Processing and characterization of ferroelectric thin films obtained by pulsed laser deposition

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Ferroelectric thin films with compositions $Pb_{0.67}La_{0.22}(Zr_{0.2}Ti_{0.8})O_3$ (PLZT) and $Pb_{0.988}(Zr_{0.52}Ti_{0.48})_{0.976}Nb_{0.024}O_3$ (PZTN) have been processed by radiofrequency assisted-pulsed laser deposition. The first set of films have relaxor properties and the second are classical ferroelectrics. Film growth was carried out over a wide range of processing parameters and the best conditions of deposition have been selected. The obtained films are polycrystalline, with perovskite structure and almost random orientation. The surface morphology has been investigated by atomic force microscopy. The ferroelectric properties have been obtained by hysteresis loop measurements. From measurements of the dielectric properties as a function of the frequency of driving signal, the amplitude and the rate of change of the bias field, the following characteristics have been found: i) a linear decrease of the capacitance with the frequency logarithm which was attributed to the interaction of pinning centers with moving domain walls; ii) a strong nonlinear decreasing of the capacitance with the increasing of the bias field amplitude, almost without hysteresis for PLZT films; iii) a hysteresis-like dependence, for PZTN films, with maxima corresponding to polarization switching; the separation between these maxima decreases with the decreasing of the rate of change of the bias field. This has been attributed to the accumulation of mobile charged defects (oxygen vacancies) near electrodes which facilitates the nucleation of domains and polarization switching.