THE SLIDING WALLS: A NEW TOOLBOX FOR MANUALLY-OPERATED MICROFLUIDIC

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Microfabrication – Manual actuation – Valves – Cell culture – Sample preparation

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1. Introduction

The fields of biology and biotechnologies are increasingly interested in microfluidics but spreading of this technology is still limited by the need of external equipment or by technical skills for fluidic operations and microfabrication. Manually-actuated microfluidics is a way to simplify the use of microfluidic systems [1-2]. However, only simple tasks could be manually performed; a versatile technology enabling manual change in channel configuration while being easily implemented in existing microfluidic design is still lacking. We propose the sliding wall technology as a new toolbox to answer this need while performing new operations.

2. Fabrication

A rigid structure is inserted inside a PDMS channel called guiding channel (see Figure 1). This channel intersects fluidic channels, and manual sliding of the rigid structure inside the guiding channel allows the modification of the fluidic network without any external equipment. Several materials and processes were successfully applied for the sliding wall microfabrication, including micro-milling of metallic sheet, soft lithography of NOA81 or stereolithographic 3D printing.

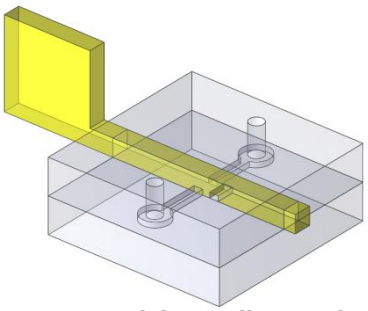

Figure 1: Sliding wall principle.

3. Applications

We have demonstrated a wide range of functionalities:

- ON/OFF valves and two-way valves withstanding up to 400 mbar.
- Manual sample loading and pumping with a minimal dead volume.
- Compartmentalization of large chambers for user-friendly 3D cell culture and migration assay of dendritic cells.
- Sample preparation with an electrophoretic preconcentration and purification of DNA.

References

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