DESIGN AND PROPERTIES OF A PYROELECTRIC MICROCALORIMETER

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ABSTRACT

A pyroelectric calorimeter consists of a pyroelectric sensor with the sample directly deposited onto one of the electrodes of the sensor. The arrangement is heated by the absorption of intensity modulated radiation at the other electrode of the pyroelectric sensor. In the case of a homogeneously poled pyroelectric sensor, the quotient of the pyroelectric current, gained at modulation frequencies ω below and above $\omega = 2D/d^2$, with D the thermal diffusivity and d the thickness of the pyroelectric sensor material directly yields the quotient of the heat capacity of the pyroelectric material and the sample. Experimental results are shown with a $30\mu m$ thick $LiTaO_3$ crystal, $25\mu m$ and $9\mu m$ thick PVDF films as calorimeter materials and with $25\mu m$ thick Ag-foils and with a $1.25\mu m$ thick Polyglutamate Langmuir-Blodgett film.

1. INTRODUCTION

Pyroelectric materials, especially the pyroelectric polymer PVDF and the copolymers of VDF with TrFE are very interesting for a variety of applications. The most important include piezoelectric and pyroelectric devices as ir-sensors [1], especially hybrid sensor arrays on silicon [2,3] and photothermal applications such as spectroscopy, imaging or the probing of thermal properties [4].

The aim of the present study is a detailed discussion of a pyroelectric microcalorimeter, which allows specific heat measurements of film samples down to the submicron thickness region.

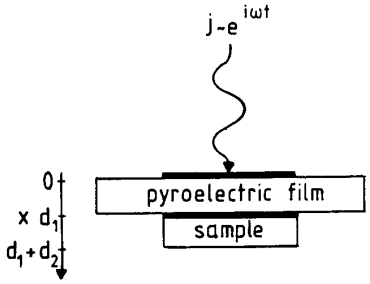

Fig. 1: Schematic view of the experimental arrangement.