DEVELOPMENT AND CHARACTERISATION OF OPTICAL SENSORS BASED ON EVANESCENT WAVE AND PHOTOACOUSTIC DETECTION

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Introduction

The photoacoustic (PA) in solids has recently been used to study the optical properties of bulk, surface and subsurface structure. In conventional photoacoustic technique the sample is placed in an enclosed gas-filled cell and illuminated with a modulated light beam. The thermal waves produced by optical absorption generate a pressure variation in the gas, which is then detected by a sensitive microphone or piezoelectric transducer. The greatest potential for photoacoustic lies in the field of solid and absorbing film, because most of these materials are in the form that made them difficult to study by using conventional optical transmission technique. In photoacoustic technique, the microphone detection system is mounted away from the sample thus allows a non-invasive study to be carried out. In this study we have used both microphone and piezoelectric detection systems.

Materials and Methods

The sample was illuminated at one side with a periodically chopped Argon-laser (Omichrome-50m Watt). The photoacoustic signals (amplitude and phase) as a function of the modulation frequency detected by a sensitive microphone and piezoelectric transducer were processed by Lock-in amplifier (SR530-Stanford Research System). The thermal diffusivity measurements were carried out using open photoacoustic cell technique.

Results and Discussion

The experiments were made for pure metals; Au, Ag, Al, Zn, Cu, Sn, polymer (ENR25, ENR50), Semiconductor (Si), gold alloys and superconducting materials. Our results are in good agreement with the value obtained by other method reported by previous researcher.

Conclusions

The method was found to be very sensitive and can be used to any form of the sample materials such as liquid, solid and powder. Our thermal diffusivity values obtained by this method are in good agreement with same data reported in the journal.

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