HIGH FREQUENCY CHARACTERIZATION AND NONLINEAR ANALYSIS OF BST THICK FILMS PRODUCED BY ELECTROPHORECTIC DEPOSITION

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Key Words: Electrophorectic Deposition, Barium Strontium Titanate, Thick films, RF characterization, nonlinear analysis.

Electrophoretic Deposition (EPD) is one of the most versatile process to fabricate electroceramic films for electronic devices. It has been a challenge to use low cost and sustainable processes that allows radio frequency (RF) electronic devices to integrate tunable room temperature films with classic electronic circuits. To respond to these needs, Barium Strontium Titanate (BST) films are proposed as the answer to adaptative RF microstrip based devices such as filters and antennas. Commercial BST thick films have been used as tunable capacitors to produce the best RF devices in terms of metrics, such as tunability.

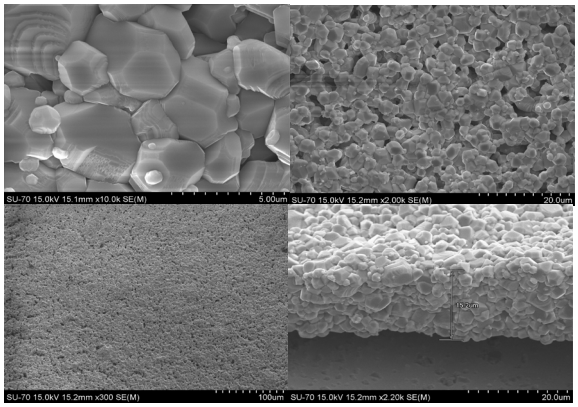

Fig.1: SEM micrographs of $Ba_{0.7}Sr_{0.3}TiO_3$ films sintered at 1350°C/h

However, commercial devices have not been explored to its maximum capabilities. For thick films of BST deposited by EPD using a probe station for RF characterization, the s-parameters are measured and a model for these films is extracted. A deep pursuit on producing a ceramic film is an essential task to establish how the fabrication conditions such as grain sizes, sintering temperature, and electrodes thickness, may play their role in the tunability, nonlinearity and memory effects in RF.

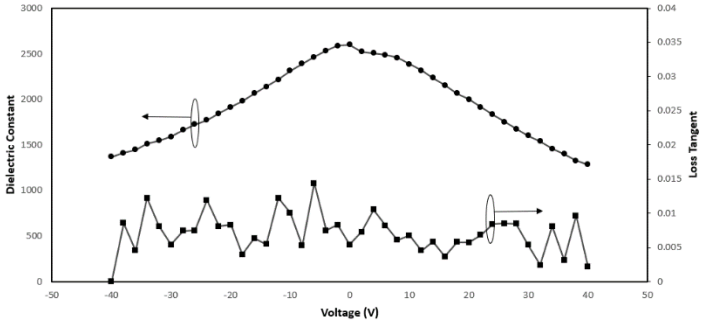

Fig.2: Relative permittivity and loss tangent as a function of bias voltage of BST films deposited from acetone with iodine-based suspensions.

Homogeneous and dense microstructure, Fig.1, $Ba_{0.7}Sr_{0.3}TiO_3$ thick films deposited from acetone with iodine-based suspensions in Pt foil exhibit very good dielectric properties, Fig.2.
During EPD cycles performance there is no visible degradation on the deposition in the first 2 hours. After that the suspension loses stability, possibly suffering from aging due to lixiviation of BST powders.

The results presented in Fig. 2 indicates a tunability up to 50% at 1KHz with quite low loss tangent. Due to this fact, these BST films are of most interest to be studied not only because of the electrical properties, but also the due to the phase transition at room temperature related to the ratios of Barium and Strontium. It is a new challenging issue to understand how the ferroelectric and paraelectric phases will impact in the nonlinear characteristics of the presented films at RF.