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INFLUENCE OF THE SOLVENTS ON THE MICROESTRUCTURE AND DIELECTRIC PROPERTIES OF Ba0.5Sr0.5TiO3 THIN FILMS PREPARED BY DIOL BASED SOL-GEL PROCESS

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Recently BaxSr1-xTiO3 (BST) has been considered an interesting ferroelectric material due to it's high dielectric constant, low dielectric loss, low leakage current density and composition dependent Curie temperature. These properties allow practical applications like in dynamic random access memories (DRAM), uncooled infrared detectors and gas detection devices. BST thin films have been prepared by different methods. Among these sol-gel processing offers advantages in terms of low-temperature preparation, compositional homogeneity, large substrate area deposition and cost effectiveness. However final properties of BST films are highly dependent on the precursors used and their stabilization.

In this study the structure and dielectric properties of $Ba_{0.5}Sr_{0.5}TiO_3$ thin films prepared by a diol based sol-gel method are investigated, as a function of the solvent. Two different solvents are employed, ethylene glycol and 1,2propanodiol, and their effect on microstructure development and dielectric properties is analised and discussed.

Films were prepared by spin coating and were annealed for 1h from 600ºC to 800ºC. Chemical structure of precursor sols was studied by IR and Raman spectroscopy. Phase formation process was analysed by DTA and XRD techniques. Film thickness and morphology were studied by Scanning Electron Microscopy (SEM) and Atomic Force Microscopy (AFM). Dielectric permittivity, loss factor and capacitance versus electric field were measured, at different frequencies between 100Hz and 1MHz at room temperature.

It is observed that films prepared with ethylene glycol show higher values of the dielectric permittivity and lower values of losses, when compared with films prepared with 1,2propanodiol. Dielectric permittivitty is 459 and 302 at 1KHz for films prepared with ethylene glycol and 1,2propanodiol, respectively, and annealed at 800ºC. Microstructure analyses reveal smaller grain size, more homogeneous and denser microstructure for films prepared with ethylene glycol. The microstructure difference can be related to the relative high boiling point and latent heat of vaporization of ethylene glycol compared to 1,2 propanodiol. This significantly reduces the tendency for film cracking, which severely degrades electrical properties