

# Polarisation Readout and Determination of Landau Parameters of VDF-TrFE Thin Films from Dielectric Nonlinearities

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*VDF-TrFE copolymer thin films of different molar compositions have been studied with regard to their application in (all-organic) FeRAMs. Thin films were prepared by spin coating on a metallized glass substrate. Dielectric nonlinearities of poled and unpoled samples were measured and associated with application-relevant properties, namely switching, readout procedure, and temperature dependence. It has been shown that polarisation of films with high fraction of VDF does not change significantly up to 80°C. Furthermore, a non-destructive method for polarisation readout has been demonstrated. The practical considerations and experimental results are discussed on the base of the Landau theory.*

**Keywords** VDF-TrFE copolymer; dielectric nonlinearity; thin films

## Introduction

P(VDF-TrFE) films offer great potential for sensor and memory applications. They have notable ferro-, pyro- and piezoelectric properties, they are flexible, transparent and most importantly they can be deposited easily. Decreasing their thickness dramatically helps compensating their main drawback, the comparably high coercive field. Initiated by the fast progress in semiconductor technology and backed by its simplicity and controllability, spin coating has become a popular deposition technique for thin and ultra-thin films. Homogenous films with thicknesses of 100 nm and below can be deposited directly from solution.

Dielectric spectroscopy is a powerful tool to study ferroelectric films [1–4]. Examining the nonlinear parts gives access to several important quantities like polarisation status, temperature-dependent loss of polarisation, and the order of the phase transition [5]. The measurement techniques and results for thicker films ( $>1 \mu\text{m}$ ) have been described in a previous work [4].

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