Sym. H : The Surface, Interface & Nano-structure of Materials

COMPOUND FILM

B-THU-22

FABRICATION AND CHARACTERIZATION OF BOROCARBIDE THIN FILMS, <u>SHUNICHI ARISAWA,</u> **T.HATANO and K.TOGANO** (National Research Inst. for Metals, Tsukuba, 305-0047, Japan)

We have reported on the fabrication of thin films of YNi_2B_2C for the first time.[1] The process, however, requires the post-annealing at 1050 °C. It is absolutely preferable to avoid such a high temperature for practical device applications and we are aiming at establishing an in-situ process at lower temperatures. To obtain films with higher Tc, it is very important to know the relationship between what we choose as substrates and what we get on them.

Three kinds of substrates, polished MgO, unpolished MgO, and polished $SrTiO_3$ were adopted. As for former 2 kinds of substrates, superconductive films were successfully fabricated with the Tc of ~11 K.

Further, we discuss the fabrication of thin films of YPd_2B_2C on $SrTiO_3$ substrate. We tried to synthesize the films of the Pd system by RF sputtering technique as well. So far, it is uncertain whether or not the 1221 phase exists in the films. However, the slight reduction of the resistance was observed at 23K, which is almost the same as the value of the bulk material.

1)S.Arisawa et al., Appl. Phys. Lett., 65(1994)1299

Sym. C : Electroceramics & Sensors

ELECTROCERAMICS- Ⅱ

C-THU-01

FAILURE OF THE NERNST-EINSTEIN EQUATION IN SEMICONDUCTING $A_{1-\delta}O$

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The Nernst-Einstein equation relates the conductivity(σ_i) to the tracer diffusivity(D_i^*) of the mobile ionic carriers(A^{2+}) in $A_{1-\delta}O$ or $\sigma_i=(z_iF)^2C_iD_i^*/fRT$. This equation has been known to fail when different mechanisms operate in conduction and diffusion. It has recently been found that the equation may fail even when an identical mechanism operates in a semiconducting compound.

The experimental evidence is presented for the system of $Co_{1-\delta}O$ and $Fe_{3-\delta}O_4$. The reason for the failure will be discussed phenominologically.

Sym. C : Electroceramics & Sensors

ELECTROCERAMICS- Ⅱ

C-THU-02

STUDY OF GRAIN BOUNDARY TUNNELING IN BARIUM TITANATE CERAMIC FILMS, <u>H. WONG</u> and P. G. Han (Department of Electronic Engineering, Cityu, Hong Kong), M. C. POON (Dept. of Electrical and Electronic Engineering, The Hong Kong Univ. of Science & Technology Hong Kong)

In this work, we investigate the temperature and electric field dependencies of current-voltage characteristics and low-frequency noise of this kind of material. Several new phenomena are observed. An abnormal field dependence of resistivity is observed in $BaTiO_3$ materials with a small averaged grain size. In addition, experiments show that the low-frequency noise behaviors are governed by grain boundary tunneling at room temperature and by trapping and detrapping of the grain boundary states at temperature above Curie point. These observations provide additional information on the current conduction and distribution of grain boundary states. Physical models for the new observations are developed. A grain boundary tunneling model for the current conduction is proposed. The new model agrees with the both the measured electric field and temperature dependencies. It suggests that grain boundary tunneling of carrier is as important as the double Schottky barrier in the current conduction in $BaTiO_3$ materials with small grain size.

C-THU-03

ELECTRICAL CONDUCTIVITY IN THE BROWNMILLERITE SYSTEM $Ba_2(In_{1-x}M_x)_2O_5$ (M = Ga, Al), <u>H. YAMAMURA</u>, H. HAMAZAKI and K. KAKINUMA, (Dept. Appl. Chem., Fac. of Eng., Kanagawa Univ. Yokohama 221 Japan), T. MORI and H. HANEDA (NIRIM,1-1, Namiki, Tsukuba, 305 Japan)

The solid solution system $Ba_2(In_{1-x}M_x)_2O_5$ (M=Ga,Al) ($0 \le x \le 0.5$) were prepared by a conventional ceramic technique, where the samples were sintered at 1400℃ in air. While $Ba_2In_2O_5$ showed orthorhombic brownmillerite phase, cubic perovskite phases were obtained in the composition range $0.3 \le x \le 0.5$ and $0.2 \le x \le 0.5$ for the Ga and the Al system, respectively. The electrical conductivity measured by DC 4 terminal method showed sharp increase around a phase transition temperature(T_d) for the brownmillerite phase, and T_d shifted to lower temperature with increase in the composition, x. However, the conductivity of the samples with the cubic perovskite phase did not show such a sharp increase, and decreased with increase in the composition, x. The phase transition was also investigated by high temperature XRD. Td values obtained by high temperature XRD were about 100℃ higher than those obtained by the electrical conductivity. The difference of T_d values was discussed from a view point of ordering in tetrahedral site in cubic perovskite structure .

THURSDAY