Exploring Next Generation High Temperature Ferroelectrics: $35Bi(Mg_{1/2}Ti_{1/2})O_3$-$65PbTiO_3$ Thin Films

C. S. Morandi[1*], S. Trolier-McKinstry[1], K.R. Udayakumar[2], S. Bhaskar[2], and J. Rodriguez[2]
[1]Department of Materials Science and Engineering, The Pennsylvania State University
Old Main, University Park, PA, 16802
[2]Texas Instruments Incorporated
12500 TI Boulevard, Dallas, TX, 75243
*Carl Morandi: csm204@psu.edu

The processing-microstructure-property relationships of $PbTiO_3$ seeded $35Bi(Mg_{1/2}Ti_{1/2})O_3$-$65PbTiO_3$ (35BMT-65PT) thin films were investigated as a function of film thickness and deposition pressure. The BMT-PT thin films from 85 to 810 nm in thickness were prepared by pulsed laser deposition from targets rich in Bi and Pb. The thin films demonstrate remanant polarizations ($\frac{\Delta P}{2}$) up to 32 $\mu C/cm^2$ based on positive up negative down (PUND) measurements. The relative permittivity (ε_r) vs temperature (T) demonstrate a maximum at ≈430 ˚C at 1 MHz and Loss tangents ($\tan(\delta)$) are ≤5%, ≤3% and ≤15% at 1 MHz at 25 ˚C, 300 ˚C and 575 ˚C, respectively, for an 85nm film. The T_{max} of the thin films was determined to be independent of film thickness. The 35BMT-65PT ε_r is 960 ± 30 after adjusting for a capacitor in series. The remanent polarization stays large until at least 200 ˚C regardless of film thicknesses studied in this work. Charge injection from one electrode occurs at high fields under some growth conditions. Processing parameters that minimize the role of charge injection will be discussed.