Sym. C : Electroceramics & Sensors

CERAMIC SENSORS

C-THU-10

GAS-SENSING MECHANISM OF VARISTOR-TYPE GAS SENSORS BY A.C. IMPEDANCE TECHNIQUE, M. EGASHIRA, Y. SHIMIZU, T. HYODO and Y. TAKAO* (Faculty of Engineering, *Faculty of Environmental Studies, Nagasaki University, 1-14 Bunkyo-machi, Nagasaki 852-8521, Japan)

Current (I) - voltage (V) characteristics of porous varistors have been investigated in air, reducing and oxidizing gas atmospheres at elevated temperatures. When n-type semiconductor oxides were used for fabricating varistors, their breakdown voltages shifted to a lower electric field upon exposure to reducing gases than that in air, while they shifted to the reverse direction upon exposure to oxidizing gases. The magnitude of the shift, i.e. gas sensitivity, depended markedly on both the varistor compositions and the operating temperature. Analysis of the sensing behavior by a.c. impedance technique revealed that the resistance of the varistors could be decomposed into four components: electrical bulk resistance, grain-boundary resistance, resistance based on oxide ion conduction and electrode-oxide interface resistance. It was confirmed that the variation in grain-boundary resistance, i.e. the potential height of the double Schottky barrier induced by the interaction between gases of interest and grain-boundary, controlled the breakdown voltage of the varistors.

C-THU-11

RESPONSE PROPERTIES FOR ORGANIC GAS OF FATTY ACID THIN FILMS USING RESONANT FREQUENCY AND RESISTANCE

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There are lots of researches which are using quratz crystal in order to apply it to sensors, for example, mass detect sensor, humidity sensor, gas sensor, etc. In this paper, we tried to apply quartz crystal to the sensor using the resonant frequency and the resistance properties. Four kinds of fatty acid which are having the same head group are coated at the surface of quartz crystal, the shift of the resonant frequency and the resistance are observed according to length of the tail group. Myristic acid(C14), palmitic acid(C16), stearic acid(C18), and arachidic acid(C20) were coated by Langmuir-Blodgett(LB) method. As results, the resonant frequency shift was observed linearly. However, there are some difference compared with Sauerbrey's equation. It can be explained by the effect of the temperature property and/or humidity. On the other hand, the shift of the resistance was observed nonlinearly.

C-THU-12

DEVELOPMENT OF MICROFERMENTER CHIP WITH MICROBIOSENSORS USING SEMICONDUCTOR PROCESSING TECHNOLOGY, JONG W. KIM(Memory Product & Technology Development Division, Hyundai Electronics Industries Co., Kyoungki-do, Korea), Young H. Lee(Drexel University, Philadelphia, PA 19104, USA)

The microfermenter chip developed in this work enables collection of process data just as in a regular fermenter but at much reduced cost. The microfermenter chip looks just like any other integrated circuit chip except that the chip has one or more well-instrumented micro-scale fermenters on it. Each microfermenter has micro-scale sensors for measuring pH, dissolved oxygen, and glucose. These sensors are made from thin films of metals and dielectric materials, and are located at the bottom of the microfermenter. The micro pH sensor showed a linear response in the pH range of 2 to 10 with a slope of approximately –50 mV/pH at 20°C in an air saturated medium. The micro DO sensor showed a linear response to partial pressure of oxygen. The micro glucose sensor was designed to operate in a kinetic regime, and the sensor showed a non-linear response.

THURSDAY

Sym. C : Electroceramics & Sensors

ELECTROCERAMICS- Ⅲ

C-THU-13

Fabrication of artificial grain boundaries using Co or Mn doped ZnO single crystals.

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ZnO ceramics doped with some additives are used as varistor. In those ceramics, the non-linear current-voltage (I-V) characteristics are thought to be due to potential barrier formed at grain boundary(GB). However, detail of the current transport mechanism through GB is not completely clarified, yet. In the present study, some artificial GB, namely bi-crystals, were fabricated to study the effect of additives and miss orientation of lattices to the characteristics of barrier.

Single crystals of ZnO doped with Co or Mn were grown by a flux method using PbF_2. Two kinds of bi-crystals were formed. One is homoepitaxial thin film deposited on the single crystal and the other is so-called bi-crystals which were bonded by hot pressing. The twisted GB were fabricated by hot pressing and the homoepitaxial film corresponds to GB without lattice miss orientation. Degree of the lattice miss orientation was determined by XRD method and the electric properties of bi-crystals were characterized by I-V and C-V measurement at 70-350 K.

It was indicated that homoepitaxial thin film showed ohmic properties, even if Co or Mn was doped. On the other hand, non-linear I-V characteristics were found in the twisted GB made from Co or Mn doped single crystals. The non-linear properties were not found in the bi-crystal made from pure single crystal.