

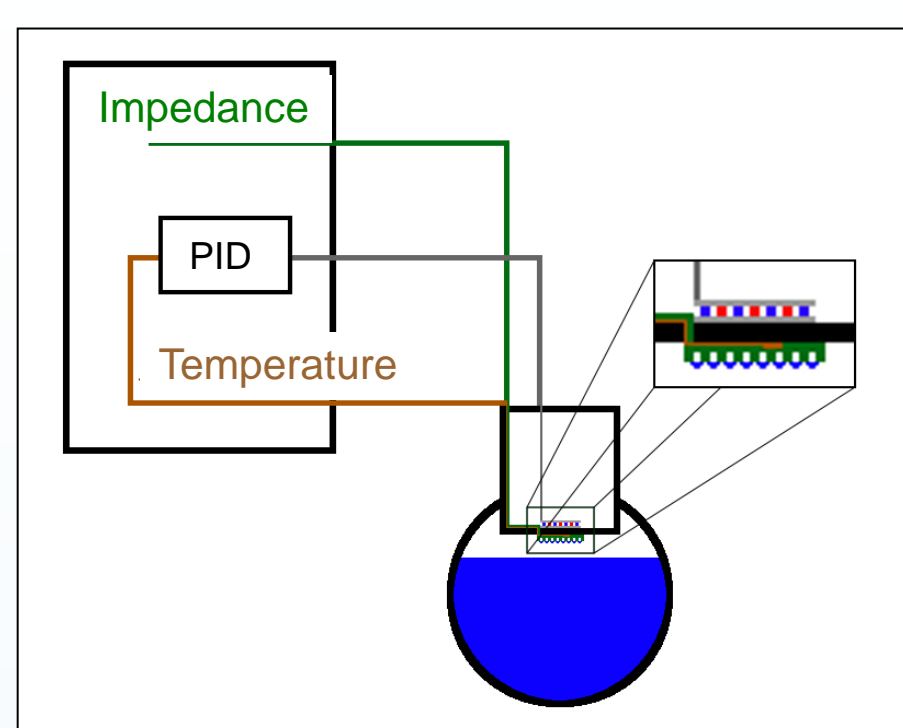
Monitoring the composition of biogas through impedance spectroscopy

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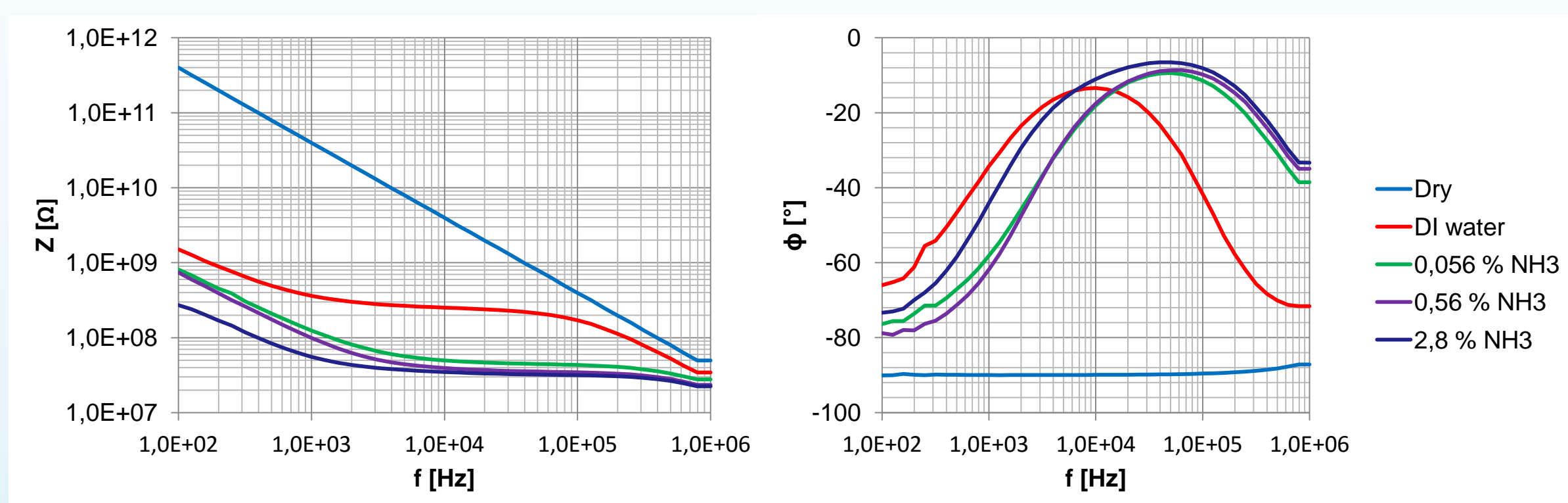
Motivation

The biological metabolic processes in biogas plants are very complex and the operator usually regards them as a "black box". There are few reliable and easy to measure indicators for early detection of emerging disorders of anaerobic biodegradation processes. Within the project "Model-based process control of biogas plants, MOST" the composition of biogas was identified as a possible indicator. For the main components methane and carbon dioxide affordable long-term stable sensors are present. However, the determination of the ammonia content in the raw gas is much more difficult.

Measurement principle



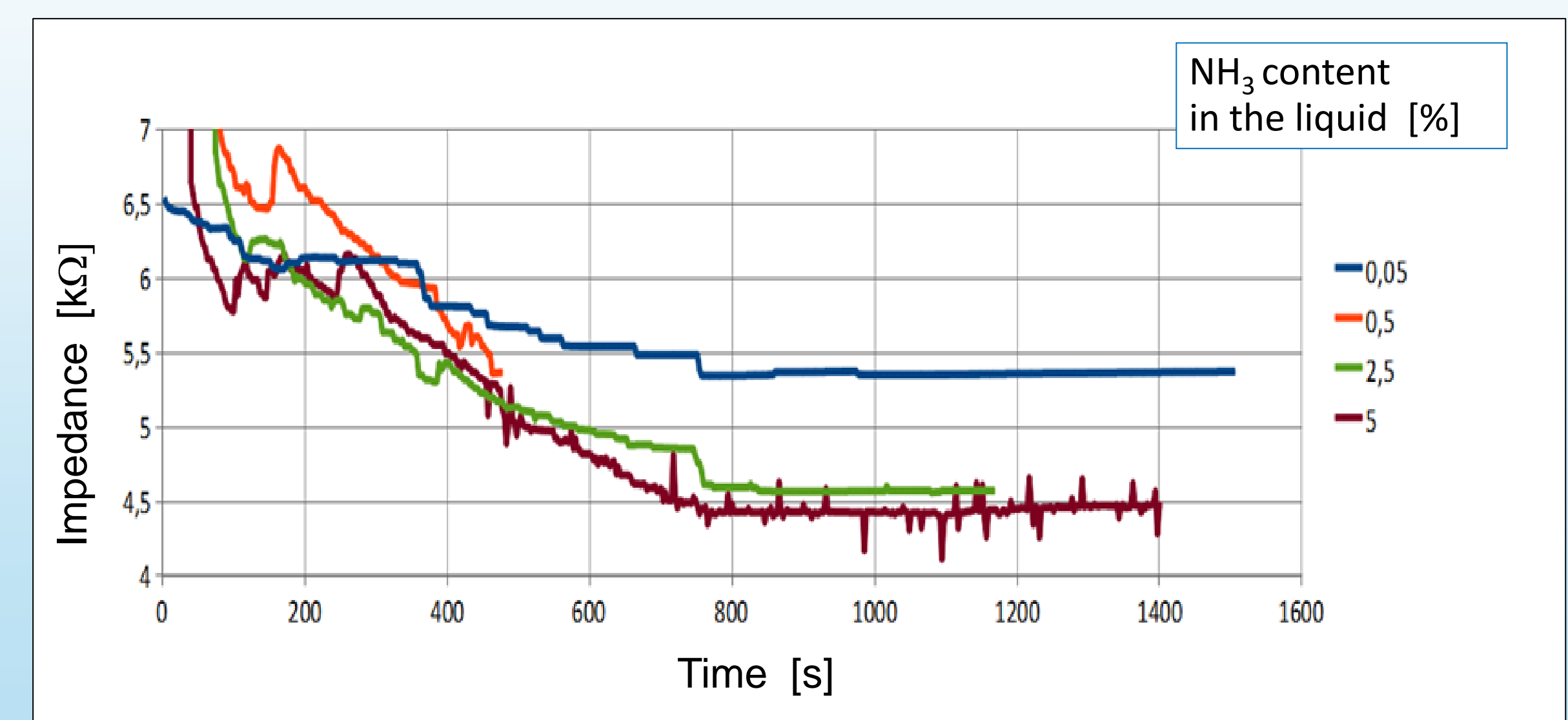
- › The monitoring of ammonia bases on an impedimetric measurement in the gas phase above the fermenter.
- › A condensate is generated by cooling the surface.
- › An impedimetric measurement is performed using an electric stray field.



Magnitude and phase of the impedance spectra

Measurement results

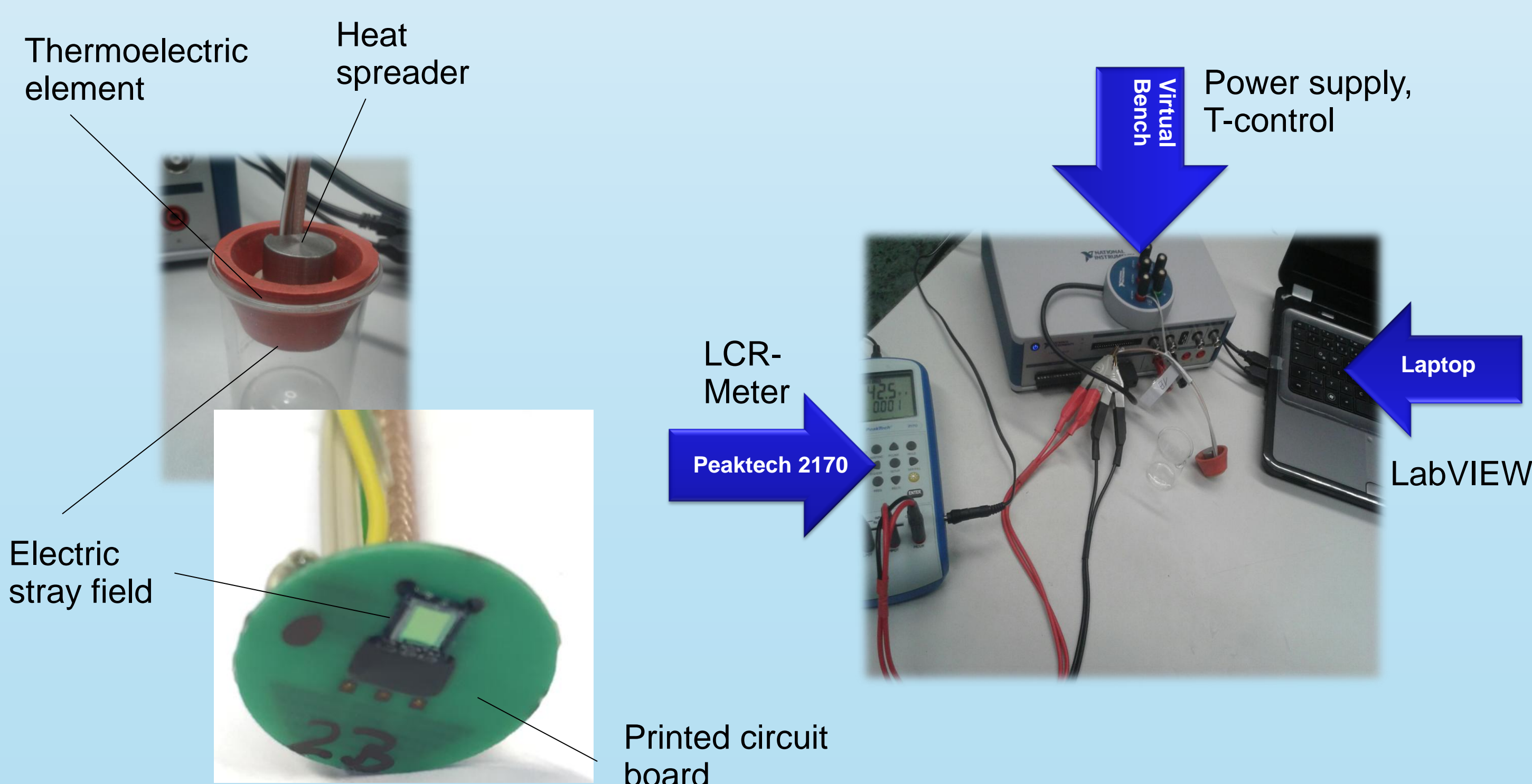
In the gas room above an aqueous ammonia solution a saturated water vapor containing ammonia is formed. After a period of equilibration a stable measurement signal is obtained. As seen below, the impedance correlates inversely with the ammonia content.



Impedance of the condensate on the stray field at 15 °C and 1kHz

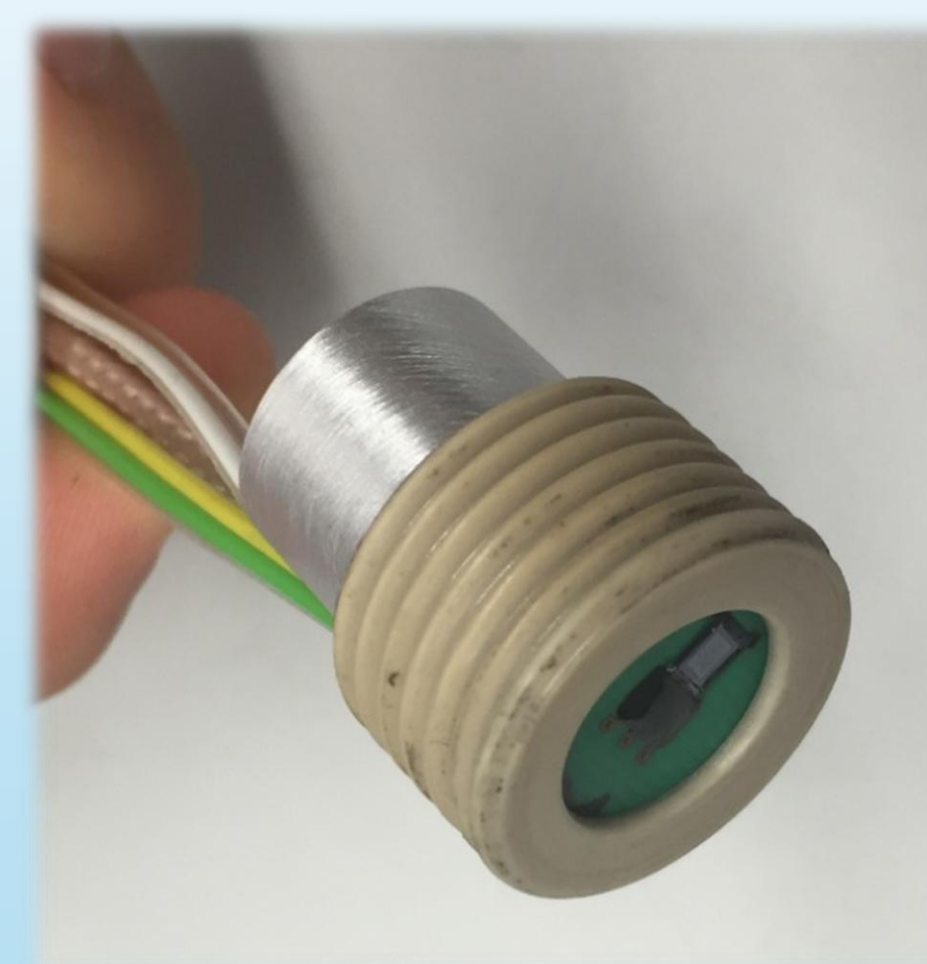
Laboratory measurement setup

An electric stray field is mounted on a thermoelectric element to analyze the condensate.



Implementation in a tube

For measurements in a gas flow the insertion of the printed circuit board in a screwable housing is possible



Conclusions

To determine the ammonia content of the raw gas the impedance of the condensate on a cooled surface can be measured. It has been shown that a continuous and stable logging of the measurement results is possible.

For measurements in a gas flow in a biogas plant the insertion of the assembly in a tube is possible.

Acknowledgment

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