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Abstract:

The cubic pyrochlore $Bi_{1.5}MgNb_{1.5}O_7$ (BMN) thin films were deposited on Pt coated sapphire substrates by rf magnetron sputtering using different pressures. The effects of sputtering pressure on phase structure and dielectric properties of BMN thin films were investigated. The X-ray diffraction results revealed that all the BMN thin films deposited at different sputtering pressures showed a pure cubic pyrochlore phase, but the films sputtered at low pressure have a better crystalline than that sputtered at high pressure. The BMN thin films sputtered at 1 Pa exhibited good crystalline with a strong (222) preferred orientation and excellent dielectric properties, which have a dielectric constant of 80, dielectric loss of ~0.007, and dielectric tunability of ~38% at bias field of 1.25 MV/cm. The dielectric constant and tunability of BMN thin films were both decreased with increasing sputtering pressure. However, the dielectric loss showed a slightly change with the sputtering pressure. Furthermore, the leakage current density of BMN thin films increased with increasing sputtering pressure, which is suggested to be related with the increasing grain size and surface roughness of thin films sputtered at high pressure.

Keywords: Cubic pyrochlore films; $Bi_{1.5}MgNb_{1.5}O_7$ thin films; Tunability; Sputtering pressure; Low loss tangent