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# Miniaturized Sensors for Monitoring and Physical Chemosensor Applications

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Novel technologies such as microsystems technology (or MEMS - micro-electro-mechanical systems) have led to new possibilities in the realization of miniaturized transducer elements, i.e., sensors and actuators. Apart from the possibility of reducing the spatial dimension of the associated system, these technologies can also offer advantages in terms of cost (due to possibility of batch production) and the utilization of physical phenomena, which particularly appear on the micro-(or nano-)scale.

For a number of application areas, this has led to a rapid development of associated electronic systems, which is witnessed, e.g., by the dramatic increase in electronics contained in today's automobiles. A lot of emerging sensor applications is related to the monitoring of gaseous or liquid media, e.g., for industrial applications in production plants. In these monitoring applications it is often desired to obtain chemical information of the considered substance. One concept to gather this information is the application of chemical sensors, which utilize so-called chemical interfaces to transform chemical information into a physical quantity, which is in turn detected by a physical transducer. An example would be a selectively absorbing chemical interface, which, upon exposure to an environment containing traces of the substance for which it is selective, increases its mass density, which can be detected by a mass sensitive transducer. Unfortunately most chemical interfaces suffer from a number of adverse properties such as limited lifetime and durability, susceptibility to poisoning by other substances, poor reproducibility, and ageing effects leading to non-reversible changes in sensitivity. This makes most of these interfaces not suitable for industrial applications and operation in harsh environments. An alternative is the utilization of so-called physical chemosensors, which merely rely on robust physical sensors and aim at extracting the desired chemical information from the measured physical parameters. This

is feasible, e.g., if an array of physical sensors is used or if some a-priori knowledge on the monitored process is available. A classical example would be the monitoring of fermentation processes by sensing the density of the brew.

In our contribution we will discuss selected recent developments and applications in the field of miniaturized sensors including sensors for viscosity, thermal conductivity, permittivity, IR-absorption, and microfluidic systems such as particle counters and particle shape detectors.