SUCCESS STORY

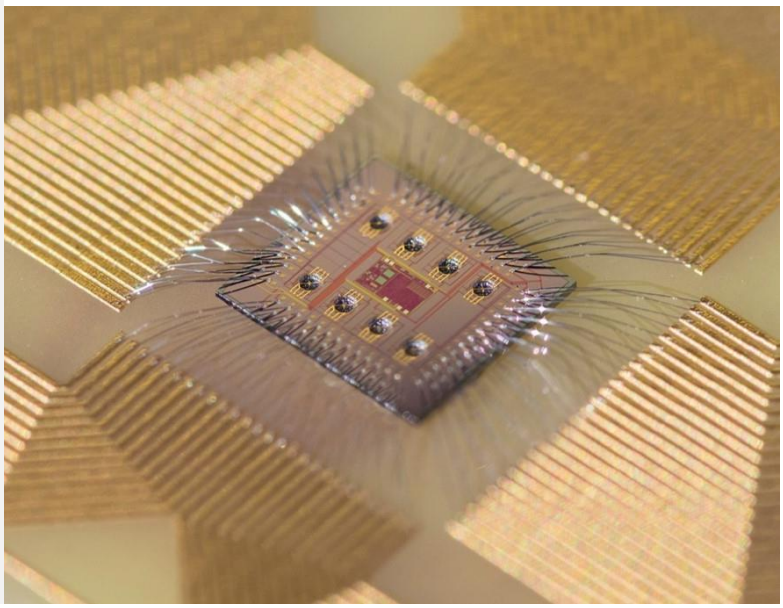
IC-MPPE / Integrated Computational Materials Process and Product Engineering

Program: COMET – Competence Centers for Excellent Technologies

Program line: COMET-Centre (K2)

Type of project: Strategic project

Project: Innovative Chemical Nano-Sensors for Safety Applications in Homes and Industry (*NanoSense)* (2018 – 2021)



CHEMICAL SENSORS FOR INDOOR AND OUTDOOR AIR QUALITY MONITORING

DEVELOPMENT OF A SENSOR PLATTFORM FOR IOT-CAPABLE SENSOR NETWORK FOR INDOOR AND OUTDOOR AIR QUALITY MONITORING

The goal of the project *NanoSense* was to develop and fabricate chemical nanosensors based on ultrathin SnO_2 films as sensing layers. The gas sensors are functionalized with highly specific mono- and bimetallic Au/Pt-nanoparticles in order to detect the toxic gas carbon monoxide (CO) in the concentration range 1 – 50 ppm in ambient air.

The Materials Center Leoben (MCL) is prototyping chemical sensors based on SnO_2 sensing layers for CO and other target gases, which are integrated on CMOS-based micro-hotplate devices enabling heating of the gas sensitive layers up to operation temperatures of 400°C.

Based on MCL-own chemical sensors as well as on commercially available gas sensors a test box has been designed and setup, which enables in-field CO detection and measurements of other environmental parameters in harsh environmental conditions (Fig.1).

The test box provides the following features:

- Gas sensors for CO developed at MCL,
- Commercially available sensors for temperature, air pressure, humidity and CO_2, CO (for comparison purposes), and Volatile Organic Compounds (VOCs),
- Raspberry pi microcomputer for data acquisition, evaluation, and visualization,
- CO-reservoir for repeated (once per week) on-board calibration of the CO gas sensor,
- Implementation of "traffic light" LED concentration indicator (green/yellow/red) showing the CO level according to the maximum admissible concentration values.

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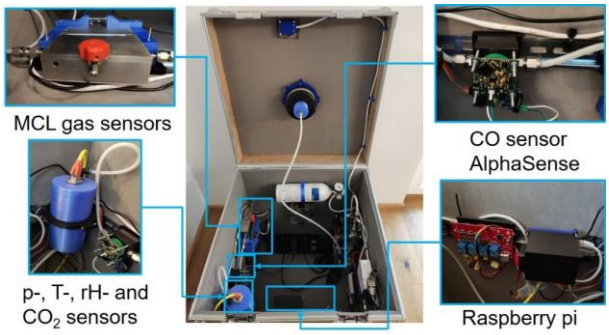

Fig.1: Test box for real-life CO measurements in harsh conditions.

The test box can be further expanded in functionality by adding other MCL gas sensors for VOCs and H_2S, for example.

Impact and effects

Based on the test-box, a miniaturized sensor platform has been developed (Fig.2), which provides all functionalities of the big test box. Additionally, this sensor platform includes a Raspberry pi microcomputer for data processing, storage, and visualization, as well as Bluetooth-connection for wireless communication and Internet-of-Things (IoT) capability.

The housing (size 10 x 10 x 6 cm^2) has been designed and fabricated by 3D-printing, six sensor platforms have been prototyped. Goal is to setup a sensor network in the rooms of MCL and to perform air quality monitoring in real life conditions.

The sensor data will be accessible for every employee using a smart phone, for example, to display the data. In a later stage the commercial sensors will be replaced by the highly miniaturized MCL-own multi gas sensor devices, which has been developed within the FP7-project MSP (GA No. 611887) and are fully integrated in CMOS devices.

In the future these sensor platforms will be also employed for outdoor environmental monitoring.

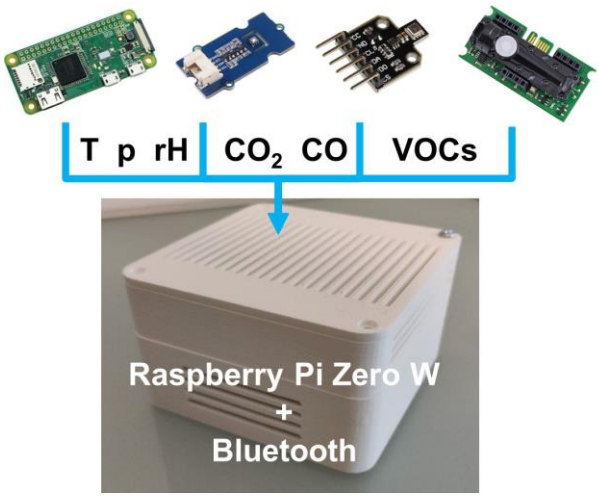

Fig.2: Miniaturized sensor platform for setting up an IoT-capable sensor network.

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