

Experiments with flowing gases in an open photoacoustic cell[†]

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Abstract. A simple gas-microphone photoacoustic cell is described in which there is no sizable loss of signal on opening the cell to the atmosphere or even under conditions of gas flow. Results obtained under different rates of flow of gases and chopping frequencies are reported. Except for carbon black, the photoacoustic signal is found to be independent of flow-rate for all the solid substances studied.

Keywords. Photoacoustic spectroscopy; open photoacoustic cell; flowing gases.

1. Introduction

The versatility of the photoacoustic (PA) technique for studying several phenomena is by now well-documented (Rosencwaig 1980; Ganguiy and Rao 1981; Tam 1986). When gas-microphones are used as the detector, it is assumed that the cell should be closed as otherwise the flow of heat to the gas phase from the solid following a non-radiative de-excitation will not result in an increase in pressure. Efforts have been made, however, to construct open PA cells so that the ranges of application of the PA effect may be further extended (Dioszeghy *et al* 1985; Kanstad and Nordal 1978). These cells have limited applications. We have exploited the fact that when a PA cell is connected to the atmosphere by a tube, the fraction of transmitted acoustic wave depends on the dimensions of the tube. By a proper choice of the diameter, length and wall thickness of the capillary such that the acoustic impedance of the capillary is increased, a simple PA cell may be constructed in which there is no sizable loss of photoacoustic signal at ordinary chopping frequencies (f), even though the cell is open to the atmosphere, or more interestingly, when a gas is flowing through the cell. In this communication we describe the cell used by us and the results obtained for various solid samples under different gas flow conditions.

2. Experimental

The cell used by us earlier (Somasundaram and Ganguly 1984) has been modified as shown in figure 1. The arms of the glass capillaries could be varied in order to operate at various f . Glass stopcocks at the end of these arms allowed the cell to be

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