Laser Induced Forward Transfer technique for the immobilization of biomaterials

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Abstract:

Laser Induced Forward Transfer (LIFT) is a direct write technique, able to create micropatterns of biomaterials on sensing devices. In this conference we will present a new approach of using LIFT technique for the printing and direct immobilization of biomaterials on a great variety of surfaces, for bio-sensor applications. In our approach, we use LIFT technique for the direct immobilization of biomaterials, either by physical adsorption or by covalent bonding. The physical adsorption of the biomaterials, occurs on hydrophobic or super-hydrophobic surfaces, due to the transition of the wetting properties of the surfaces upon the impact of the biomaterials solution with high velocity. The unique characteristic of LIFT technique to create high speed liquid jets, leads to the penetration of the biomaterial in the micro/nano roughness of the surface, resulting in their direct immobilization and avoiding any chemical functionalization layer. In this conference we will present the direct immobilization of enzymes and proteins on Screen Printed Electrodes (SPEs), for the fabrication of electrochemical biosensors able to detect phenolic compounds and herbicides. For the enzymatic biosensor, used for the detection of phenolic compounds, the observed LOD for catechol was 150 nM, while for the protein biosensor, used for the detection of herbicides, the observed LOD was 8-10 nM. Moreover, regarding the covalent immobilization of biomaterials, we will present the direct immobilization of thiol modified aptamers, on alkene and alkyne modified Si_3N_4 surfaces, by laser-mediated "click chemistry" reactions, where a laser pulse is used both for the printing and the photo-activation of the aptamers that react with the alkene/yne surfaces by thiol-ene/yne reactions. This approach effectively combines the classical benefits of click reactions with the advantages of a photoinitiated process, which can be activated at specific times and locations, resulting in a powerful method for chemical immobilization of biomaterials.