ANALYSIS OF THE SPATIAL DISTRIBUTION OF POLARIZATION IN PVDF-FOILS FROM THE FREQUENCY SPECTRA OF THE PYROELECTRIC CURRENT

S. Bauer, B. Ploss

Institut für angewandte Physik,
Universität Karlsruhe, Karlsruhe, West Germany

Intensity modulated radiation is absorbed at the surface of the PVDF-foil and generates a temperature wave. Its penetration depth decreases with increasing frequency of modulation. Pyroelectric currents are generated within the penetration depth of the temperature wave and contain, therefore, information on the spatial distribution of the polarization. The modulation frequency is varied over seven orders of magnitude. From the pyroelectric current the polarization distribution is deduced by a method of analysis which has been successfully used for the characterization of imperfections in semiconductors.

INTRODUCTION

A number of methods for analyzing charge and polarization distributions in pyroelectric polymers were developed during the last years. The methods which use propagating pressure pulses or pressure steps give direct images of either the piezoelectric distribution or of its gradient [1]. The methods using heat pulses or heat waves give the Fourier coefficients of the distribution, but the main difficulty is to deduce these Fourier coefficients from the experimental data [2-7]. In the present paper we develop a new deconvolution method. This method is tested experimentally with sandwiched PVDF-foils which are prepared with a priori known polarization distributions.

THEORETICAL BASIS

The sample is regarded as a infinite sheet of thickness d. The temperature increase in the sample after the absorption of an infinitely short heat pulse $q\delta(t)$ (q in J/m^2) and neglecting heat loss from the sample to the

CH2593-2/ 88/ 0000-0028$01.00