

Flexible fluidic microchips based on thermoformed and locally modified thin polymer films

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This paper presents a fundamentally new approach for the manufacturing and the possible applications of lab on a chip devices, mainly in the form of disposable fluidic microchips for life sciences applications. The new technology approach is based on a novel microscale thermoforming of thin polymer films as core process. The flexibility not only of the semi-finished but partly also of the finished products in the form of film chips could enable future reel to reel processes in production but also in application. The central so-called 'microthermoforming' process can be surrounded by pairs of associated pre- and postprocesses for micro- and nanopatterned surface and bulk modification or functionalisation of the formed films. This new approach of microscale thermoforming of thin polymer film substrates overlaid with a split local modification of the films is called 'SMART', which stands for 'substrate modification and replication by thermoforming'. In the process, still on the unformed, plane film, the material modifications of the preprocess define the locations where later, then on the spatially formed film, the postprocess generates the final local modifications. So, one can obtain highly resolved modification patterns also on hardly accessible side walls and even behind undercuts. As a first application of the new technology, we present a flexible chip-sized scaffold for three dimensional cell cultivation in the form of a microcontainer array. The spatially warped container walls have been provided with micropores, cell adhesion micropatterns and thin film microelectrodes.