$LiNbO_3$-based feroelectric heterostructures thin films.

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The increasing demand for fast, reliable and high-density information storage and processing is responsible for the renewed interest in ferroelectric thin films. In this context, $LiNbO_3$-based ferroelectric heterostructures have been the subject of intensive research due to their potential implementation in high-frequency modulators and other surface acoustic wave devices.
In an attempt to both develop novel integrated electro-optical systems and offer new functionality for future $LiNbO_3$-based devices, the layer-by-layer growth of $LiNbO_3$ (LN) thin films onto In_2O_3:Sn (ITO)-coated <111>-Si substrates has been investigated by r.f. sputtering. Morphological, compositional and ferroelectric characterizations have all demonstrated the effectiveness of the ITO buffer-template associated to a two-stage deposition process of the ferroelectric layer in elaborating reliable LN/ITO/Si composite structures. Homogeneous, dense and crystalline stacked layers could be obtained, that exhibit a preferential c-orientation. Piezoresponse imaging and hysteresis loop establishment have confirmed the polar activity of such as-deposited materials, with remanent polarization and coercitive field of about 18 $\mu C.cm^{-2}$ and 100 $kV.cm^{-1}$, respectively. Multi-layer procedures, up to 4 successive deposits, can subsequently improve the structural and macroscopic ferroelectric properties of such as-grown composite structures. The enhancement of polarization, as high as 40 in 4-stacked layers, is attributed to c-oriented seed-layer-induced crystallization (self-polarization) and interfacial (migratory) polarization.
The present study will give some key information on the complexity of the crystallization process and the structure-property relationships involved.