermal diffusion brings as many ionophore molecules to the membrane surface as can form ion-complexes in the corresponding counter from analyte solution.

**CONCLUSION:**

Fiber-optic biosensors will play a significant role in the development of biosensors because they can be easily miniaturized and integrated for the determination of different target compounds in a wide variety of application fields, such as industrial process and environmental monitoring, food processing, and clinical applications.

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