

CAVITY RING-DOWN SPECTROSCOPY

Principles

Cavity ring-down spectroscopy (CRDS) is an optical technique used for measuring very low absorption coefficients usually in gases. By measuring absorption coefficients of a gas at particular wavelengths it is possible to assess the gas concentrations with high precision.

Typically the concentration n in absorbing gases is measured employing the principle shown in Fig. 1. The gas is put inside a cell with length d and the absorption coefficient α is determined by measuring light intensity before and after the cell. Usually due to low resolution light intensity measurements and low absorption there is a limit at which the concentration of the gas can be measured with high precision. The absorption measurement is enhanced by modifying the cell – mirrors with high reflection coefficients are added at both sides of the cell, the light can be trapped causing prolonged interaction of the light with the gas.

In such case the measurable absorption coefficient and thus the concentration limit can be reduced by several orders.

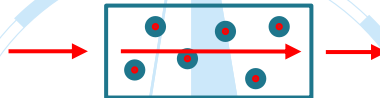


Fig. 1. Gas concentration measurement employing single light transmission through the gas cell

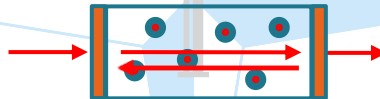


Fig. 2. Gas concentration measurement in cell with mirrors with high reflection coefficients causing multiple beam transmission through the gas cell

In the CRDS measurement a laser pulse is coupled to a cell and the pulse decay time is captured with a reference (empty) cell and cell filled with a particular gas. The pulse decays faster if cell is filled with an absorbing gas.

CRDS system

OPTEK has built and delivered a CRDS system equipped with 266 nm pulsed laser for measurement of acetone concentration. During the development of the device custom optical system and software were created. The tool allows measurement of acetone concentration in real time with 1 ppm resolution.



Fig. 3. The developed CRDS system capable of time resolved measurement of acetone concentration with 1 ppm resolution.

Please contact as at info@optek.lv if you would like to find out more.