Fluorescence on a chip: optical flow diagnostics

Project aim

This Project represents part of the design of a Lab-on-a-Chip device. It performs a DNA analysis in an online quality control application. A miniaturized two-phase flow is chosen to combine the benefits of confined sample compartments (i.e. droplets) with the easy-to-control parameters of a miniaturized device (e.g. temperature, pressure). Mixing, transport, reaction and separation are the fundamental processes that need to be understood and controlled. In order to enhance mixing or control reaction kinetics, it is necessary to vary the influencing parameters of the drop internal convection pattern: the channel geometry, the compartment length, the flow velocities and the material properties of the contact surfaces. As a case study, two immiscible liquids are used to produce aqueous compartments dispersed in an octanol carrier phase in a micro channel. The indices of refraction of the two liquids are matched, in order to optically access both phases of the two phase flow simultaneously. Experimental methods, such as micro-PIV and micro-LIF, are used to obtain three dimensional measurements of the flow patterns and of the degree of mixing in the micro-fluidic device. Using a detection method, e.g. fluorescence or bioluminescence we intend to characterize different samples (be they cells or constituents) and to distinguish between normal and non-normal samples. Further "down" the channel this information can be used to sort the normal from the non-normal samples using an active micro-channel phase separator or the methods mentioned above.

Progress

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Dissertations

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Scientific publications

1. Miessner, U.; Lindken, R.; Westerweel, J.: Velocity Measurements in microscopic Two-Phase Flows by Means of Micro PIV. 14th Int Symp on Applications of Laser Techniques to Fluid Mechanics, Lisbon, Portugal, 7-10 July, 2008.
2. Miessner, U.; Lindken, R.; Westerweel, J.: Velocity Measurements in microscopic Two-Phase Flows by Means of Micro PIV. Proceedings of ASME ICNMM2008 6th International Conference on Nanochannels, Microchannels and Minichannels, paper# ICNMM2008-62093. Darmstadt, Germany, June 23-25, 2008.

Project leaders

J Westerweel, BJ Boersma, JCR Hunt, G Ooms

Research theme

Complex dynamics of fluids

Participants

U Miessner, R Lindken, J Westerweel

Cooperations

Prof. Dr. I T Young, Quantitative Imaging, Dr. M.F. Van Wordragen, Agrotecnology & Food Innovations, WUR, Firesland Coberco Diary Foods B.V, Aquamarijn Micro Filtration B.V.

Funded

MicroNed

1st 50% 2nd - 3rd 50%

Start of the project

2005

Information

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