Fraunhofer
IKTS

MICROFLUDIC MULTISENSOR SYSTEMS

B. Capraro[1], D. Schabbel[1], T. Henkel[2], M. Beyer[3], M. Pohl[3]
[1]Fraunhofer-Institute for Ceramic Technologies and Systems IKTS, [2]Leibniz-Institut für Photonische Technologien e.V., [3]Lust Hybrid-Technik GmbH

Thüringer Aufbaubank
EFRE EUROPA FÜR THÜRINGEN
EUROPÄISCHER FONDS FÜR REGIONALE ENTWICKLUNG

MOTIVATION

Silicon and LTCC (low-temperature cofired ceramics) are standard materials for microsensor and microsystem technologies with numerous applications. Typical processes implemented into micro technology, e.g. photolithography and microstructuring, thick-film and thin-film technology, methods of construction and interconnect technology can be applied to both materials. This results in efficient production capabilities of microfluidic microsystems. Integration of both materials in a combined system would, however, open a new path for complex microsystems with a high level of integration and new applications.

CONCEPT OF INTEGRATION

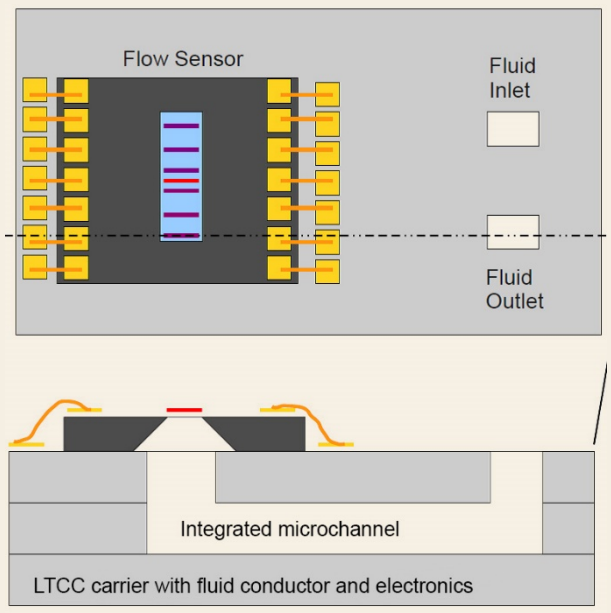

Figure 1: Flow sensor concept.

OBJECTIVE OF DEVELOPMENT

The aim of this research project was to develop a multisensor platform for monitoring material and process parameters in the area of green technologies. Based on the integration platform LTCC, the fluid management and sensor technology responsible for monitoring process and material parameters, is combined with silicon-based microelectronics required for processing, validation and transmission of measured data to higher level control centers. As a result, monitoring tasks that conventionally require decentralized sampling, transportation into a special laboratory, analysis of the samples in these laboratories and feedback of the test results are implemented directly in multisensor systems on-site. The resulting continuous access to process variables allows to reduce the number of control cycles and enables a resource-optimized operation and production process through short-term and rapid adaptation of the operating regime to changing requirements. For lab-on-a-chip systems with long service life and long service intervals, the integration of sensor systems and actuator components is of particular interest.

REALIZATION

As part of the project work, silicon-based microfluidic sensors for integration into LTCC systems were developed. These sensors allow for measurement of flow rate, temperature, conductivity, pressure and optical density. The development and qualification of a non-porous LTCC tape, which is anodically bondable to silicon, plays a pivotal role for the realization of the hybrid system.

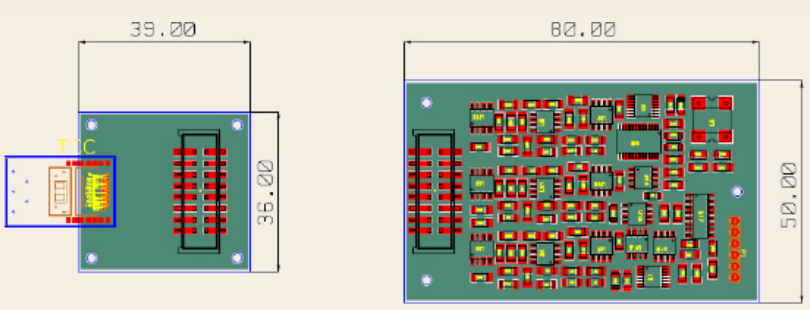

Figure 2: Design of the circuit.

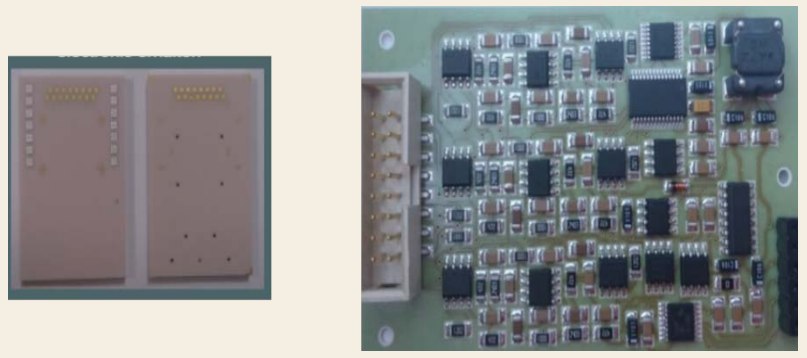

Figure 3: LTCC module.

ACKNOWLEDGMENT

We thank the "Thüringer Aufbaubank" for support of the project "MultiSens"(2011 VF 0022).