

## PROJECT

In the KonSens Project, sensor systems are developed, validated, and operated in form of functional models for the application areas Structure Integrated Sensors and Mobile Multi-gas Sensors. Key aspects are the detection and evaluation of corrosion processes in reinforced concrete structures as well as the detection and quantification of very low concentrations of toxic gases in air. The adaption of sensor principles from the lab into real-life application including appropriate communication techniques is a major task.



## CONTACT

Bundesanstalt für Materialforschung  
und -prüfung (BAM)  
Unter den Eichen 87  
12205 Berlin, Germany

### Project coordinator

Dr.-Ing. Matthias Bartholmai  
FB 8.1 Sensors, Measurement and Testing Methods  
☎ +49 30 8104-1912  
✉ matthias.bartholmai@bam.de

🌐 [www.bam.de](http://www.bam.de)

201700379

Sicherheit in Technik und Chemie



## KonSens

Communicating Sensor Systems  
for Structural Health Monitoring and  
Environmental Monitoring



FOCUS AREA  
**ANALYTICAL SCIENCES**

## STRUCTURE INTEGRATED SENSORS

In recent years, Structural Health Monitoring have gained in importance, since growing age of buildings and infrastructure as well as increasing load requirements demand for reliable surveillance methods.

The combination of sensors for condition monitoring and Radio Frequency Identification (RFID)-Technology enables the development of sensor systems, which can be completely embedded into the structure, particularly into concrete components. Such wireless, integrated sensors can measure parameters, e.g., corrosion activity or moisture content in situ, without insertion of wires which provide vulnerabilities.

In the field Structure Integrated Sensors two strategies are followed: On one hand the development and implementation of completely embedded sensor systems consisting of RFID-tag and in situ sensors, and their further application potential (e.g. for precast concrete elements, roadways, wind power plants, and maritime structures). On the other hand the demand for a structure integrated corrosion sensor is addressed. Objective is the development of a long-term stable, miniaturized, fiber optic sensor for a ratiometric and referenced measurement of the pH-value in concrete as an indicator for carbonation and corrosion.

## MOBILE MULTI-GAS SENSORS

Environmental pollution through emission of toxic gases becomes an increasing problem not only in agriculture (e.g. biogas plants) and industry but also in urban areas. In future, environmental emissions as well as ambient air and industrial air components must be monitored in even lower concentrations as nowadays. This concerns technical gases that are used as input substances (e.g. biogases, gases for fuel cells) as well. Consequentially, demands arouse for measuring concentrations as low as the low ppm or even ppb range. Current state-of-the-art technologies, as for instance electrochemical sensors, have reached their limits in this regard.

The selectivity of luminescence-based sensors is caused by the combination of the sensing dye and the material which is used as accumulation medium for concentration of the analyte. This principle enables to develop gas sensors with high selectivity and sensitivity for defined substances. Additional benefits, particularly of fluorescence-based sensors, are their capability for miniaturization and potential multiplex mode. Objective is the development and implementation of sensors based on fluorescence detection for defined toxic gases (ammonia, hydrogen sulfide, ozone, and benzene) with sensitivity in the low ppm or even ppb range. Additionally, the integration of such sensors in mobile sensor devices is addressed.

## OBJECTIVES

Objective is the adaption of sensor methods from the lab into real-life application including appropriate communication techniques in the areas Structural Health Monitoring and Environmental Monitoring. The implementation is processed through the development, validation, and operation of sensor systems in form of robust and easy to apply functional models.

The KonSens Project targets synergy effects in the addressed application areas through cross-divisional and interdisciplinary cooperation within BAM. Basis is the competence in the scientific fields of synthesis of sensor materials, calibration methods, development of mobile sensor devices, system integration, data communication, application expertise, analysis and evaluation of sensor data, as well as sensor data fusion.

