Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Thin Polymer Films as Microvalves in Microfluidic Devices CLEMENCE VERGNE, FABRICE MONTI, PATRICK TABELING, UMR 7083 CNRS ESPCI, YVETTE TRAN, LUCIE DEVYS, UMR 7615 CNRS ESPCI, MMN TEAM, PPMD TEAM — We report on a novel technology allowing the integration of microvalves and micropumps in lab-on-a-chips made of either soft or hard materials. The approach is based on the grafting of responsive hydrogels onto the microchannel walls. These gels undergo large volume variations by absorbing or expelling water when subjected to external stimuli (here, temperature is used as the stimulus). The hydrogel thin films we study here are chemical polymer networks that are covalently bound to the surface. The first step of the elaboration of that valves is the development of the surface-attached hydrogel thin films. The objective is to obtain hydrogel films with a wide range of thicknesses. The second step is the completion of the microfluidic system by bonding a channel on the active surface. The polymer used is thermoresponsive, at room temperature the swollen gel forms a thick layer, measuring typically several micrometers. When the system is heated above the LCST (Low Critical Solution Temperature), the gel collapses, forming a submicrometric film. In this work we introduce two different applications. In the first situation, the gel layer constitutes a variable resistance. In the second situation the polymer entirely closes the channel after swelling, thus forming a valve.

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Date submitted: 14 Nov 2011 Electronic form version 1.4