QEPAS Analyzer for Solids and Liquids

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Short abstract: Quartz-enhanced photoacoustic spectroscopy (QEPAS) employs a quartz tuning fork (QTF) as detector for the photoacoustic signal and enables laser spectroscopic gas sensors with extraordinarily high detection sensitivity [1]. We adapted this powerful technique for the analysis of solid and liquid samples and present potential applications and newest results.

Quartz-Enhanced Photoacoustic Spectroscopy (QEPAS) is a technique in which the soundwave is detected by a quartz tuning fork (QTF). It enables particularly high specificity with respect to the excitation frequency and is well known for an extraordinarily sensitive analysis of gaseous samples. So far, his technique has almost exclusively been used for the investigation of gaseous samples. The most common setup is the so called on-beam configuration. This involves the light passing through the gap between the prongs of the QTF. To amplify the signal, the QTF is often positioned between two identical cylindrical resonance tubes. In the off-beam configuration, the sound pressure wave is detected at a certain distance from the laser beam. The QTF is here typically positioned outside a resonance tube at a narrow opening [1-4].

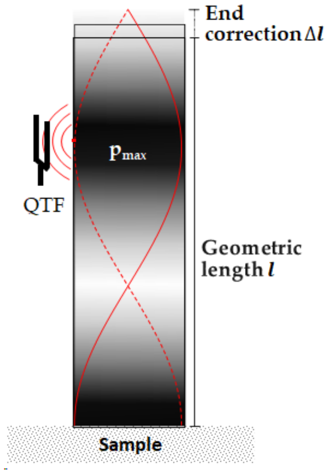

Fig. 1 Sound pressure amplitude in the half-open cell.

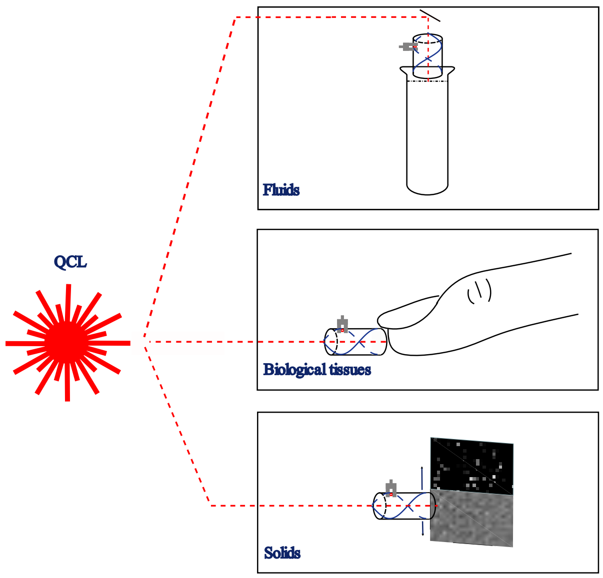

Fig. 2 Potential applications of the QEPAS sensor for solids and liquids.

We have developed a photoacoustic (PA) cell that allows it to apply this powerful technique for the analysis of solid and liquid samples. The cell represents a half-open cylinder that exhibits an acoustical resonance frequency equal to that of the QTF and, therefore, additionally amplifies the PA signal [5-7]. The antinode of the sound pressure of the first longitudinal overtone can be accessed by the sound detector (see Figure 1). We present newest experimental results and potential applications, reaching from medical diagnostics to imaging (see Figure 2).

References

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