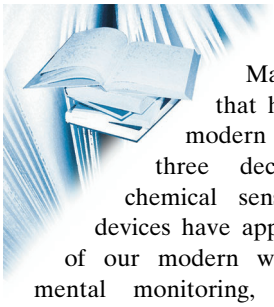

Chemosensors

Many key developments that have been introduced in modern industry during the last three decades are based on chemical sensors. These innovative devices have applications in many fields of our modern world, such as environmental monitoring, process control, and health-care. They are integrated into computerized equipment, and the performance of the overall system determines the degree of commercial success.

The book *Chemosensors*, edited by B. Wang and E. V. Anslyn, is organized in four sections consisting of chapters written by experts in their fields. Section 1 describes the fundamental phenomena that are important for every chemically sensitive layer. Different types of receptors are discussed in Section 2. By combining such a receptor with a transducer one obtains a chemical sensor, and these are described in Section 3. The critical step in the exploitation of chemical sensing is to identify potential commercial applications. To illustrate that, Section 4 presents some case studies.

The importance of intermolecular interactions is emphasized in Section 1. First, the effects of Van der Waals interactions are discussed, then supramolecular chemistry (e.g., in cyclodextrins) is considered, followed by hydrogen bonding and ionic contributions. Covalent interactions can have an important role in cases where the rise and decay of an analyte concentration is very fast.

Section 2 discusses the design of receptors, using strategies based on the lock-and-key principle. Some important tools for receptor design are computer modeling, combinatorial chemistry, molecular imprinting, and the principle of self-organization of dendrimers and nanoparticles.

A sensor consists of a selective coating that is capable of chemical recognition and can also generate an electrical signal, as described in Section 3. The transducer principles that are used include optical methods based on fluorescence, absorbance, or surface plasmon resonance (SPR), electrochemical methods, and the generally applicable mass-sensitive devices such as quartz crystal microbalances (QCMs). Fluorescence methods are very sensitive, but electrochemical detection is widely favored because of the simplicity of the instrumentation. Both QCMs and SPR have the advantage of being universally applicable without labeling.

Optical detection of neutral analytes and of ions such as Hg^{II} can be performed by a combination of a dye with a recognition system. Simpler methods of detection are those based on ion-selective electrodes and cyclic voltammetry. Sensors based on SPR and QCM have a wide range of applications. In SPR, surface plasmons generate an evanescent field, and the method has advantages for the detection of proteins. The resonance frequency of a quartz microbalance is reduced by the adhesion of small molecules, and the method can be applied to complex bioanalytes. Generally, the performance of sensors with poor selectivity can be improved by using an array of sensors, which allows pattern recognition.

The ultimate goal of sensor development is to design specific products. These efforts are described in Section 4, which presents some case studies. The detection of ions is of wide interest. Some applications focus on biology, e.g., to detect ions inside cells by the use of fluorophores.

All four sections of the book contain many contributions on special topics from a large number of authors. This aspect can be criticized, because some chapters are highly specialized, and because there is overlapping of some topics. The strategies of combining coatings with transducers include many possibilities. Therefore, a monograph of this kind should give a general overview of the sensor as a unit, and should describe how the sensor layer is adapted to the transducer. However, the main part of the book deals with intermolecular interactions. It does not explain how to design a complete sensor to measure an analyte. A reader approaching this book might think at first that it resembles a textbook of organic chemistry. Usually, a sensor is characterized in terms of its analytical capabilities. The selectivity and sensitivity of the sensor should be given precisely, and the data should be presented in the form of sensor characteristics. Furthermore, the dynamic behavior is important both with regard to saturation effects and to rise and decay times. Analytical chemistry with sensors is a quantitative science, and the results are given as numbers with a specified degree of accuracy. Additionally, it must be noted that sensors will be important in both the condensed phase and the gas phase. Not only organic materials are of importance—metal oxide semiconductor sensors are also used widely in a well-known variety of applications.

Concerning the overall rating of the book, it will be especially valuable to readers who are interested in modern supramolecular chemistry. Thus, the title should be changed as follows: "Supramolecular Chemistry—Possible Applications in Chemical Sensing".

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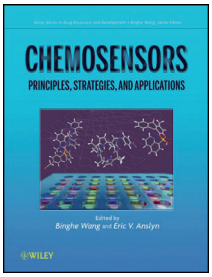

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