Textured (1-x)$Pb(Mg_{1/3}Nb_{2/3})TiO_3$-$xPbTiO_3$ (PMN-PT) Ceramics and Their Electrical Properties

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Lead based ferroelectrics, especially $Pb(Zr_{1-x}Ti_x)O_3$ (PZT) and (1-x)$Pb(Mg_{1/3}Nb_{2/3})TiO_3$-$xPbTiO_3$ (PMN-PT) have been dominant materials in various electronic device applications owing to their large piezoelectric response (200–500 pC/N for ceramics, 1500–2500 pC/N for single crystals). PMN-PT single crystals are grown by the Bridgman and solid state crystal growth techniques (SSCG). Both techniques that are mentioned have high costs and yield single crystals with compositional gradients. Therefore, studies in recent years have focused on obtaining textured polycrystalline ceramics with a high degree of grain orientation, exhibiting single crystal like properties in preferred directions. In this study, textured 0.675$Pb(Mg_{1/3}Nb_{2/3})O_3$-0.325$PbTiO_3$ ceramics were produced by templated grain growth method (TGG) using plate like $BaTiO_3$ (BT) seed materials. PMN-PT matrix powders were calcined at 700ºC-850°C for 2 h in covered alümina crucibles. After calcination, 1 wt. % excess PbO was added to the powders to enable the grain growth in the TGG process. The texture fraction as a result of different sintering time and temperature was determined with Lotgering method. The electrical properties of textured and random ceramics were evaluated by means of polarization and strain vs. electric field measurements.

Keywords: Piezoelectric Ceramics, Textured Ceramics, Lead-based, PMN-PT