



## Multi-purpose Chemical Condition Monitor ARTINOS®

SYSCA AG (Knittlingen), Forschungszentrum Karlsruhe,  
MicroMountains Applications AG (Villingen)

**SYSCA**  
Systeme und Service für die Chemische Analytik  
Systems and Services for Chemical Analysis

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micromountains  
applications **ma**

**KIT**  
Karlsruhe Institute of Technology

### BACKGROUND and BASICS

- The Electronic Nose **ARTINOS® Multi-Scan** is a gas sensor system which is able to detect and identify single gases as well as complex odours down to the ppb-range. The gas sensory heart of ARTINOS® is a sensor chip carrying a microarray of gradually different gas sensors.
- ARTINOS® is suited for online analysis of gases or odours released from a product or during a process. These gases or odours are mostly a fingerprint for product quality or a process state. ARTINOS® can therefore be employed for process or quality control in industry but also for many other applications.

#### Some examples of possible applications are:

- Controlling production processes
- Contamination control of food containers
- Controlling gas tightness of packages
- Intelligent leak-detection
- Monitoring biofilters
- Incoming or outgoing inspection
- Monitoring gas-emission or -immission
- Monitoring ambient air
- Controlling threshold values
- Toxic gas warning
- Odour assessment in car interior
- Breath analysis for medical diagnosis and many others

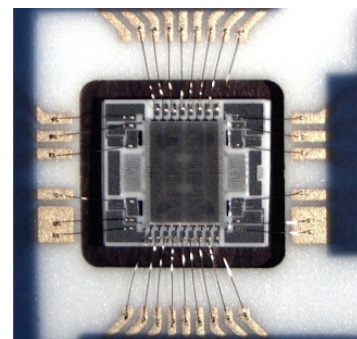
- In order to improve sensitivity and selectivity of the ARTINOS® system new detecting materials based on nano-structured metal oxides are developed for the gas sensor chip within the scope of the "NASGAM" project (management: MicroMountains Applications AG).



ARTINOS® Multi-Scan 210

### CONCEPT and SOLUTION

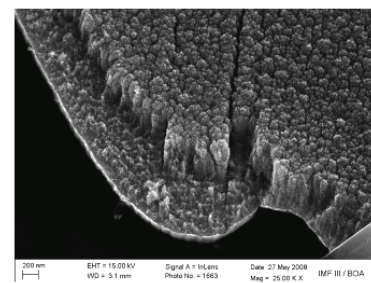
- The ARTINOS® sensor chip carries a microarray of gas sensors which is based on a single metal oxide detection layer, e.g. tin dioxide. At higher temperatures (approx. 300°C), the electrical conductivity of the metal oxide sensitively depends on the composition of the ambient atmosphere. The sensors of the microarray are obtained by subdividing the metal oxide film with a set of parallel electrodes.
- Sensitivity and long term stability of the detection layer strongly depend on the morphology of the metal oxide. Detection layers composed of metal oxide nanoparticles show excellent sensitivity, however long-term stability is often poor.
- In the course of the NASGAM project a new approach is pursued to stabilize the nanoparticles in order to improve long-term stability of corresponding detection layers.



Gas sensor chip (centre, size: 4 x 5 mm<sup>2</sup>) carrying the microarray.

### STATUS and OUTLOOK

- Detection layers composed of stabilized nanoparticles have been produced in a microwave plasma process at Forschungszentrum Karlsruhe. Sensor chips have been constructed with this new kind of detection layer.
- Gas sensory tests showed that sensitivity of the "nanoparticle detection layers" was about 5-times higher compared to regular detection layers. The high sensitivity still persists after operating the sensor for three months, pointing to good long-term stability.
- The next step will be to modify the production process and facility in order to be able to deposit detection layers for a higher number of microarrays (up to 100) at the same time on a ceramic substrate.



Detection layer composed of metal oxide nanoparticles.

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