APPLICATION OF THE X-RAY COMBINED ANALYSIS TO THE STUDY OF LEAD TITANATE BASED FERROELECTRIC THIN FILMS

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Lead titanate based ferroelectric thin films are well known for their excellent properties that make them good candidates for several applications in microelectromechanical systems, dynamic and ferroelectric random access memories (DRAM and FeRAM) and also in high frequency components. In order to obtain a complete characterisation of the structural parameters, texture and stress state of these films, a recently developed combined analysis of the X-ray diffraction data is carried out. The advantages of this approach reside in the fact that we obtain simultaneously quantitative and more reliable information of the microstructural parameters of the films, as a cyclic Rietveld, quantitative texture analysis and stress analysis is performed. The method avoids artefacts like bias coming from refining independently one or some given parameters (i.e. unit-cell) when these are intrinsically correlated to others (i.e. residual stresses), since the refinement converges to the best solution of the whole ensemble of parameters of importance. Results obtained for the ferroelectric films are analysed and compared to others obtained with more conventional techniques.

The study of a series of films with the same composition deposited on different platinised substrates will shed light onto the influence of the stress developed during the processing on the microstructure of the resulting film. The small structural differences introduced by the different amount of Ca doping of the $PbTiO_3$, which are usually difficult to detect with high accuracy in thin films, will also be analysed with this method.