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Sensing of Chemical Substances Using Light-Induced Potential Changes of Organic Membranes

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Sensing of chemical substances was investigated based on the light response (photovoltaic effect) of an organic semiconductor. Copper phthalocyanine and lipid materials were used in the fabrication of transducer membranes. Light-induced potential was affected by the presence of electrolyte and nonelectrolyte. The photovoltaic method can detect changes in surface characteristics of the membrane electrically.

1. Introduction

In biological systems, chemical stimuli are received on the surface of a biomembrane which is very thin and has a very small area. In such a sensor, electric surface potential or conformation of the membrane changes easily; therefore the stimuli can be detected with high sensitivities. Surface electric potential changes caused by electrolytic substances can be easily measured by potentiometric methods in artificial membrane systems such as LB, vacuum-evaporated and various thick membranes. On the other hand, it is difficult to detect nonelectrolytic substances by means of simple electric measurement methods because of the weak electrical interaction between chemicals and membranes. Nonelectrolytes affect the membrane surface; however, such a change of the surface cannot be detected in thick membranes electrically. Therefore, chemical sensors having properties similar to those of biological systems have not been realized.

In the present study, changes in surface characteristics are measured in terms of the light-induced electric potential, i.e., photovoltaic effect, by the use of a photosensitive