INTEGRATION OF AMORPHOUS SILICON PHOTOSENSORS WITH AN ELECTROWETTING-ON-DIELECTRIC SYSTEM

Y. Antonacci[1], D. Caputo[1], G. de Cesare[1], A. Nascetti[2], R. Scipinotti[1]
[1]Department of Information Engineering, Electronics and Telecommunications, University of Rome "La Sapienza", Via Eudossiana 18 - 00184 Roma
[2]Department of Astronautics, Electrical and Energy Engineering, Sapienza University of Rome, Via Salaria 851/881 - 00138 Roma

Electrowetting-On-Dielectric (EWOD) is an emerging technology for the handling of fluid droplets in Lab-on-Chip (LoC) systems as alternative to continuous flow microfluidics. It allows the handling of droplets (movement, splitting, merging) and is also defined as digital microfluidics (DMF). It relies on the ability to vary the contact angle of an electrically conductive liquid droplet on a hydrophobic surface by means on an external electric field.
In this paper, we present the integration on a single glass substrate of an EWOD device and an array of amorphous silicon (a-Si:H) photosensors for the achievement of a compact LoC with on-chip detection.
The EWOD device, deposited on one side of the glass substrate, is constituted by a linear array of electrodes covered by a 1μm-thick PolyDimethylSiloxane (PDMS) layer. This film acts both as dielectric and hydrophobic material, simplifying the fabrication process.
The a-Si:H photosensors, deposited on the other side of the glass substrate, are aligned with the EWOD electrodes and their role is to detect optical signals associated to luminescent phenomena occurring in liquid droplets. The on-chip detection, achieved by coupling the a-Si:H photosenors with the digital microfluidics, maximizes the sensitivity of the system due to both the small distance between the site where the luminescence occurs and the photosensor as well as to the focusing effect provided by the small drop of liquid.
The fabrication procedure of the entire LoC has been designed and optimized to keep the functional compatibility of the different technological steps.
Experimental results obtained moving forward and backward a water droplet over an EWOD electrode and monitoring the current signal of the corresponding photosensor demonstrate the successful system operation and the overcoming of all the integration issues.