Accepted Manuscript

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PII: S0925-8388(17)32504-5

DOI: 10.1016/j.jallcom.2017.07.139

Reference: JALCOM 42555

To appear in: *Journal of Alloys and Compounds*

Received Date: 22 May 2017

Revised Date: 11 July 2017

Accepted Date: 12 July 2017

Please cite this article as: H. Dong, J. Jian, H. Li, D. Jin, J. Chen, J. Cheng, Improved dielectric tunability of PZT/BST multilayer thin films on Ti substrates, *Journal of Alloys and Compounds* (2017), doi: 10.1016/j.jallcom.2017.07.139.

Improved dielectric tunability of PZT/BST multilayer thin films on Ti substrates

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Abstract:

$PbZr_{0.2}Ti_{0.8}O_3/Ba_{0.6}Sr_{0.4}TiO_3$ (PZT/BST) multilayer thin films on $LaNiO_3$ buffered Ti substrates were fabricated by sol-gel method. Results show that there are tetragonal PZT phase and cubic BST phase in the phase structure of PZT/BST films. These films with small grain size also exhibit enhanced dielectric temperature stability and reduced leakage current density. Dielectric anomaly is found for such PZT/BST multilayers: the maximum of dielectric constant and tunability respectively reaches 501 and 41.1% (400 kV/cm) when the thickness content of BST films is 50%. The corresponding temperature coefficient of permittivity (TCP) is only 2.7×10^{-4} /^{o}C. Furthermore, dielectric constant and tunability of such PZT/BST thin films are calculated by phenomenological theory. The experimental data of dielectric constant and tunability are both in between the calculated results of without and complete electrostatic coupling, indicating that dielectric anomaly is caused by electrostatic coupling and part coupling takes place in the fabricated films.

Key words: thin films; sol-gel processes; dielectric response; phenomenological theory