Rapid prototyping of 3D Organic Electrochemical Transistors by composite photocurable resin

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Rapid Prototyping (RP) promises to induce a revolutionary impact on how the objects can be produced and used in industrial manufacturing as well as in everyday life. Over the time a standard technique as the 3D Stereolithography (SL) has become a fundamental technology for RP and Additive Manufacturing (AM), since it enables the fabrication of the 3D objects from a cost-effective photocurable resin. Efforts to obtain devices more complex than just a mere aesthetic simulacre, have been spent with uncertain results. The multidisciplinary nature of such manufacturing technique furtherly hinders the route to the fabrication of complex devices. A good knowledge of the bases of material science and engineering is required to deal with SL technological, characterization and testing aspects. In this framework, our study aims to reveal a new approach to obtain RP of complex devices, namely Organic Electro-Chemical Transistors (OECTs), by SL technique exploiting a resin composite based on the conductive poly (3,4-ethylenedioxythiophene): polystyrene sulfonate (PEDOT:PSS) and the photo curable Poly(ethylene glycol) diacrylate (PEGDA). A comprehensive study is presented, starting from the optimization of composite resin and characterization of its electrochemical properties, up to the 3D OECTs printing and testing. Relevant performances in biosensing for dopamine (DA) detection using the 3D OECTs are reported and discussed too.