Quantification of Binary Mixtures of the Freones R22 and R134a by Surface Plasmon Resonance

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Introduction
Chlorofluorocarbons cause damage to the ozone layer. The goal of this work was the detection of R22 in the vapour of R134a using Surface Plasmon Resonance.

A single sensor set-up was used for the multi-component analysis. The temporal information of the sensor is evaluated.

A microporous polycarbonate was used as sensitive layer. The thickness of the sensitive layer was varied between 60 and 300 nm.

The sensor response during analyte sorption and desorption was time-resolved evaluated by neural networks. Some hundred binary mixtures of R22 and R134a were measured by SPR.

Analytes
R22 Diffuorochloromethane
R134a 1,1,1,2-Tetrafluoroethane

Sensitive Layer
Poly carbonate Makrolon®
Makrolon M2400, Bayer AG,
Leverkusen, Germany

Microporous polymer: median pore diameter 0.1 nm

Calibration
441 different mixtures as calibration-set
Each mixture was evaluated by 21 neural nets

400 different mixtures as independent test samples
Each mixture was evaluated by 21 neural nets

Results
Relative Error:

<table>
<thead>
<tr>
<th></th>
<th>Median Cross-Validation-Error</th>
<th>Median Test-Data-Error</th>
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<tbody>
<tr>
<td>R22</td>
<td>2.6 %</td>
<td>2.2 %</td>
</tr>
<tr>
<td>R134a</td>
<td>3.6 %</td>
<td>3.0 %</td>
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Summary and Outlook
By the variation of the layer thickness the measurement-time can be reduced to 60 seconds of analyte exposition.

Short measurement times can be realised.

The results show that detection of the two analytes with only one sensor can be realised very good.

The Prediction of 400 independent test mixtures (not used for calibration) was very exact for R22 and R134a.

A high purity of R134a can be guaranteed.

Measurement of other small analytes with the same instrumental set-up is possible.