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# 16th Dresden Sensor Symposium

## 16. Dresdner Sensor-Symposium

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After the 15th Dresden Sensor Symposium in 2021 had to be transformed into an online event on short notice, many researchers requested to switch the bi-annual rhythm to allow an earlier meeting in person for the sensor and measurement science community in Dresden. Thanks to the organizers at Dechema and the strong support from AMA and the program committee we could organize the 16th Dresden Sensor Symposium as onsite event in Dresden from December 5 to 7, 2022 to enable the sorely missed direct exchange with colleagues during talks, at posters and over a beer.

This symposium comprised eight invited talks providing an overview in various exciting areas in sensors and measurement science plus 20 talks selected from the submitted contributions as well as 46 posters, which were presented in a poster pitch session and during multiple poster sessions over the three-day event. After the publication of the conference contributions on the platform amascience.org [1], this special issue with six selected extended contributions is published in order to increase awareness for topics covered in the symposium, make them accessible to a wider scientific community and along the way encourage further exchange. The selection is based on the poster awards as well as the general interest received for specific topics.

The 16th Dresden Sensor Symposium, prepared by the newly upgraded Fachsektion Mess- und Sensortechnik and jointly organized by Dechema e.V. and AMA e.V., was dedicated to the latest developments in sensor technology covering a wide spectrum from biomedical applications to quantum sensors and from industrial applications to food and agriculture covering hot topics like smart odor analytics and animal welfare. For a small conference of around 100 participants with a family atmosphere, this broad scope is fairly unique. It challenges all participants, scientist from academia and industry alike, to think outside the box and discuss ideas cutting across their normal areas of expertise.

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The six contributions in this special issue, extended versions of papers presented at the symposium, similarly cover a wide range of topics in sensors and measurement science.

The first article by Patrick Wagner et al. is a review based on one of the invited talks at the symposium. The heat-transfer method and related techniques are an elegant, surprisingly versatile and sensitive approach for bioanalytical sensors. The effect, first observed in 2012, has been studied intensely over the last years and expanded to cover various techniques. The contribution provides an excellent overview of the state-of-the-art and of the potential for future development.

Similarly fascinating is the approach described by Lars Dähne et al. using a novel highly sensitive optical method based on whispering gallery modes in tiny fluorescent beads. The resonance frequency of the circular light waves within these high refractive index beads is very sensitive to surface modifications and, thus, adsorption of molecules which shift this resonance. This is detected with compact instruments using laser excitation and a high-resolution spectrometry. Applications are found in biosensing, layer-by-layer deposition of polymers, drug release and others.

The third paper by Julia Herzog et al. is also based on plasmonic sensing of refractive index changes, but here a hydrogel is used as transducer material. The potential of chemical modification of the gels allows tailormade interaction with various molecules in solution thus achieving selective detection of chemicals even in a complex matrix. This is demonstrated for ethanol with good reversibility and considerably faster response and recovery compared to previous hydrogel sensors with read-out based on pressure sensors [2]. First applications could be found in fermentation processes which play a central role in the food industry and biotechnology.

Merle Sehlmeyer et al. address medical applications, a field of increasing interest not only for sensors, but also for modern measurement methods. In this contribution, cell growth is detected on cochlear implant electrodes using impedance spectroscopy. The functionality of these implants strongly depends on the maximum current stimulating the spiral ganglion cells and this is very sensitive to cell growth. While impedance measurements are already implemented on common implant systems, secondary

effects such as changes in the perilymph or the implant position can interfere with the established measurement. The contribution introduces impedance spectroscopy to increase the information gained by the measurement and uses FEM simulations to model the various effects with the final goal of improving the prediction of hearing deterioration in patients.

The contribution by Dennis Arendes et al. addresses a measurement and calibration system that was established to advance the development of gas measurement systems for complex gas mixtures. Many applications, e.g. in indoor and outdoor air quality monitoring, assessment of food freshness or medical breath analysis are faced with very complex mixtures that can only be mimicked to some extend in gas mixing systems for sensor characterization and calibration. This paper extends the previous contribution by Arendes [3], which presented a novel modular gas test bed allowing unrivalled mixtures with 16 or more independent components. The new contribution describes the extensive qualification, optimization and quality control measures implemented to make full use of this potential which is indispensable for the development of smart gas sensor systems based on advanced machine learning methods.

Similarly, the final contribution by Lars Buntkiel et al. addresses an innovative measurement system for characterization of bioprocess reactors to improve the efficiency of mixing and fermentation. Poor mixing and dead zones in biogas fermenters, bioreactors, or activated sludge basins lead to inefficient utilization of resources and greatly reduced energy efficiency. Flow following sensor particles integrating multiple pressure, temperature and inertial sensors are used to characterize and eventually optimize the flow field inside these reactors. For this the movement of the particles needs to be estimated and orientation resolved acceleration measurements are one approach for determining the flow field inside metal vessels and opaque liquids. The results are strongly dependent on the calibration of the sensor particles and enhanced by stochastic models for data evaluation.

I invite you to read and enjoy these excellent contributions which should provide insights into different fields and hopefully fresh ideas for your own research not only in sensors and measurement science. Finally, I hope to see many of you at the next Dresden Sensor Symposium scheduled for November 25–27, 2024.

## References

[1] 16. Dresdner Sensor-Symposium 2022, *Langfassungsband*. Available at: https://www.ama-science.org/assets/Dresdner-Sensor-Symposium/16.-Dresdner-Sensor-Symposium-2022/e-Booklet-16.-DSS-2022.pdf [accessed: Feb. 10, 2023].

[2] S. Schreiber, N. Steinke, and G. Gerlach, “Chemische Hydrogelsensoren auf Basis des Bimorpheffekts mit kurzer Ansprechzeit,” in *15. Dresdner Sensor-Symposium*, Tagungsband, 2021, SS. 290—294.

[3] D. Arendes, H. Lensch, J. Amann, A. Schütze, and T. Baur, “Modular design of a gas mixing apparatus for complex trace gas mixtures,” in *15. Dresdner Sensor-Symposium*, Tagungsband, 2021, SS. 326—31.