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# Heat capacity measurement in solids by means of the photoacoustic technique

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**Abstract.** We report a method for determining the specific heat capacity in solids by means of the photoacoustic (PA) technique in a heat transmission configuration. This method involves a modulation frequency range where the samples are thermally thin and a liquid (i.e., distilled water) as a reference sample. It is free of PA cell parameters and was tested in some metals and semiconductors. The results agree very well with literature reported values for these samples.

## 1. INTRODUCTION

There are several methods for the practical determination of heat capacity per unit volume ($\rho c$). Some of them are discussed in detail in Ref. [1], while in Ref. [2] an excellent overview of the most useful calorimetric and thermal methods is given. In the last years we have witnessed the development of Photoacoustic (PA) methods [3] for measurement of the thermal properties of materials. As to the best of the author's knowledge none of the existing PA methods in a heat transmission configuration allows the direct measurement of the heat capacity per unit volume at room temperature of solids, in this paper we propose a novel variant of the PA technique for this purpose.

## 2. METHOD AND EXPERIMENTAL RESULTS

A light beam is modulated at a variable frequency $f$ and uniformly focused onto a sample after it have passed through a transparent liquid layer used for reference purposes (this reference is held onto the sample's surface by means of a Teflon O-Ring). The sample-reference system closes a 5.5 millimeter diameter opening of a 3 millimeter long cylindrical cell cavity. The modulated beam is absorbed by the sample of thickness $l_s$, and the generated heat propagates into the liquid as well as through the sample towards the PA chamber. The air pressure oscillations, $\delta P$, generated within the PA chamber are sensed by a sensitive condenser microphone connected to the cell's air chamber through a 1mm wide duct located in the cell wall. A lock-in amplifier interfaced with a personal computer is used to measure the microphone response signal.