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MULTI GAS SENSING BASED ON PHOTOACOUSTIC SPECTROSCOPY BY USING TUNABLE DIODE LASERS

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Gas sensing using resonant photoacoustic spectroscopy has been proved to be a very good technique for low concentration measurements. In this work, we present a gas sensor capable to measure three substances simultaneously that are unwanted hydrogen precursors in fibre optics manufacturing. Water vapour (H_2O), methane (CH_4) and hydrogen chloride (HCl) at wavelength of 1368.6 nm, 1651.0 nm and 1742.4 nm respectively are measured with DFB tunable laser diodes. The coupling of the wavelengths is achieved by using optical fibres terminated with a collimator to launch the light directly into the photoacoustic cell.

The resonant photoacoustic cell is designed to operate on the first longitudinal acoustic mode. The optimisation of the cell constant to achieving the best acoustic signal is obtained by varying the geometric dimensions (radius and length) of the cell. Simulations show that the radius should be as small as possible and that the length should be as long as possible. In addition to those two parameters the resonant frequency and the volume must be reasonable (frequency must be greater than 1 KHz to avoid $1/f$ noise). A critical comparison between the simulations and the real cell will be presented.

First results show that a sensitivity of 0.3 ppm for water vapour, 0.4 ppm for hydrogen chloride and 1 ppm for methane can be obtained for such a cell.