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

SURFACE MODIFICATION

### B-THU-18

**GROWTH OF NANOTUBES WITH HETEROGENEOUS COMPOSITIONS BY A PLASMA EVAPORATION METHOD** Y. SHIMIZU AND Y. MORIYOSHI(College of Engineering, Hosei University, 3-7-2Kajinocho Koganeishi Tokyo, 184-8584, Japan) S. KOMATSU*, T. IKEGAMI*, T. ISHIGAKI*, T.SATO*, AND Y. BANDO* (*National Institute for Research in Inorganic Materials, 1-1 Namiki Tsukuba 305-0033, Japan)

Evaporated chemical species from both pure and copper added BC4N in a dc arc plasma were deposited as nanotubes on a disk cooled with water. The nanotubes collected from the disk were characterized by high-resolution transmission-electron microscopy(TEM) and electron-energy-loss spectroscopy(EELS). The microstructures of them observed by TEM and the K-edge absorption data for B, C, and N atoms analyzed by EELS indicated the presence of combined nanotubes consisting of carbon and boron nitride, and carbon nanotubes containing copper in themselves. However, a homogeneous phase of BCXN nanotubes could not be obtained. A possible formation mechanism of the nanotubes was briefly discussed.

key words: nanotube, BN, carbon, formation mechanism

### B-THU-19

**INITIAL GROWTH MODE OF AlN(002)/SAPPHIRE(001) THIN FILMS GROWN BY RF MAGNETRON SPUTTERING,** H. C. KANG, S. H. SEO, M. S. YI, H. H. LEE, AND D. Y. NOH (Department of Materials Science and Engineering, and Center for Electronic Materials Research, Kwangju Institute of Science and Technology, Kwangju 506-712, Korea)

Initial state growth of the AlN(002) thin films grown on sapphire(001) substrates was studied in X-ray scattering experiments. At the initial stage of the growth, the high quality epitaxial flat films of 30Å were formed. As the epi-layer became thicker than 30Å, part of the film was occupied by the columnar seeds. Fully grown AlN(002) thin films were composed of the epi-layer and the columnar structure. The lattice spacing of the epi-layer changed continuously during the growth. As the RF power increases, the critical thickness, where the lattice constant attains the bulk value, decreases, and the relative amount of the columnar structure increases. We suggest a model for the initial growth of the AlN(002) thin films based on the experimental results, that is rather different from the reported models.

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COMPOUND FILM

### B-THU-20

ORIENTATION CONTROL OF ZnO THIN FILMS FOR ULTRAVIOLET LIGHT EMITTING DEVICES, I. OHKUBO, A.OHTOMO, T.OHNISHI, M.KAWASAKI, H.KOINUMA[a](Tokyo Institute of Technology, Yokohama 226-8502, Japan) T.YASUDA, Y.SEGAWA(The Institute of Physical and Chemical Research, RIKEN, Aoba, Sendai 980-0868,Japan)

Recently, we have demonstrated a room-temperature laser action caused by excitonic stimulated emission(390nm) in ZnO nanocrystal thin films[1] and this triggered intensive research of ZnO as a material for UV emitting devices. Here, we show detailed study of orientation control of ZnO films on sapphire substrates.

Epitaxial ZnO thin films were prepared on as-polished and atomically flat sapphire(0001) substrates at various substrate temperatures by laser MBE. Crystal structure was analyzed by four-circle XRD and ion scattering spectroscopy. On as-polished substrates, the in-plane orientation was found to be ZnO[1010]//sapphire[11$\bar{2}$0] regardless of substrate temperature. However, that on atomically flat sapphire(0001) substrates changed from ZnO[10$\bar{1}$0]//sapphire[1010] at low temperature(400℃~450℃) to ZnO[10$\bar{1}$0]//sapphire[11$\bar{2}$0] at high temperature (800℃~835℃). The former films had a termination of (0001) crystallographic plane (the Zn face), whereas the latter showed the (000$\bar{1}$)O face termination. The orientation control of ZnO on sapphire will be discussed based on the thermodynamic and kinetic factors of initial growth processes.

a)Also a member of CREST, Japan Science & Technology Corporation.

[1] P.Zu et al,Solid state Commun.,103,459(1997).

### B-THU-21

**STRUCTURAL DEPENDENCE OF THE GALVANOMAGNETIC PROPERTIES OF TRANSITION-METAL ALUMINIDE THIN FILMS,** K. W. KIM, Y. V. KUDRYAVTSEV, and Y. P. LEE (Dept. of Physics, Sunmoon Univ., Asan, 336-840, Korea), J. Y. Rhee (Dept. of Physics, Hoseo Univ., Asan, 336-795, Korea)

Structural dependence of the galvanomagnetic properties of CoAl and FeAl alloy films was investigated in this study. The ordered and disordered alloy films of 150 nm thick were prepared by flash evaporation on heated and cooled substrates, respectively. The temperature dependence of resistivity has been measured in 5 - 300 K temperature range with and without magnetic field of 0.5 T. An influence of the order-disorder structural transition on the temperature dependence of resistivity is disscussed in connection with the data of magnetic properties, and analyzed in the framework of the partial localization of the electronic states and the variable-range hopping conductivity.