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# Innovative Engineered Sensors Based On Silica, Silver Nanoparticles and Titania with Self-Cleaning Features

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## Extended Abstract

Passivation of the electrode surface and fouling are important challenges in electroanalysis during the use of modified electrodes in complex matrices, especially in the biomedical and environmental fields (Soliveri et al., 2015). The production of highly engineered devices, ad hoc designed for specific applications, could overcome such problems, accessing really effective sensors. A performing, reliable and reusable sensor that could be cleaned by a simple irradiation with UV or solar light would perfectly match this goal.

In this context, a three-layered transparent electrode, in which silver nanoparticles are embedded between a bottom silica and a top titania layer (Maino et al., 2013 and Welch and Compton, 2006), was developed. Such structure confers to the device multifunctional properties for a complex biomedical challenge: the detection and quantification of catecholamine neurotransmitters. The sensor was thoroughly investigated in order to understand the role of each component with the aim of making the device a robust and efficient electroanalytical system.

The overlayer was made of anatase (the active polymorph of titanium dioxide) as confirmed by X-ray diffraction and by measuring the photodegradation of model contaminants. The size distribution of silver nanoparticles, the device architecture and surface homogeneity were inspected by electron microscopy. Electrochemical techniques (cyclic voltammetry and electrochemical impedance spectroscopy) revealed that a highly ordered distribution of silver nanoparticles constitutes the active core of the device, allowing easier electron transfer and better quantification of the analytes even in the presence of conventional interferents, *e.g.* ascorbic and uric acid. Titania photoactive top layer allowed total recovery of the device performance in terms of sensitivity after a fast and simple UV-A cleaning step, affordable with different UV sources. This self-cleaning property, combined with a remarkable resistance against aging and ease of use, allows to employ the sensor also in on-field and remote applications.

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