Multifunctional coatings and innovative fabrication process for low voltage electrowetting on dielectric applications

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Electrowetting on dielectric (EWOD) based digital microfluidics is explored as a promising device to manipulate droplets by controlling the wetting behavior of liquids on the dielectric surfaces applying a voltage [1, 2].

In this work a study of EWOD actuations on coplanar electrodes under parallel configuration, fabricated with not expensive processes for low actuation voltage, is carried out.

To accomplish this aim the innovation on processes and the use of multifunctional coatings has been developed:

(i)Starting from a conductive layer of 100nm of ITO deposited by sputtering, the electrodes have been designed and fabricated by using laser ablation instead of photolithography, with the advantage of the speed of this process. The electrodes have been designed with a gap of 50nm between them.

(ii)A unique low cost layer, developed by sol-gel technology, based on silica precursors (TEOS/MTES) under acid catalysis, which meets both properties dielectric and hydrophobic, has been developed. This reduces the manufacturing time (from a bilayer, usually PMMA and Teflon to only one) besides lowering the price of the device.

The device has been tested with a nonaqueous droplet (Ethylene glycol as solvent and sodium dodecyl sulfate as surfactant 0.1%) [3] and its movement takes place at low voltage as it can be seen in Figure 1.

References

[1] Junghoon Ledd, Hyejun Moon, Jesse fowler, Thomas Schoellhammer, Chang- Jin Kim. Sensors and Actuators A95 (2002) 259-268
[2] Xu. Xiaowei, Zhang Yuliang, Sun Lining, Chinese Journal of Physics, 56 (2018) 2887-2896
[3] Debalina Chatterjee, Boonta Hetayothin et al. Lab chip, 6(2006)199-206

Figures

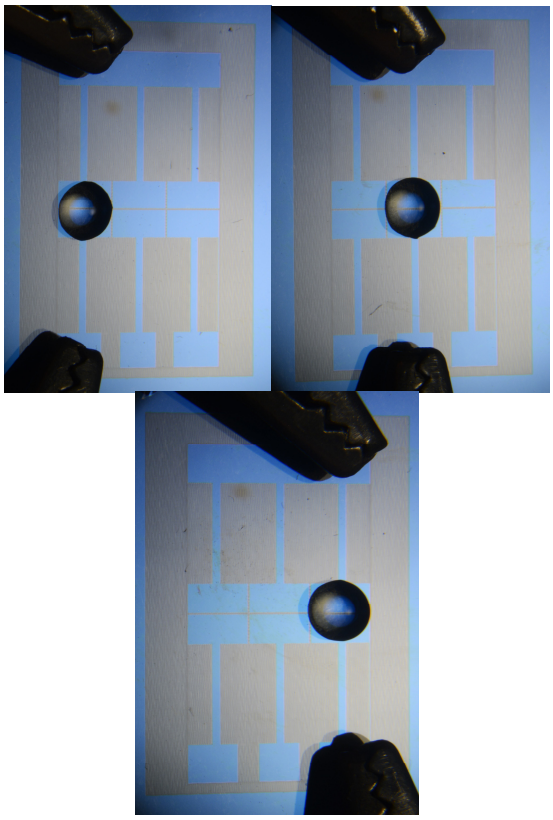

Figure 1: EWOD droplet movement after applying a voltage