ELECTROCHEMICAL H_2O_2 SENSORS BASED ON Pd and Cu NANOSTRUCUTERS

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In the last decades, with the fast improvement of electronics, the field of sensors is highly expanding. The basic idea of sensors is to detect something and then trigger a corresponding action. This simple, but very important, concept can be used in different fields: from chemical industries to farms, from the environmental monitoring [1] to a point of care analysis [2]. Currently, talking about sensing of chemical species, different techniques are used, such as Atomic Absorption Spectroscopy (AAS), Graphite Furnace Atomic Absorption Spectroscopy (GFAAS), Inductively Coupled Plasma Mass Spectroscopy (ICP-MS), IR spectroscopy, redox titration and so on. Despite they are highly efficient in terms of sensitivity, selectivity, Limit Of Detection (LOD) and accuracy they have different drawbacks: first of all, are extremely expensive for both equipment and operational costs, require highly skilled personnel, are time consuming and, above all, are just laboratory techniques so can't be used as in situ and real time analysis. Taking advantage of brilliant attributes, such as, portable, simple to develop, the use-friendliness, economical, miniaturized dimensions, in recent years, many researchers are working on electrochemical sensors based on nanostructures and/or nanomaterials. Electrochemistry provide a wide range of applications for the detection of chemical targets depending on the technique that is used.
In this work, ordered array of Pd and Cu nanowires was obtained through a displacement deposition reaction in a commercial polycarbonate membrane and used as an electrochemical sensor of hydrogen peroxide. Detection of hydrogen peroxide is very important in several fields because, owing to its oxidizing and reducing properties, this compound is widely used for treatment of waste water, paper and contaminated soil and also in medical applications 'cause his concentration can be related to the glucose concentration in the blood. Hydrogen peroxide detection, trough chronoamperometry, occurs due to a redox reaction that happen at the electrode/electrolyte interface. Consequently, the higher is the surface area the better will be the features of the sensor. This is the reason why we choose to use a nanostructured electrode. The nanostructured electrodes were obtained by a two steps methods that permit to obtain very stable nano-electrodes of Pd and Cu with a very high surface area. We carried out selectivity tests against four different species, accuracy tests obtaining very high selectivity with a good accuracy and a low LOD in a very wide linear range (Figure 1 and Table 1).

References
[1] Ming Li, Nanostructured Sensors for Detection of Heavy Metals: A Review, ACS Sustainable Chem. Eng., 2013, 1 (7), pp 713–723
[2] Z. Dai, F. Yan, H. Yu, X. Hu, H. Ju; Novel amperometric immunosensor for rapid separation-free immunoassay of carcinoembryonic antigen; Journal of immunologiacal Methods, Apr 2004, 287 (1), 12-20

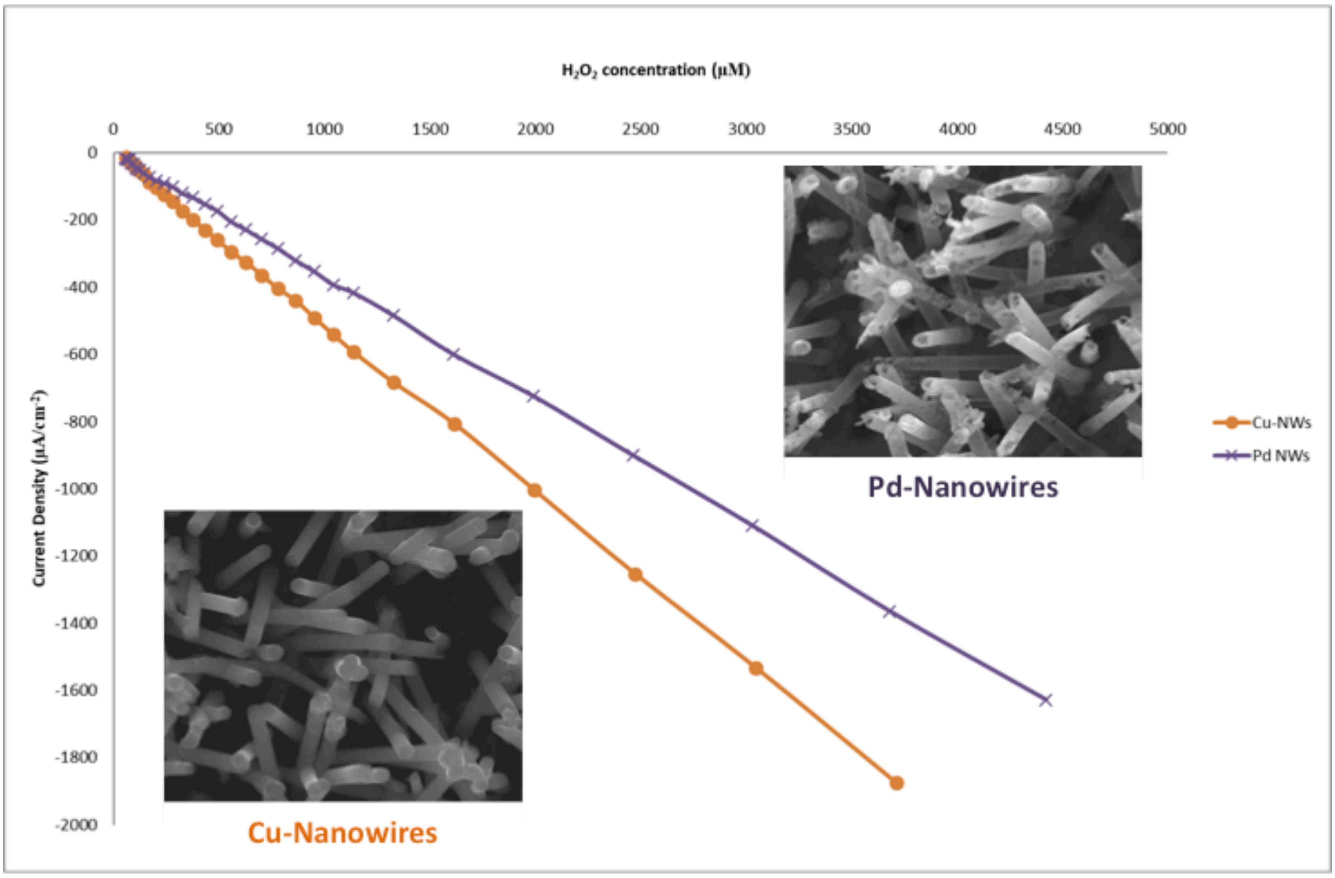

Figure 1. Calibration lines of Pd and Cu nanowires, obtained by galvanic deposition, as electrochemical sensor for the detection of hydrogen peroxide. The insets show the morphology of Pd and Cu nanowires.

Table 1. Main feature of Cu and Pd nanowires electrodes, obtained by galvanic deposition, as electrochemical sensor for the detection of hydrogen peroxide.

Sample	**Linearity range (µM)**	**LOD (µM)**
Cu NWs	61-3700	13.8
Pd NWs	53-4400	13.3