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Temperature Transient Responses of a Semiconductor Gas Sensor for Smell Identification

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This paper describes temperature transient responses of a semiconductor gas sensor. Surface temperature of the sensor is monitored by an infrared thermometer. The sensor shows a significant dependence on the changing rate of surface temperature. In a rapid cooling condition without gas components, the logarithm of the conductance is proportional to the reciprocal of the absolute surface temperature. A slow temperature change induces a nonlinear absorption response. Transient responses with gas exposure are explained by three phenomena relating to the surface temperature. Specific gas dependencies are shown in transient conductance profiles. This fact can be used in gas and smell identification.

1. Introduction

Semiconductor gas sensors have frequently been used in smell identification systems[1–3] since they are commercially available, reliable and simple to use. However, the information obtainable from them is limited to one conductance value for each sensor at a time. Therefore a large number of sensors would be needed if we were to perform smell identification by a pattern recognition method using an array of different sensors.

The objective of this research is to extract more, and/or more accurate information from a single sensor than by the conventional methods. It is well known that the semiconductor gas sensors have temperature-dependent gas selective characteristics. Using this fact, we can obtain temperature spectra of sensor responses. If we