Ferroelectrics, 1994, Vol. 156, pp. 345–350
Reprints available directly from the publisher
Photocopying permitted by license only

PROBING OF PYROELECTRIC DISTRIBUTIONS FROM THERMAL WAVE AND THERMAL PULSE MEASUREMENTS

BERND PLOSS
Institut für angewandte Physik der Universität Karlsruhe
Kaiserstraße 12, D-76128 Karlsruhe, Germany

(Received August 9, 1993)

Abstract Recently a method for the evaluation of pyroelectric profiles from thermal wave measurements has been introduced, which is based on the construction of a scanning function from the measured pyroelectric spectra. This procedure is extended for the application to thermal pulse data. Well adapted to the propagation behaviour of thermal waves, the scanning function algorithm avoids problems with oscillations and instabilities and delivers an approximated polarization distribution in a very simple and direct way. An on-line analysis of thermal data is possible, giving access to a thermal recording of dynamic processes. The mathematical procedure and its physical basis are given together with numerical and experimental examples.

INTRODUCTION

The development of methods for a spatial profiling of polarization or charge in dielectric materials is motivated by fundamental interests, as well as by applications of these materials. Various techniques are available for the measurement of charge and polarization profiles, using either the pyroelectric or the piezoelectric effect. The diffusive propagation of heat takes place on a timescale, which makes pyroelectric profiling techniques appropriate for a high resolution profiling of the surface near region of a sample. The lack of evaluation procedures, which are well appropriate and easy to handle, was a handicap of the thermal profiling techniques in the past. In this paper, the scanning function algorithm for the analysis of spectra measured with the laser intensity modulation method (LIMM), which has been introduced recently, is extended to the analysis of thermal pulse measurements.

THERMAL PROBING

The samples investigated by thermal probing techniques are films or disk shaped plates, covered on both surfaces with thin opaque metal electrodes. A thermal excitation is