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Abstract

This investigation establishes, for the first time, the viability of micro-photoacoustic infrared spectroscopy (microPAS). A cell that allows photoacoustic (PA) infrared spectroscopy measurements on small samples was constructed and tested in this work. The setup allows visualizing the sample and selecting specific measurement positions. It can be used with conventional Fourier-Transform infrared spectrometers and a variety of light sources, including conventional near- and mid-infrared lamps, synchrotron radiation, and laser sources. The cell was successfully used to discriminate between individual polymer beads based on differences between their PA spectra. The demonstrated spatial resolution is better than 100 µm and, in at least one case, as good as 20 µm.

1. Introduction

Photoacoustic (PA) spectroscopy has been used to characterize a wide variety of materials during the last four decades. The technique belongs to the extensive group of photothermal and thermophysical methodologies, interrogating both optical and thermal properties of matter. PA spectroscopy generally enables non-destructive, non-preparative analysis of solids and liquids; this capability may be critically important in situations where sample quantities are limited and/or traditional preparation methods must be avoided. Depth