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Combinatorial studies in $Ba_{0.45}Sr_{0.55}TiO_3$ thin films for microwave components by radio frequency magnetron sputtering FIKADU ALEMA, AARON REINHOLZ, KONSTANTIN POKHODNYA, Center for Nanoscale Science and Engineering, North Dakota State University, Fargo 58102ND — The optimization of dielectric properties of ferroelectric thin films for microwave applications can be limited due to the time and resources consumption of the corresponding device fabrication and testing for each doping level. We report the use of a combinatorial technique to achieve the optimal doping level of $Ba_{0.45}Sr_{0.55}TiO_3$ (BST) thin film with three dopants, Mg, Nb and lanthanide (Ln) metal. The process uses two R.F. magnetron sputtering BST sources doped with few at. % of Mg^{II}/Nb^{V} in charge compensating concentration and Ln^{IV}, respectively. The guns were shifted and tilted each by 30° in opposite directions to realize the dopants gradient across a static wafer. The film is reactively co-sputtered on the static 4" platinized Al_2O_3 wafer. The film crystallinity and phase purity were analyzed and correlated to its dielectric properties measured on 2432 MIM capacitors that are of lithographically fabricated using Pt top electrode. After electrical testing, the wafer was diced into 22 16x16 mm^2 samples, and the elemental analysis of each piece was performed. The correlation between the composition and dielectric properties was established and the optimal dopant concentrations for obtaining maximum tunability of 75% and minimum loss of 0.02 were determined.

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