

Nanobiosensors school: Inkjet printing for ubiquitous ultra-fast and low cost electrochemical biosensors fabrication

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Biosensors fabrication should guarantee high performances and reliability, low variable costs and possibly low investment. Furthermore, the recent pandemic showed us the increasing need of decentralized (virtually ubiquitous) production.

Inkjet printing with nanofunctional inks and office-like equipment have these characteristics, as will be showed in the tutorial which will be presented at the school on nanobiosensors.

Indeed, inkjet printing of metallic nanoparticles-based inks with consumer printers on flexible semipermeable substrates offers the opportunity for easy, one step, and affordable production of flexible electronic devices with a nice control in resolution and on the electrical properties of the printed structures.

The addition of hydrophobic layers, for example by wax printing, can effectively passivate the semipermeable layer for electrochemical measurements in contact with electrolyte solutions (avoiding imbibition and parasitic currents between the printed electrodes).

Finally, the encapsulation of the obtained devices with patterned lamination pouches or biadhesive sheets permit obtaining complete electrochemical flexible sensors even with microfluidic channels.

Functionalization of these devices can space between standard approaches such as using antibodies and thiolated aptamers, and more advanced nanobiotechnological approaches such as using nanoswitching labelled aptamers or CRISPR/Cas enzymes.

Last but not least, the readout of these devices can be performed with portable and wireless systems, including but not limited to smartphone sensing through the audio and microphone channels, low-energy Bluetooth modules connected to integrated potentiostat chips, and RFID capacitive, resistive and electrochemical biosensing systems.