



MIGRATEWS2016-KEYNOTE LECTURE-1

INTEGRATED SYSTEMS FOR REAL-TIME FLOW AND COMPOSITION MEASUREMENT

J.C. Lötters

University of Twente, Enschede, The Netherlands

j.c.lotters@utwente.nl

ABSTRACT

There are many different devices for the handling of small and extremely small flow rates of both gases and liquids, such as flow sensors, pumps, valves and mixers. Although individual devices have their own specific functionality, they have mostly not been designed from the system point of view. In a well-designed microfluidic handling system, it should be possible to easily integrate different functionalities, such as flow measurement, control, dosage and analysis, into a single compact system.

Microsystem technology (MST or MEMS) is used in the manufacturing of devices and systems to enable acceptable size, functionality and cost in a large field of applications. A complicating factor in the use of MEMS is that the technology and cleanroom process used for different components, for example a flow sensor and a control valve, are not always compatible. Furthermore, the current functionality of a component or (sub)system is usually limited to one parameter, for example measurement of the flow rate.

If a wider range of applications is to be opened up then the microfluidic handling system needs to provide a multiple functionality, for example in addition to the flow rate measuring the density, viscosity, heat capacity, thermal conductivity, energy content and composition of the medium flowing through the system. Besides the functional properties that the system should have, it also needs mechanical, fluidic and electrical connections with the outside world. Furthermore, during the design phase of a new microfluidic handling system, it should be determined in advance if all of necessary components and subsystems are feasible and compatible with the technology and will fit into the system.

Examples of the application of the above-mentioned microfluidic handling systems are for instance:

- health: improving infusion pumps and systems for intravenous therapy
- food: real-time measurement of the milk quality
- chemistry: high throughput experimentation
- oil: enhanced oil recovery, well and reservoir optimisation; prohibit salt crystallisation
- gas: measure the composition and energy content of fuel gases, for example natural gas, biogas, LNG
- semiconductor: etching of electronics
- water: real-time measurement of water quality

In the presentation, integrated systems for real-time measurement of flow and composition will be shown. Examples of the application of these microfluidic handling systems will be given.