Monolithic fabrication of glass suspended microchannel resonator for enhanced biosensing application

Monolithic fabrication of glass suspended microchannel resonator for enhanced biosensing application

Roberta Calmo[a], Andrea Lovera[b], Stefano Stassi[a], Alessandro Chiadò[a], Francesca Bosco[a], Carlo Ricciardi[a]

[a] *Department of Applied Science and Technology, Politecnico di Torino, Corso Duca degli Abruzzi 24, 10128 Torino, Italy*
[b] *FEMTOprint SA, Via delle Industrie 3, 6933Muzzano, Switzerland*

Key words: Monolithic fabrication, suspended microchannel resonator, biosensing

Resonating micromechanical structures have been recently developed as highly sensitive platform to study how drugs affect cells growth [1, 2, 3]. Unfortunately the time-consuming and challenging fabrication process [4] represents the main drawback for the implementation of these platforms in new point-of-care devices.
In this work, we present an innovative and rapid fabrication process, of totally transparent suspended microchannel resonator (SMR), based on the femtosecond laser direct writing [5]. By using this new approach it was possible to fabricate the resonant structure and the integrated microfluidic system in one-step (Figure 1a).
The SMR shows remarkable mass and density resolution (0.14 pg and 0.001 kg/m^3 respectively), comparable to state of art SMR silicon based sensors [6, 7]. These values were evaluated by the means of a calibration curve correlating the frequency response (Figure 1b) in function of the density of different fluids flushed inside the suspended microchannel. Once the device was mechanically characterized, the effective biosenging capability has been demonstrated by evaluating the microbial load of aqueous solutions containing different concentrations of *P. fluorescens*. The unique transparence of the SMR provides the opportunity of combining mechanical and optical characterizations for direct monitoring of bacteria activity and drug resistance.

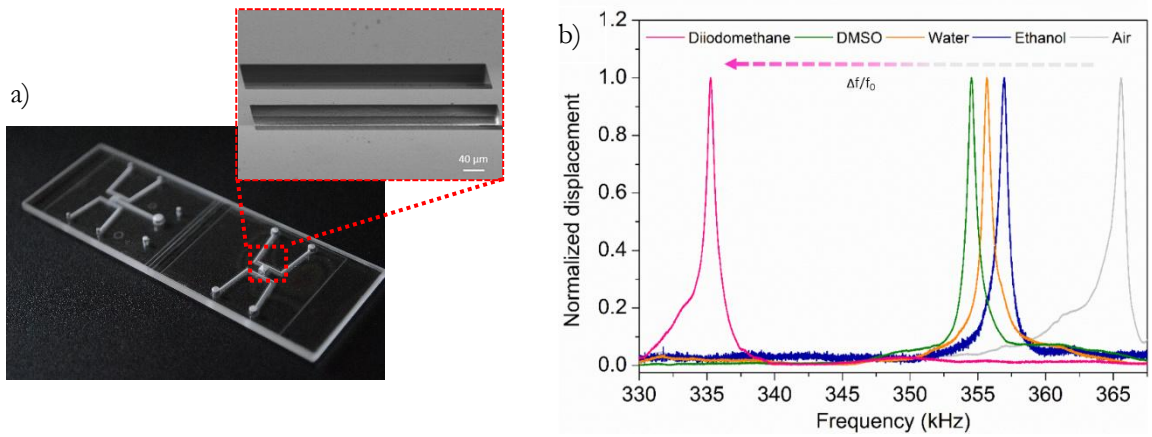

Figure 1: a) The SMR integrated with the microfluidic system; b) evaluation of the capability of the SMR to distinguish liquid characterized by different density.

References

[1] N. Cermak et al. Nature biotechnology, 2016, 34, 1052-1059
[2] J. Lee et al., Nano Letters 2010, 10, 2537–2542
[3] M.M. Stevens et al., Nature biotechnology, 2016, 34, 1161-1167
[4] T.P. Burg et al., Physical review letters, 2009, 102, 228103
[5] Y. Bellouard et al., Journal of Laser Micro / Nanoengineering, 2012, 7, 1-10
[6] M. F. Khan et al., Sensor and Actuators B:Chemical, 2013, 185, 456-461
[7] D. Lee et al., Scientific Reports, 2016, 6, 33799