IR reflectometric interference gas sensors

Dr. Nicolae Leopold,
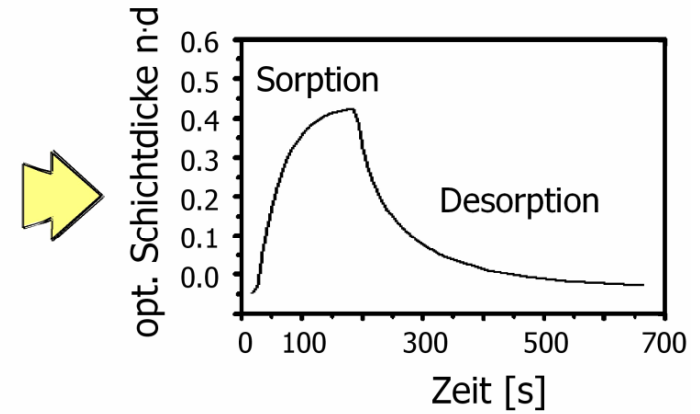Prof. Dr. Bernhard Lendl
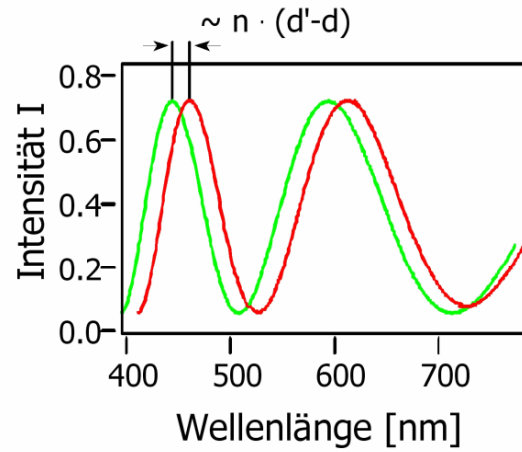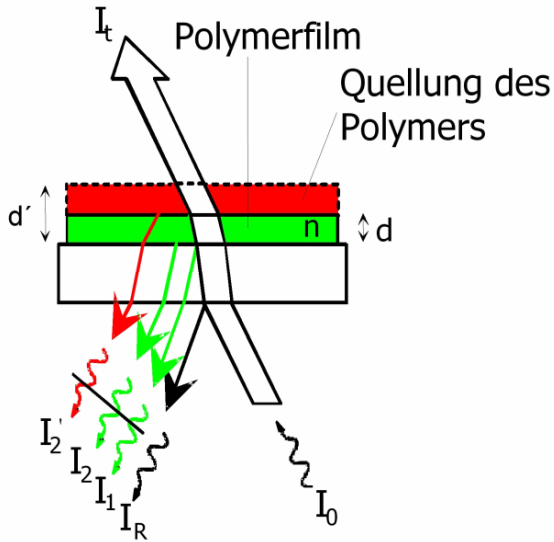
Overview

Reflectometric interference spectroscopy (RIfS) theory, setup and applications
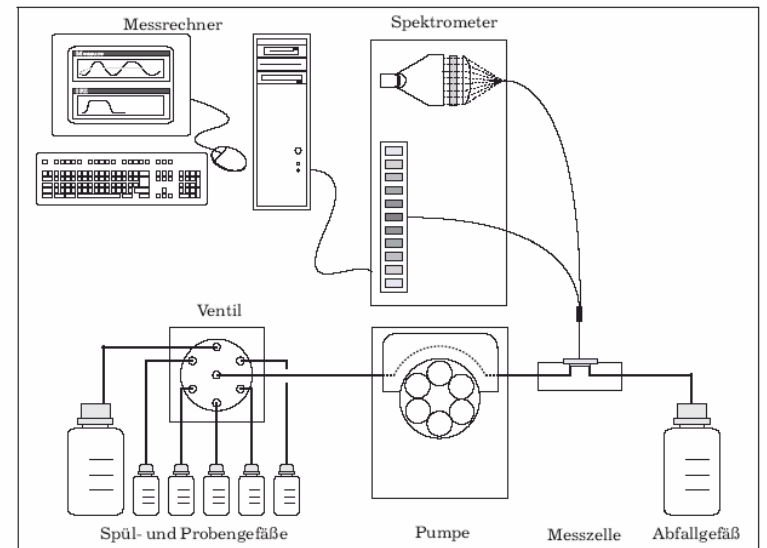
IR-RIfS setup

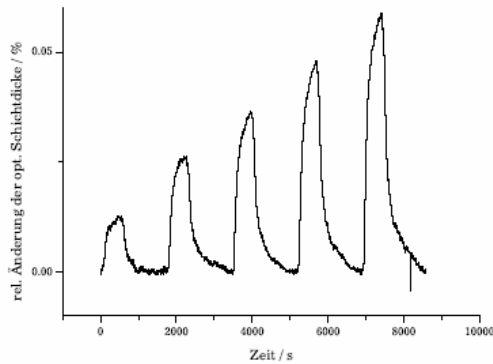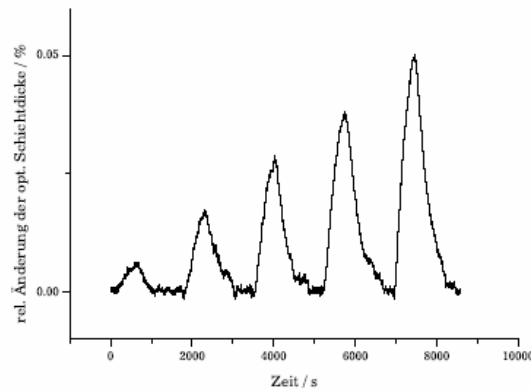Results obtained with the new IR-RIfS setup

RIfS

Applications

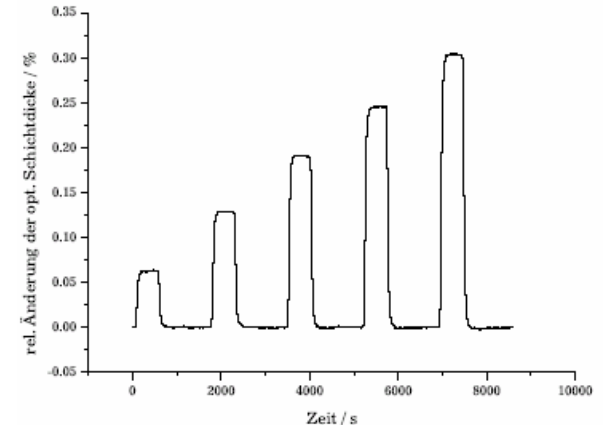- Environment
- Process control
- Bio-applications

RIfS applications

Relative Schichtdickenänderung bei Einwirkung von **Benzol**konzentrationen von 8, 16, 24, 32 und 40 mg/l.
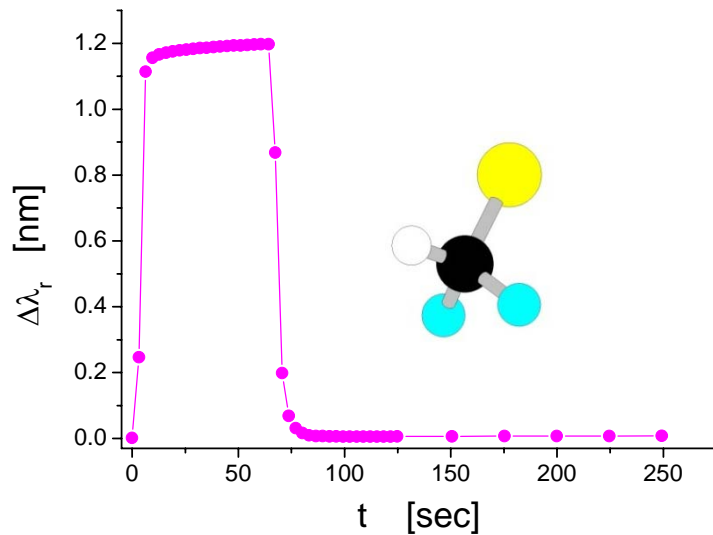
Relative Schichtdickenänderung bei Einwirkung von **1,2-Dichlorbenzol**konzentrationen von 2, 6, 10, 14 und 18 mg/l.
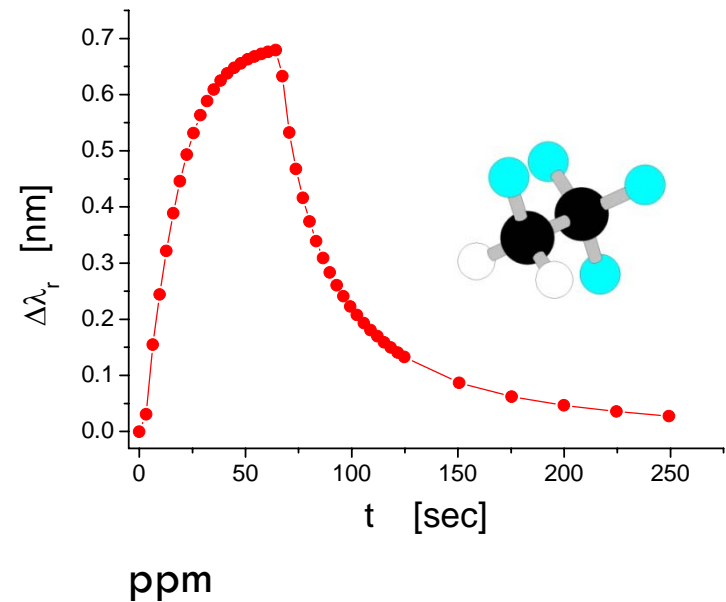
Relative Schichtdickenänderung bei Einwirkung von **Phenol**konzentrationen von 2000, 4000, 6000, 8000 und 10000 mg/l.
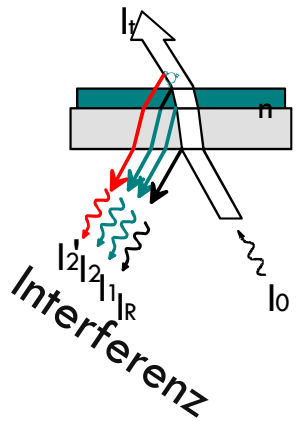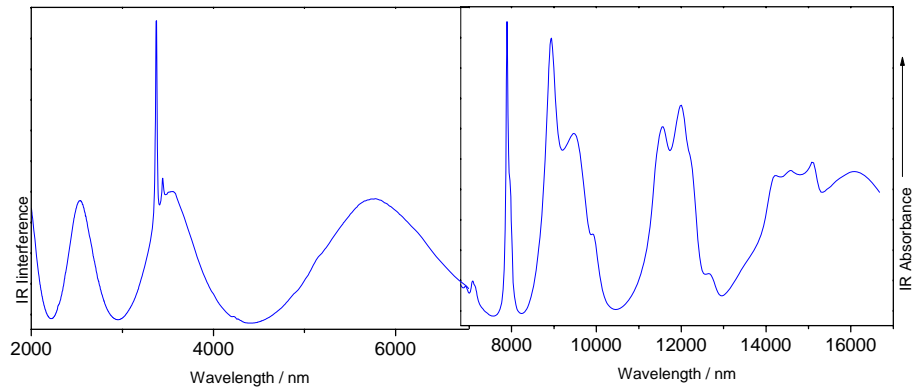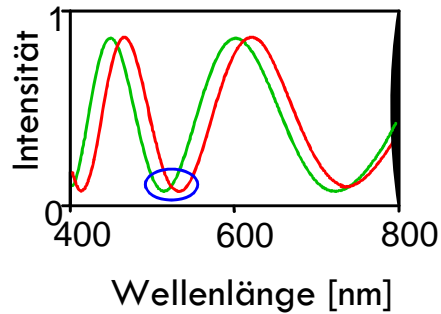
L. Steinle, Diplomarbeit 2005, Universität Tübingen

RIfS gas sensors

Combining RIfS with IR absorption

Si
Si plate
flow out
polymer layer
flow in
KBr window
IR beam
MCT detector
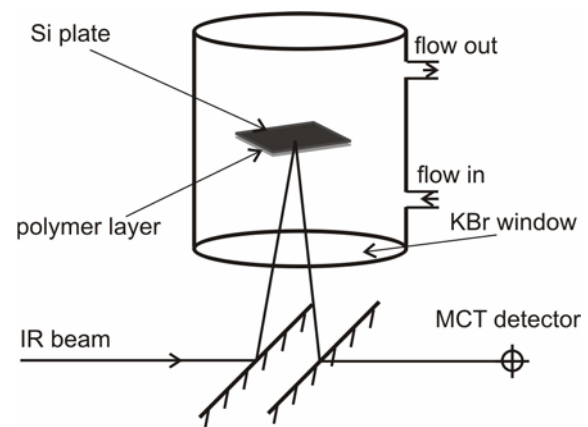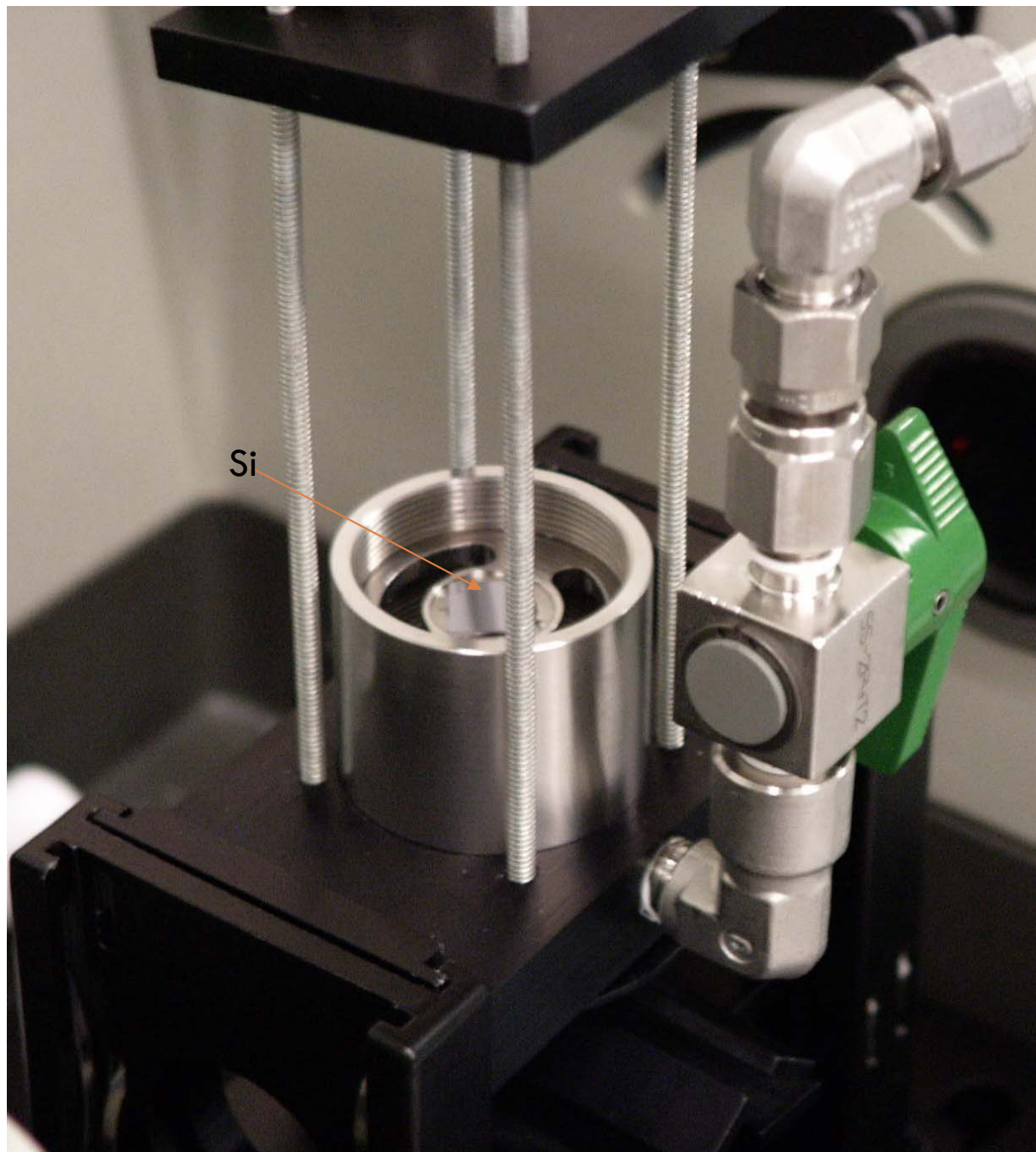
$$\tilde{\nu}_1 = 5072 \, cm^{-1}$$

$$\tilde{\nu}_1' = 5000 \, cm^{-1}$$

$$n \cdot d = \frac{\Delta m \cdot \lambda_1 \cdot \lambda_2}{2 \left(\lambda_1 - \lambda_2 \right)}$$

Δd= 240 nm
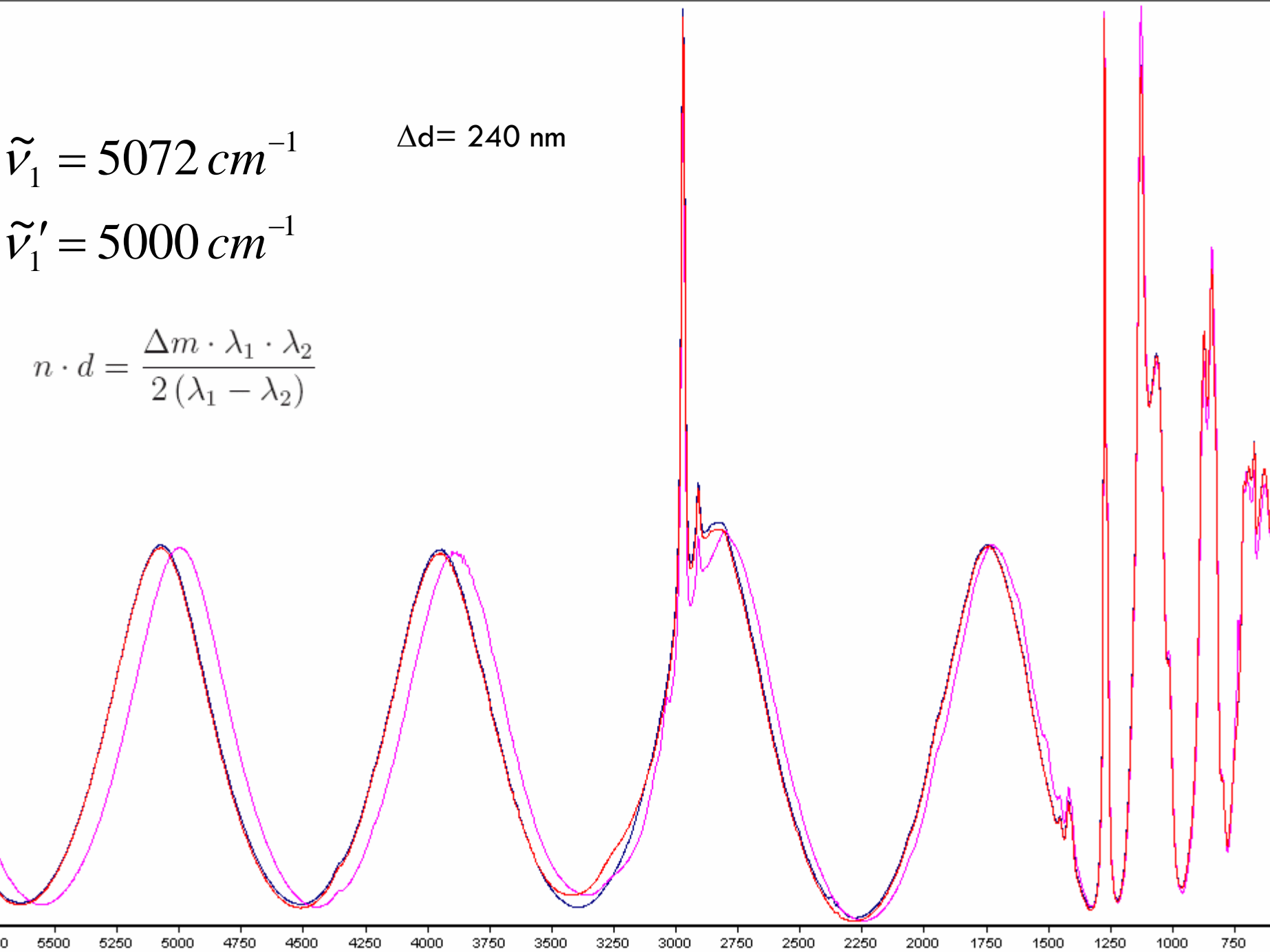
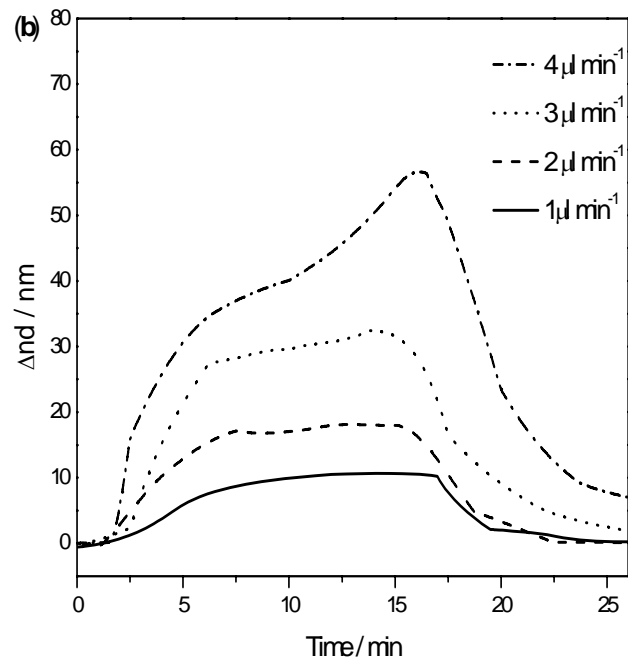# IR-RIfS results

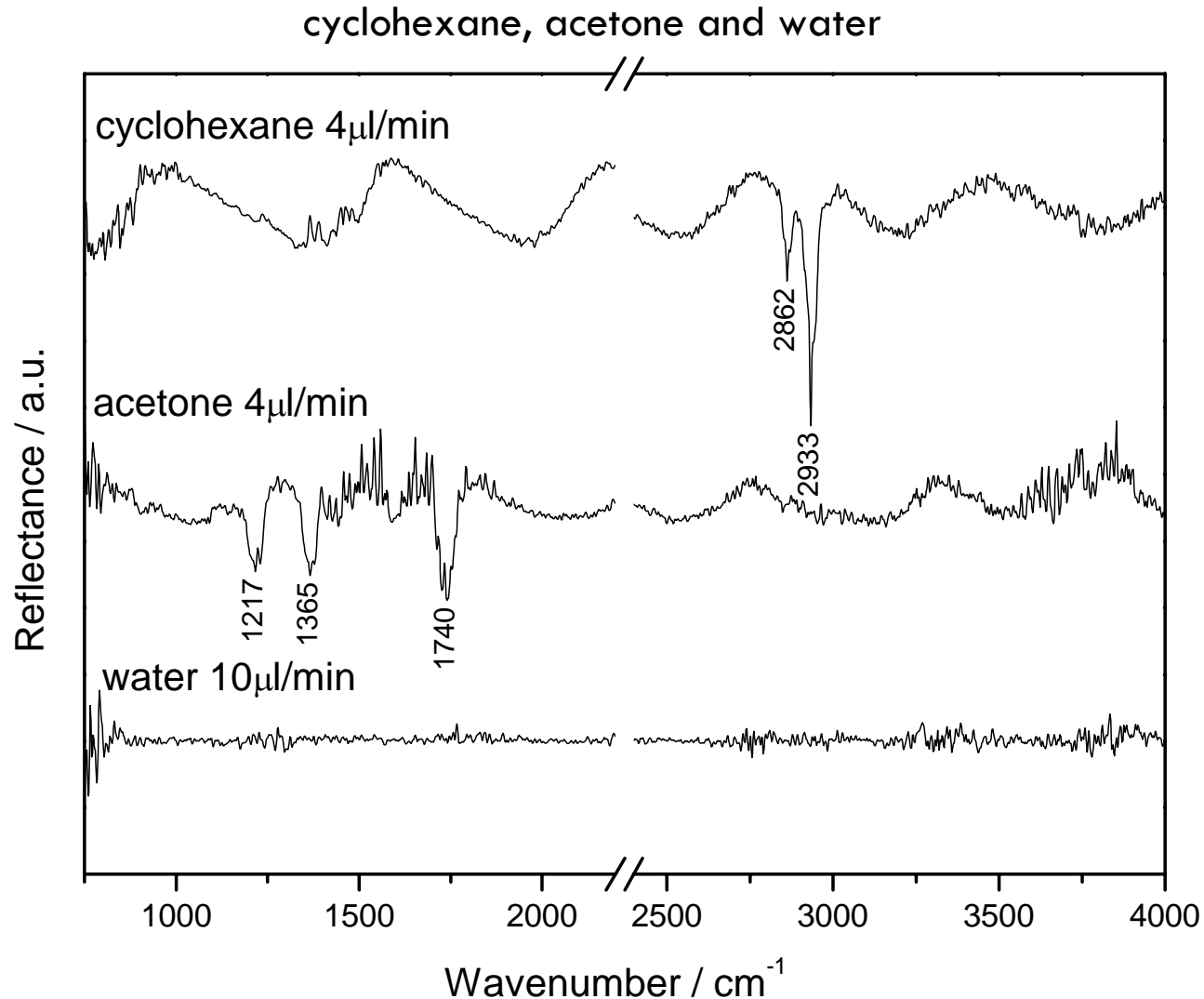108 ppm o-dichlorobenzene
767 ppm m-xylene
3037 ppm toluene

IR-RIfS setup
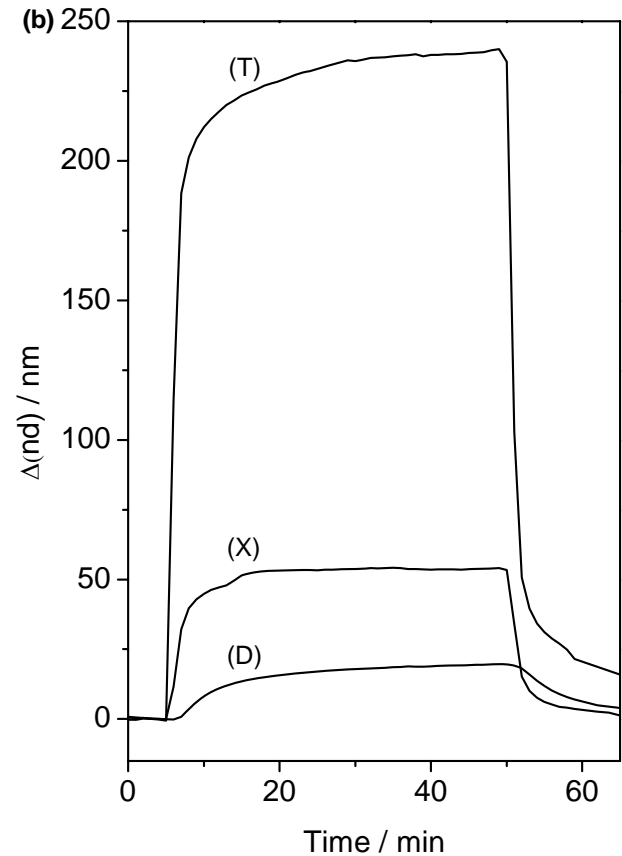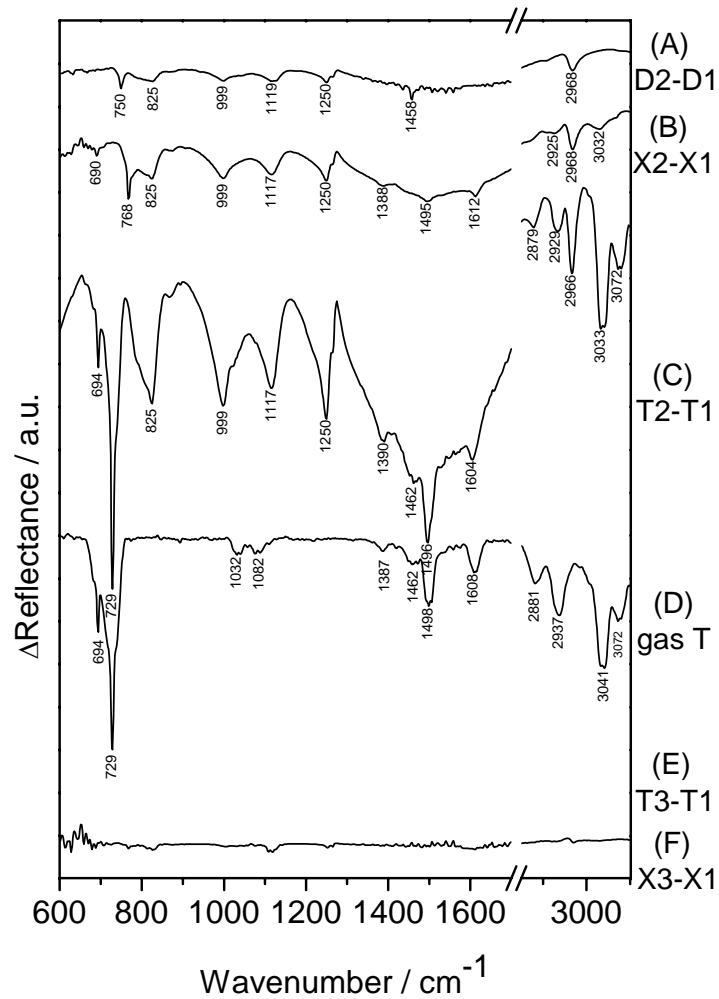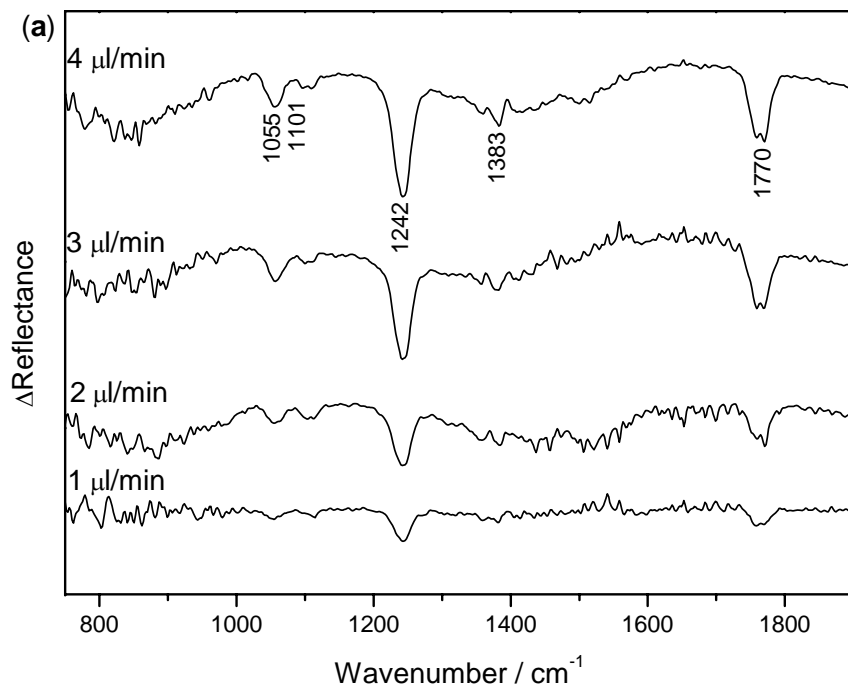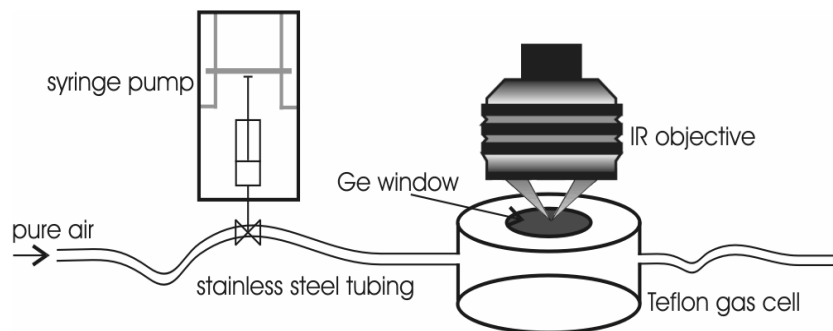
Difference IR reflectance spectra

cyclohexane, acetone and water

Conclusions

- A new gas sensing approach that enables simultaneous recording of IR and RIfS spectra was described.

- Analyte specific information is offered by IR absorptions and partially by the hydrophobe polymer layer, as it responses selective only to non-aqueous analytes.

- Quantitative assessments are obtained from the IR absorptions and the spectral shift of the interference pattern.

RIfS-Bio: time resolved and label free measurements

Qualitative Measurements

→ **binding / no binding**

Quantitative Measurements

concentration

kinetics
association- und dissociation rate constants

thermodynamics
affinity and binding constants

Protein-protein interactions
DNA hybridization