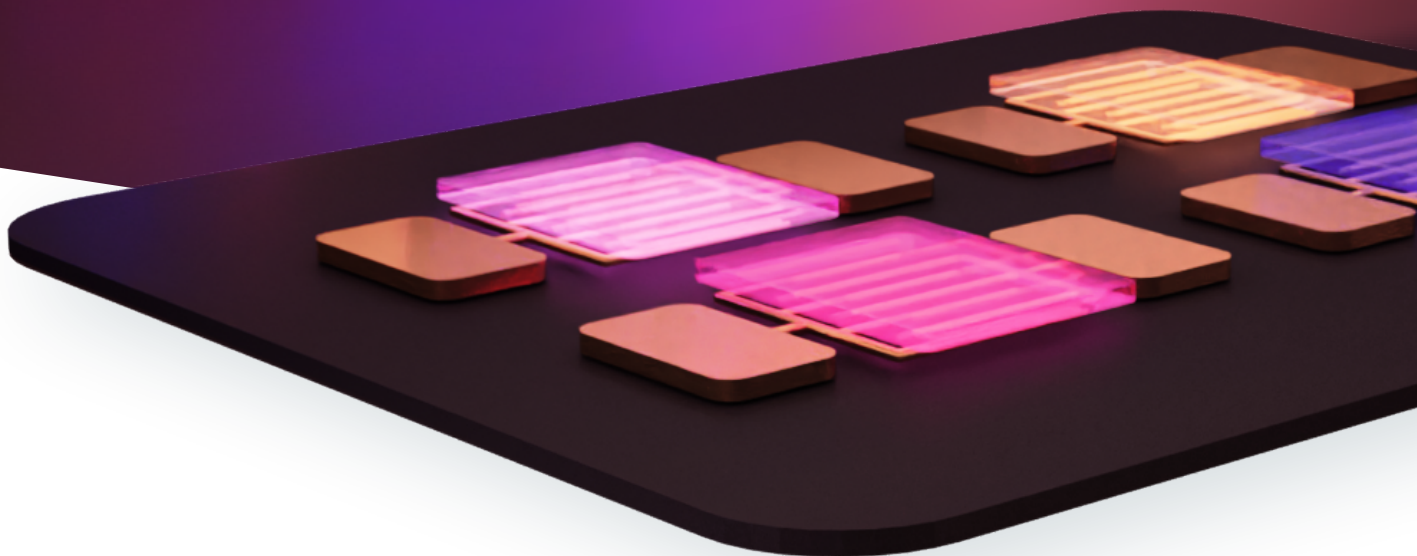




# Multi-pixel gas sensor platform

FOR A WIDE RANGE OF APPLIANCE AND CONSUMER MARKETS



## Message from the Project Management Team

The intention of this newsletter is to provide news on the project progress and to discuss ongoing topics relevant to AMUSENS. This newsletter is intended for internal and external project partners, stakeholders and all other interested bodies. For more detailed information about the project, we invite you to visit our [project website](#), which is constantly updated with the latest project related news.



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## Technical Update

Gas sensors are crucial in the personal and industrial monitoring to analyse personal exposure to air pollutants or to critical gases, to control product quality such as in the food industry, and in health care by analysing gases from human body. These applications require miniaturized low power and low-cost gas sensors with good gas selectivity to be integrated in personal devices, in product packaging or in widely distributed sensor networks. AMUSENS aims at developing a gas sensor platform with flexible selectivity to different gas environments by combining a multipixel approach and artificial intelligence to adapt the data analysis to the targeted applications. It is based on metal oxide sensing materials on micro-hotplate platform, which are already available on the market for low power applications, but suffer from a lack of selectivity. Gas-selective multi-pixel

sensors based on different metal oxide materials have been demonstrated, but their industrialization is limited to few industrially available materials. By using original additive manufacturing approaches for local liquid-phase and gas-phase depositions, we aim at extending the choice of available materials and demonstrate their sustainability in wafer-scale processing. Artificial intelligence will be used both to accelerate the choice of materials and for data fusion to determine specific patterns in the gas analysis. Three specific applications chosen in the fields of personal environmental monitoring and health care (metabolic states), as well as stress levels estimation, will demonstrate the adaptability of the platform, based on an analysis of the users' requirements.

### Work performed and main achievements:

The first period of the project was dedicated to the definition of the requirements for the targeted end-user case and the selection and development of the gas sensing materials to be integrated in the multipixel platform. This fine selection has started from a thorough analysis of the end-user requirements in terms of gases to be detected and related conditions, with a final selection of 12 target gases to be addressed during the project. A preliminary selection of the sensing materials to be developed was made from the literature. The materials (MO nanostructures) and material combinations (coated MO nanostructures) were analysed in terms of sensitivity and potential selectivity to targeted gases, processability with the envisioned additive manufacturing approaches, and were finally screened by performing a safety analysis of the proposed materials, resulting in 6 MO nanostructures and 6 coatings to be investigated. More than 24 materials and material combinations were then processed using laboratory-scale methods, i.e. standard drop casting and batch atomic layer deposition, including duplicates (2 to 4 samples for each) for statistical analysis. All devices have been exposed to up to 10 gases under the same protocol and various conditions (temperature, humidity). The main result from this first period is a database of sensing response for all devices that

have been tested. In parallel, analysis algorithms were developed to analyse the response through machine learning and select the most appropriate material combinations for specific gas selectivity. The algorithm has been validated on data available in the literature and has demonstrated to be ready for analysing the data produced during the project, although the current data are still not fully appropriate for a perfect selection, which will be investigated at the beginning of the next period.

In parallel, preparation steps for the next period include the design and fabrication of a new testing chamber that will allow a more accurate determination of the key sensing parameters, such as response and recovery time, and that will be used to enhance the statistics of gas sensing data to train the AI algorithms. All materials investigated in the first phase have also been transferred using local deposition methods, i.e. inkjet printing for MO nanostructures and DALP® for the coating. At last co-design workshops have been organized to better target the user needs for the end user cases to be tested at the end of the project.



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## Results beyond the state of the art:

The first period of the project has been dedicated to the choice and the development of gas sensing materials to be integrated into the multi-pixel platform for the targeted user cases, namely monitoring personal exposure and breath analysis for fitness and stress estimation. The main results beyond the state of the art are:

- A literature review and the critical analysis using the expertise of the consortium conducted for the identification of 12 target gases and 12 most promising materials to be combined for a selective detection of the target gases. The materials are specifically selected with a fully integrated approach combining all aspects for an optimum future industrial transfer, from sensing properties to processability and safety requirements.
- A total number of 24 material combinations have been tested under exposure to 10 gases and various conditions (temperature, humidity) to build up a consistent database of gas sensor responses. Such a fully consistent set of measurement allowing the direct comparison of such a large number of materials and conditions is hardly described in the literature and will be a major output of the project.
- Ink formulation validated for the inkjet printing of metal oxide nanostructures with highly challenging aspect ratios (nanorods, nanobundles).
- Local deposition of 4 different materials using original Direct Atomic Layer Processing (DALP®) method.
- Definition of user needs in the domains of monitoring personal exposure to gases and breath analysis for fitness and stress estimation.



## Past and upcoming events

### Meeting in September 2025

The AMUSENS F2F Meeting was successfully held in Wroclaw, Poland, from 10–11 September, kindly coordinated by Renaud Leturcq from the Luxembourg Institute of Science and Technology (LIST).

Over two intensive days, project partners came together to review and assess project progress, exchange knowledge, and align on next steps.

The meeting opened with a Technical Project Overview. Afterwards, each partner presented

the status and plans of their Work Packages. In addition, WP Leaders Group Meeting and session for the Ethics Working Group took place within these two days.

This face-to-face meeting marked a significant step in ensuring AMUSENS remains on track, with clear alignment on technical tasks and ethical considerations. We thank all partners for their active contributions and commitment!



## AMUSENS end user co-design Workshop in October 2025

On October 16, 2025, the AMUSENS project reached a crucial validation milestone by hosting its major European workshop, "Understanding your environment & listening to your body: Shape the ideas behind the sensors of tomorrow." This online session was the third and final event in the project's intensive user co-design phase.

Held via ZOOM and the interactive MIRO platform, it brought together 22 participants from across Europe to validate, refine, and contrast user requirements identified in previous local workshops.

For more information please visit: [\[link\]](#)

## Next AMUSENS F2F meeting in June 2026

The next AMUSENS face-to-face meeting will take place on June 25–26, 2026, at the National Technical University of Athens (NTUA) in Athens, Greece. The meeting is hosted by project partner

ICCS and will bring together all consortium members to review progress, discuss key developments, and align on forthcoming activities.

Find all events on: [\[link\]](#)

## AMUSENS Videos

The newest addition, **AMUSENS use case video**, shows how personal environmental exposure monitoring can track air quality across daily micro-environments and provide clear, color-coded alerts and recommendations to support healthier choices.

All project-related videos are showcased on **Vimeo**.





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### New Scientific Publications:

- „The Dimensionality of MOX Sensors in Air Quality assessment“, [\[link\]](#)
- „Development of wafer singulation technique for MEMS and MOX gas sensors using 355 nm UV laser ablation process“ [\[link\]](#)
- „Novel Multi Pixel-based Gas Sensor Fabricated by Local Inkjet Printing of Metal-oxides Structures“ [\[link\]](#)
- „A Study of 355 Nm UV Laser Ablation Process for Singulation of Silicon Wafers“ [\[link\]](#)
- „A Probabilistic Approach for Drift Compensation of Gas Sensor Data“ [\[link\]](#)

### New Public deliverables:

- D1.1 – Project Quality Plan [\[link\]](#)
- D6.1 – Database of gas sensing responses [\[link\]](#)
- D6.2 – Algorithm for the selection of most promising materials by AI [\[link\]](#)
- D6.3 – Report on user needs for the development of a single sensor [\[link\]](#)
- D11.1 – Plan for dissemination and exploitation incl. communication activities [\[link\]](#)

### Project Partners:



Luxembourg Institute of Science and Technology Luxembourg [Luxembourg]



Université de Liège Belgium [Liège]



University of Brescia Italy [Brescia]



Ellona SAS France [Toulouse]



Technikon Forschungs- und Planungsgesellschaft mbH Austria [Villach]



ATLANT 3D Nanosystems APS Denmark [Taastrup]



Institut Mines-Télécom France [Palaiseau]



Sciosense Germany GmbH Germany [Reutlingen]



Science For Change, SL Spain [Barcelona]



JLM Innovation Germany [Tübingen]



Institute of Communication & Computer Systems ICCS Greece [Athens]



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**Project Coordinator:** Luxembourg Institute of Science and Technology  
**Coordinator Support:** Technikon Forschungs- und Planungsges. mbH  
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For more information about the AMUSENS project, visit our website or contact the project management team:  
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