
Chemical Sensor Technology

Vol.4

Edited by

Shigeru YAMAUCHI

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Preface

Research activity on chemical sensors is now flourishing throughout the world. Many papers on chemical sensors are being published in journals and read at domestic and international conferences. They convince us that *chemical sensors are here to stay*. When Prof. Seiyama organized the *Sensor Research Group* within the Electrochemical Society of Japan in 1977, *sensor* was not a popular term. Now, topics on sensors appear in newspapers, weekly magazines, and even on TV. This represents general acceptance and recognition that sensors are an indispensable element in modern society.

In the fourth volume of this series we have compiled state-of-the-art review papers on new principles, new devices, and detailed mechanism of various chemical sensors. They will help readers gain further understanding of devices in their own work and widen their scope in related areas concerning chemical sensors.

One strategic field of chemical sensors is biosensing for medical and health care equipment, especially useful in geriatric medicine. Frequent health checks at one's own home will be more and more necessary to keep the elderly healthy and active as the proportion of the aged in the population steadily increases all over the world. In some cases health conditions will have to be monitored constantly to give warnings or provide emergency assistance at the right time. Sensors discussed to date for this kind of application are mainly physical sensors for position, temperature, pressure sensing, or electrocardiography. Because biochemical substances play major roles in physiological processes such as metabolism, excitation and contraction of skeletal muscle and neurotransmission chemical sensing of the related biochemical substances will eventually become indispensable. From this point of view more than half the papers in this volume are relevant to biosensing. It is hoped that the reviews on biosensing will be beneficial to the future development of this kind of device.

Although various kinds of new devices and principles have been proposed not all of them have been commercially successful. Even scientifically fascinating and well-engineered devices sometimes find difficulty in the commercial market. Some of these encounter problems in the fact that reasonable production cost is required for a successful device, not just high performance. Moreover, new devices must be introduced at the right time to meet social needs. In this respect, I believe it is still instructive to read the legendary story of success in the development of the Taguchi gas sensor.

I wish to acknowledge the efforts of all the contributors who have prepared

manuscripts and the editorial board members who have given valuable advice. I would also like to express my sincere thanks to Mr. Ippei Ohta and other staff members of Kodansha Scientific Ltd. who have worked on this volume.

Shigeru YAMAUCHI

Editor

September 1991

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1. INTRODUCTION

The semiconductor-type gas sensor was first put to practical use in 1968 as a sensor for domestic gas leak detectors. This was the Figaro TGS (Taguchi Gas Sensor).

Naoyoshi Taguchi (former chairman of Figaro Engineering Inc.) began working on the sensor in 1962 and achieved success after six years of total dedication to the project. After the present author then established Figaro Engineering Inc. and became first in Japan to put the sensor to practical use.

The semiconductor-type gas sensor was first utilized in the field of domestic gas detectors thanks to its advantages of high sensitivity, high reliability, etc. At a later stage, the sensor was applied to detect alcohol content in drivers suspected of driving under the influence, to detect incomplete combustion in boilers, as auto-cooking sensors for electric ovens, etc.

In Japan, Taguchi is a self-employed inventor and this invention was developed completely on his own. Much of the recent high technology that has appeared as a result of systematic research contrasts strikingly to the humble origins of Taguchi's achievements.

This book is dedicated to Naoyoshi Taguchi for his achievement in developing the sensor after a long arduous road to acceptance, resulting finally in its being put to practical use by Figaro Engineering Inc.

2. INVENTION OF THE GAS SENSOR

2.1 Brief Personal History Prior to the Invention

Naoyoshi Taguchi was born in Kobe, Japan, in 1936. Taguchi has been my friend since elementary school and even then he was already full of curiosity and had a keen interest in exploration. Whenever he went to a filthy area near his house, his pockets would be full of insects such as ant lions, moles and rocks that he had gathered on his own. When he went to town, he would collect electric wires, tools, electric parts used in cars, radios, and generators in a junkshop and come back with his bicycle loaded with them. When he visited a fireworks display, he used to run around collecting

Development of the TGS Gas Sensor

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