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Light-Responsive PEDOT:PSS- based blend with dynamic properties for bioelectronic applications

Ottavia Bettucci[1], Federica Corrado[1], Mirko Prato[1] and Francesca Santoro [2]
[1]*Center for Advanced Biomaterials for Healthcare, Tissue Electronics, Istituto Italiano di Tecnologia, Naples, Italy*
[2] *Materials Characterization Facility, Istituto Italiano di Tecnologia, Genoa, Italy*

One of the main challenges in bioelectronics is the enhancement of the physical and electrical coupling between cells and electronic devices to ensure stability and adequate cross-talk over time [1]. This is mainly achieved by designing active electrodes to resemble biomimetic features of cells and extracellular matrix (ECM) and enable recognition sites for cells to ultimately seamless integrate with the synthetic electronic peer[2]. This is particularly relevant considering that the cell-ECM environment is highly dynamic and thus electronic devices should adapt to this continuous environmental change and simultaneously preserve their electronic performance[3]. In addition, recently inorganic electronic materials have been successfully paired by conductive polymers (CPs) in order to overcome well-known limitations such as stiffness, biocompatibility and transduction mechanisms at the interface with biological systems [4]. Among CPs, poly(3,4-ethylenedioxythiophene):poly(styrene sulfonate) (PEDOT:PSS) is one of the most used in bioelectronics due to its high conductivity, biocompatibility and stability in biological environment [5]. However, to date, the engineering of CPs does not provide dynamicity.
To reach this goal a novel dynamic PEDOT:PSS with azobenzenes moieties has been synthesized to combine the conductivity of PEDOT:PSS and the photo-switching mechanism of azobenzenes in a unique light-responsive conductive polymer [6].The azobenzene functionalized PEDOT (**azo-tz-PEDOT:PSS)** by surface post-functionalization *via* Huisgen [3+2] azide-alkyne cycloaddition with alkyne-bearing azobenzenes moiety[7] (Fig.1). Here the attachment of azobenzene moieties on the film surface is characterized by means of infrared spectroscopy and x-ray photoelectron spectroscopy (**XPS**). The morphological characterization of the desired product is carried out through atomic force microscopy (**AFM**) and scanning electron microscopy (**SEM**) analyses. Meanwhile, the electrochemical characterization is performed through Electrochemical impedance spectroscopy (**EIS**) and cyclic voltammetry (**CV**) measurements. Such new material has been used for the fabrication of a PEDOT:PSS-based OECT bearing a light modulable planar gate made with a photo-responsive PEDOT:PSS.

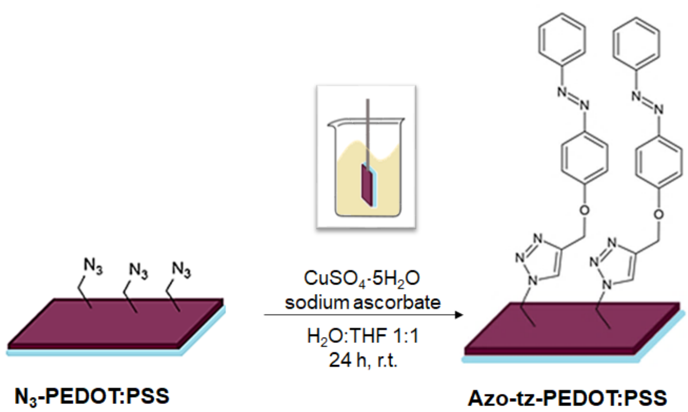

Fig. 1. Post functionalization of PEDOT:PSS through click chemistry reaction

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