Microfluidics and 3D nanostructuring for chemical analysis and beyond

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The proven contribution of microfluidics to the advancement of the analytical chemistry field originates from three main elements: 1) the miniaturization of the analytical instrument itself, enabling portable and eventually handheld systems, 2) the potentiality of working with extremely small amounts of analyte, while maintaining the quality of the analysis, and 3) the exploitation of physico-chemical scaling laws, facilitating innovative sensing concepts.
In this presentation a number of examples of the above, extracted from the ongoing research activities of the MCS group, will be highlighted. As a first case, the continuous development of microfluidic components (including the required miniaturized periphery) for high-resolution NMR of liquid samples will be discussed, including an outlook of where this technology may go in the near future. A second topic is concerned with activities in the area of chromatography on a chip, with a focus on HPLC, GC and protein adsorption, including a glimpse of what 3D printing might bring for this method. Next, a few examples will be shown drawn from the research collaboration of MCS, Saxion and NFI, in the area of forensic science, where microfluidics and nanotechnology are expected to aid in the selection, sampling and securing of traces at the crime scene. Finally, some promising and hopefully thought-provoking 3D nanostructures will be shown, which were made with a combination of (maskless) photolithography, thin film deposition and corner lithography, such as parallel flow-through particle traps, which are scalable within a range of tens of nm's to tens of μm's.