

Micro- and Nanofluidics – Basics and Applications

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The microfluidic part of the course will deal with flow properties on the microscale and handling of microscopic objects such as particles, droplets, cells and DNA strands in microchannels. A variety of examples will be given for separation methods in microfluidic devices, including batch methods (on-chip electrophoresis, on-chip chromatography etc.) and continuous flow methods such as free-flow electrophoresis or pinched flow fractionation.

The nanofluidic part of the course will give an overview of fundamental physicochemical phenomena that determine liquid and analyte behaviour in nanoscale devices. Which properties remain the same when structures are scaled down from the micro- to the nanoscale and which properties change? What happens when device dimensions become comparable to the dimensions of the analyte molecules?

Starting from these fundamental phenomena, an overview will be given of their application to create state-of-the-art separation systems that contain functional nanofluidic elements or are based upon such elements. Finally, some possible future developments of the field will be sketched.

Jan Eijkel studied pharmacy and theology. He obtained his Ph.D. at the University of Twente in the Netherlands with Piet Bergveld, on the subject of potentiometric protein sensors. Subsequently he worked as a senior postdoctoral research associate with Andreas Manz at the SmithKline Beecham Institute for Analytical Sciences at the Imperial College London, where his research was focused on developing separation and detection systems for microanalytical systems. He was co-founder of the startup company 'CASECT', developing microplasma detection devices. In 2003 he moved to the BIOS/Lab-on-a-Chip group of Albert van den Berg at the MESA⁺ Institute of the University of Twente where he became charged with the development of the nanofluidic research. Since November 2004 he is an assistant professor. The focus of this research is both on the study of fundamental physicochemical phenomena in nanochannels (such as chemical equilibria, ion exclusion, filling and drying, osmosis and pervaporation) and on applications of these phenomena for (bio)chemical research and chemical separation. In 2005 he (co)organized the first international Nanofluidics workshop. He is invited author of regular focus papers in "Lab on a Chip".



Nicole Pamme obtained a Diploma in Chemistry from the University of Marburg, Germany, in 1999. For her PhD she went to Imperial College London, where she worked on single particle analysis in microfluidic chips in the group of Prof. Andreas Manz. This was followed by a stay in Tsukuba, Japan as an independent research fellow in the International Centre for Young Scientists (ICYS) at the National Institute for Materials Science (NIMS). In December 2005 she took up a lectureship position in analytical chemistry at the University of Hull (UK). Her current research interests include bioanalysis in microfluidic devices, applications of magnetism in microfluidic devices and continuous flow separations.

