Nanocomposites and nanomaterials

Influence of bottom electrode structure on $Na_{0.5}Bi_{0.5}TiO_3$ films phase composition

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The work is devoted to techniques of obtaining of $Na_{0.5}Bi_{0.5}TiO_3$ (NBT) thin films by the ex-situ method with RF magnetron sputtering applied.

Heterostructure Pt/Ti/SiO_2/Si is formed on a flat polished plate of a crystalline silicon Si(100) substrate and is used as a bottom electrode for NBT thin films. Anti-diffusion SiO_2 layer is obtained by thermal oxidation of the substrate at T=700ºC during 8 hours in air. Then layers of Ti and Pt are deposited by magnetron sputtering in Ar atmosphere (P=15mTorr). Obtained heterostructure is exposed to thermal treatment at T=700ºC during 1 hour. NBT film is deposited by the RF magnetron sputtering (13.56MHz) on the ionically cleaned and heated to 200ºC heterostructure in Ar/O_2 mixture (1:2) atmosphere (chamber pressure 10 mTorr). The NBT ceramics obtained by traditional technique is used as the target. After deposition the films are annealed at T=600-750ºC in air. The film and target structures are controlled by XRD. Our investigations show that the Pt surface becomes not uniform after annealing. During annealing the Ti layer interpenetrates the Pt layer that leads to local exfoliation and, consequently, to a disruption of the phase composition of the NBT films. Our investigations show that it is preferable to use TiO_2 dioxide as the adhesion layer instead of active titanium layer in the bottom electrode structure. The TiO_2 layer is obtained by RF magnetron sputtering of Ti target in Ar/O_2 mixture (1:1) atmosphere (pressure 40 mTorr) on SiO_2/Si substrate heated to 300ºC. The Pt layer is homogenous and stable during annealing at T=700ºC when the thickness of the TiO_2 layer in the Pt/TiO_2/SiO_2/Si heterostructure is in range 20-100 nm. NBT films are single-phase structure and XRD patterns show presence of Pt(111) and NBT peaks[1]. Influence of deposition parameters and annealing temperature on the films structure is discussed.

1. *Daryapurkar A., Kolte J., Gopolan P.* Influence of oxygen gas pressure on phase, microstructure and electrical properties of sodium bismuth titanate thin films grown using pulsed laser deposition // Thin Solid Films. -2015.**-579,**-P. 44-49.