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Tunable dielectric properties of Barium Magnesium Niobate (BMN) doped Barium Strontium Titanate (BST) thin films by magnetron sputtering FIKADU ALEMA, AARON REINHOLZ, KONSTANTIN POKHODNYA, Center for Nanoscale Science and Engineering, North Dakota State University — We report on the tunable dielectric properties of Mg and Nb co-doped $Ba_{0.45}Sr_{0.55}TiO_3$ (BST) thin film prepared by the magnetron sputtering using BST target (pure and doped with $BaMg_{0.33}Nb_{0.67}O_3$ (BMN)) on $Pt/TiO_2/SiO_2/Al_2O_3$ 4" wafers at 700 °C under oxygen atmosphere. The electrical measurements are conducted on 2432 metal-ferroelectric-metal capacitors using Pt as the top and bottom electrode. The crystalline structure, microstructure, and surface morphology of the films are analyzed and correlated to the films dielectric properties. The BMN doped and undoped BST films have shown tunabilities of 48% and 52%; and leakage current densities of 2.2x10^{-6} A/cm^2 and 3.7x10^{-5} A/cm^2, respectively at 0.5 MV/cm bias field. The results indicate that the BMN doped film exhibits a lower leakage current with no significant decrease in tunability. Due to similar electronegativity and ionic radii, it was suggested that both Mg^{2+} (accepter-type) and Nb^{5+} (donor-type) dopants substitutTi^{4+} ion in BST. The improvement in the film dielectric losses and leakage current with insignificant loss of tunability is attributed to the adversary effects of Mg^{2+} and Nb^{5+} in BST.

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