TAILORING OF THE ELASTIC PROPERTIES BY TEXTURE CONTROL IN FERROELECTRIC THIN FILMS FOR MEMS

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The use of piezoelectric thin films in advanced devices such as microelectromechanical systems (MEMS), not only rests on the excellent piezoelectric coefficients, as the ones achieved in some ferroelectric lead titanate derived compositions, but also on their mechanical behaviour. Due to the anisotropy of the elastic properties of single crystals, the values obtained in polycrystalline thin films strongly depend on the crystallographic orientation or texture of the individual crystals. This makes the study of the correlation between texture and elastic properties of high interest for the processing of advanced piezoelectric thin films with tailored properties, regardless of which, not much work related has been reported up to now.

In this communication we present the analysis of the variations observed in the elastic tensor of a series of modified lead titanate thin films with different orientations. The different textures were induced either by deposition on modified substrates or by changes of the annealing route. Orientation distribution functions (ODF) for all films were obtained by an advanced texture quantitative analysis of x-ray diffraction data of several pole figures. From the ODF, we are able to calculate the macroscopic elastic properties by the geometrical mean procedure of the single-crystal properties. The results show, among other things, that the inducement of a texture component along the <111> direction increases the stiffness of the films (which stiffness, I mean which direction ?). This is a promising result in the tailoring of the mechanical properties of these piezoelectric thin films for applications.