Dielectric Bi_3NbO_7 thin films grown on flexible substrates by Nano Cluster Deposition

Hyun-Woo Lee[1], Soon-Gil Yoon[1,2*]

School of Nano Science and Technology[1], Graduate of Analytical Science and Technology (GRAST)[2],

Chungnam National University, Daeduk Science Town, 305-764, Daejeon, Korea

Abstract : Transparent BNO thin films were grown on Al-doped ZnO (AZO)/Ag/AZO/polyethersulfon (PES) (abbreviated as AAAP) transparent electrodes at a low temperature by the NCD technique. The BNO films grown on the crystallized AZO/Ag/AZO (AAA) electrodes exhibit an amorphous phase with a root mean square (rms) roughness of approximately 2 nm in the range of deposition temperature. The capacitors (Pt/BNO/AAAP) with BNO films grown at 100 °C show a dielectric constant of 24 and dissipation factor of 8% at 100 kHz, a leakage current density of about 8 × 10^{-6}A/cm^2 at an applied voltage of 1.0V. The optical transmittances of the BNO/AAAP exhibited above 80% at wavelength of 550nm at all of deposition temperature. The mechanical stability of the BNO/AAA as well as AAA electrode with the PES substrates through the bending was ensured for flexible electronic device applications. The transparent BNO capacitors grown on AAAP are powerful candidate for integration with the transparent solar cells.

Key Words : Dielectric, BNO, Capacitor, Flexible electronic device

1. Introduction

In the future, solar cells for energy production will be adopted at a transparent window, and if that is realized, solar cell modules should be prepared transparently. In addition, electric power produced by a solar cell needs to be stored by the transparent capacitors. In order to integrate the system, both solar cell and the capacitors were fabricated in transparent electronic devices. Especially, if the transparent capacitors are entrained in the flexible electronic devices, polymer substrates are indispensably needed and a low temperature process below 200 °C should be adopted for both the electrode and the dielectric materials. Transparent solar cells and transparent capacitors with a flexible characteristic will be integrated in the future.

2. Experiment

In this study, in order to ensure the flexibility of the transparent capacitors, transparent capacitors were demonstrated using the BNO dielectric films grown on AAA bottom electrodes instead of Ni/Al/PES by an NCD technique. The structural, electrical, and optical properties of BNO films were investigated for the films grown on AAAP below 200 °C.

3. Results and Discussion

Figures 1(a) and 1(b) show XRD patterns and variations in rms (root mean square) roughness, respectively, of the BNO films grown on AAAP at various temperatures.

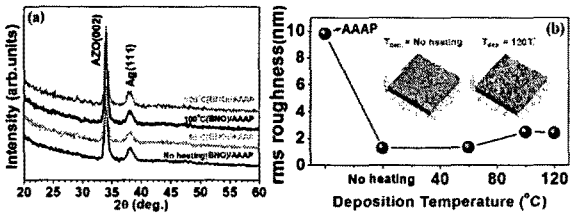

Figure 1. (a) XRD patterns and (b) an rms roughness of BNO films grown at various temperatures on AAAP. The inset in (b) shows AFM three dimensional images of the BNO films grown without substrate heating and at 120 °C.

4. Conclusions

The BNO thin films were grown on AAAP transparent electrodes at a low temperature by the NCD technique. The transparent BNO capacitors grown on AAAP are powerful candidate for integration with the transparent solar cells.

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