Visualization of Dielectric Constant-electric Field-temperature Phase Maps for Imprinted Relaxor Ferroelectric Thin Films

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The dielectric phase transition behavior of imprinted lead magnesium niobate–lead titanate relaxor ferroelectric thin films was mapped as a function of temperature and dc bias. To compensate for the presence of internal fields, an external electric bias was applied while measuring dielectric responses. The constructed three-dimensional dielectric maps provide insight into the dielectric behaviors of relaxor ferroelectric films as well as the temperature stability of the imprint. The transition temperature and diffuseness of the dielectric response correlate with crystallographic disorder resulting from strain and defects in the films grown on strontium titanate and silicon substrates; the latter was shown to induce a greater degree of disorder in the film as well as a dielectric response lower in magnitude and more diffuse in nature over the same temperature region. Strong and stable imprint was exhibited in both films and can be utilized to enhance the operational stability of piezoelectric devices through domain self-poling.