A printed heater for the rapid drying of inkjet biosensors using consumer printers

G. G. Dalkiranis[1,2,*]
M. Urban[2], G. Rosati[2,*], G. Maroli[2] and A. Merkoçi[2,3,*]
[1]*São Carlos Institute of Physics, University of São Paulo, P.O. Box 369, 13560-970 São Carlos, SP, Brazil.*
[2]*Catalan Institute of Nanoscience and Nanotechnology (ICN2), Edifici ICN2, Campus UAB, 08193, Bellaterra, Barcelona, Spain.*
[3]*ICREA Passeig Lluís Companys 23 08010 Barcelona, Spain*.
dalkiranis@gmail.com
giulio.rosati@icn2.cat
arben.merkoci@icn2.cat

The academic and industrial community have devoted and are currently devoting important efforts to diagnose diseases quickly, easily and with a low cost. Biosensors have an important role in this direction, since they can swiftly detect biological compounds at the point of care. An increasingly popular method to fabricate biosensor is inkjet printing, reducing the cost and fabricating devices with high reproducibility out of the cleanroom. In this context, the use of consumer printers to fabricate biosensors have been widely explored in the last years. However, a pre-treatment of the substrate surface using a coating material or/and a primer solution typically needs to be performed. A method to potentially avoid it and tune the ink adhesion properties, is to heat up the substrate surface during the printing. Therefore, in our work we designed and fabricate a heater to dry the printed ink in real-time, during the printing. We optimized the design of the heater using finite element modelling and we printed it with a conductive silver nanoparticles (AgNPs) ink by an EPSON XP1500. Temperature measurements demonstrated that the heater surface could reach up to 95 °C, this value was limited by the heater substrate. With the use of the heater, placed inside the printer, AgNPs electrodes were printed onto several flexible substrates such as PET, Kapton and paper, without the need of a coating material and/or a primer solution application. Microscopic imagens showed the difference between the process with and without the heater. Furthermore, the heater itself is produced by the same printer, thus allowing for its acquisition and installation at no cost.

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