SILVER NANOWIRE SENSOR FOR SENSITIVE AND RAPID DETECTION OF H_2O_2

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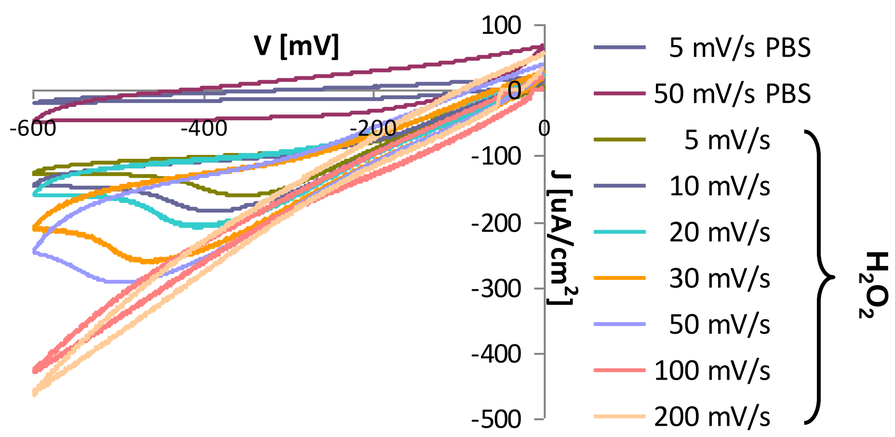
With the development of nanotechnology and the miniaturization of devices, it is a great need to develop sensitive, selective and compact in size sensors as modern diagnostic devices. Recently, a lot emphasis in the medical and environmental sectors was put on creating hydrogen peroxide sensors. Hydrogen peroxide plays a significant role in the pharmaceutical, chemical and food industries [1]. Conventional methods of detection of H_2O_2 are not able to meet many requirements posed to them, including speed, reliability and ease of implementation. Alternative electrochemical methods are characterized by good performance, high sensitivity and relatively low production costs. Especially, high selectivity and sensitivity methods seem to be most suitable for the determination of hydrogen peroxide [2]. In real samples, such as biological fluids, there are electroactive interfering substances such as ascorbic acid (AA), uric acid (UA) and acetaminophen (AP) that may generate electricity and thus interfere with the detection of hydrogen peroxide.

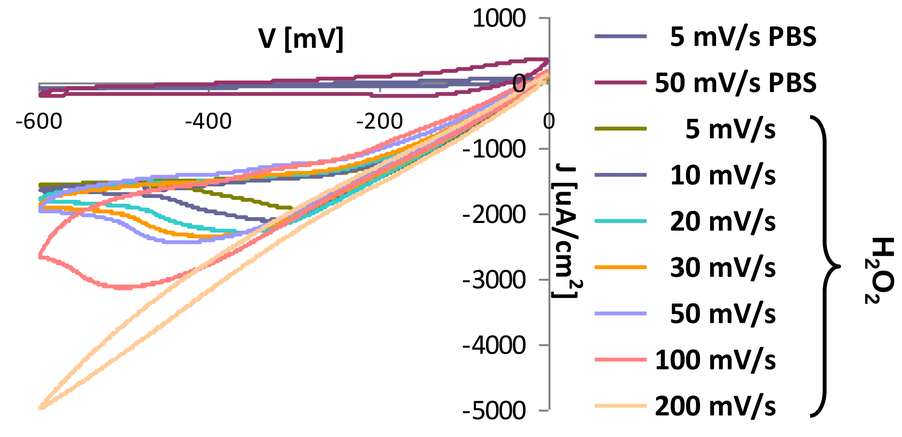
Nanostructured electrochemical H_2O_2 sensor was prepared by cathodic electrodeposition of silver inside nanoporous anodic aluminum oxide (AAO) templates. AAOs were synthesized via a simple and cost-effective two-step anodization of aluminum. After a suitable treatment, free standing Ag nanowire arrays were obtained and investigated as amperometric sensors for the detection and determination of hydrogen peroxide in the presence of interfering substances such as glucose and ascorbic acid. Typical electrochemical techniques, including cyclic voltammetry and chronoamperometry were applied for examination of nanostructured sensors. The CV tests were used to select an appropriate potential for the reduction of hydrogen peroxide. The chronoamperometric measurements carried out in a phosphate buffer solution (pH 7.4) were used to study the response of electrochemical sensors to different concentrations of the analyte.

Results for Ag nanowires obtained by two step anodization in solutions:

H_2SO_4 or $H_2C_2O_4$

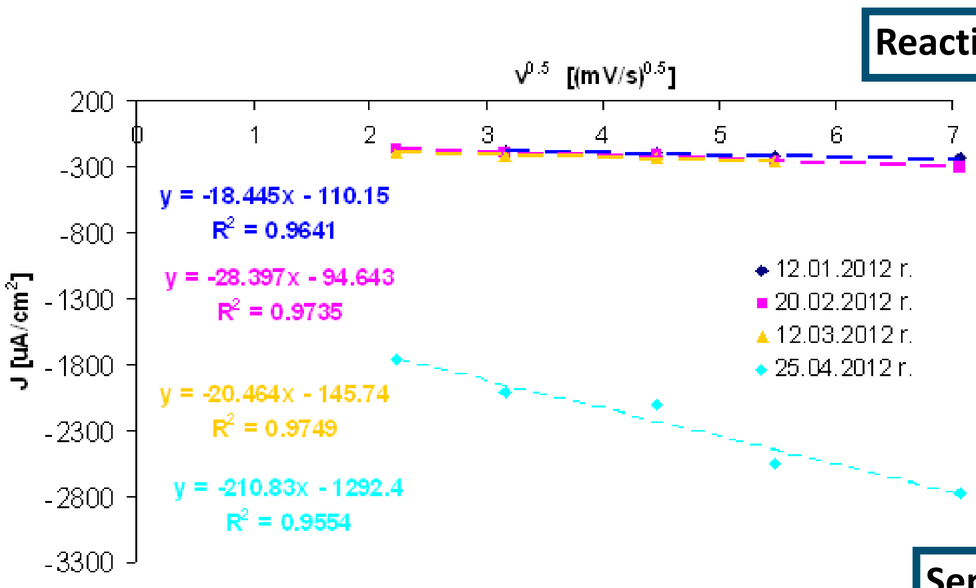
Cyclic voltamperograms of Ag nanowires electrode recorded in PBS in the absence and presence of H_2O_2 at different scan rates: 5, 10, 20, 30, 50, 100, 200 mV/s.

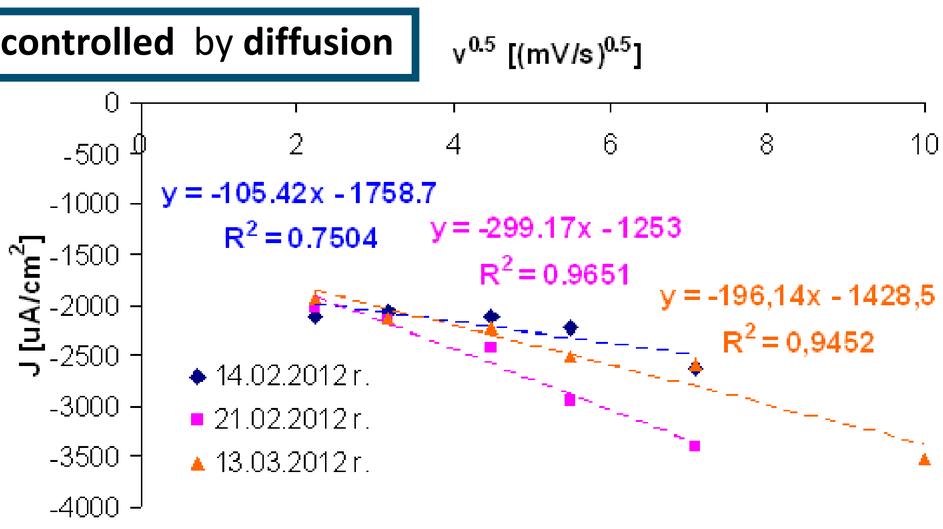




Reaction controlled by diffusion

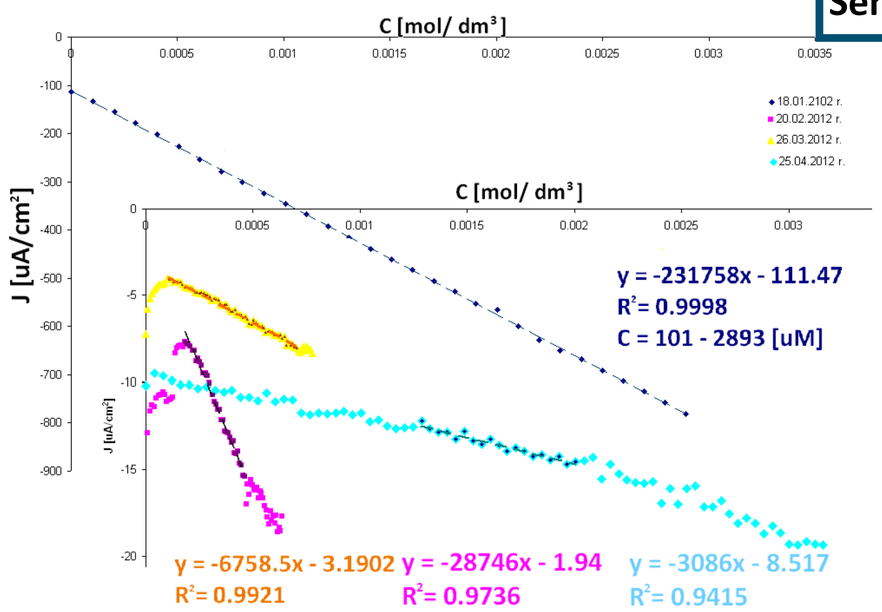
Plots of peak current density vs. square root of scan rate.

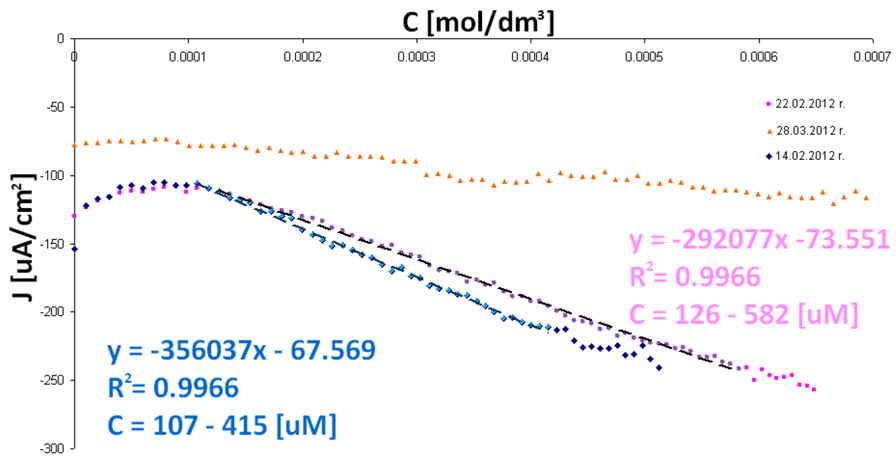




Sensor stability in time

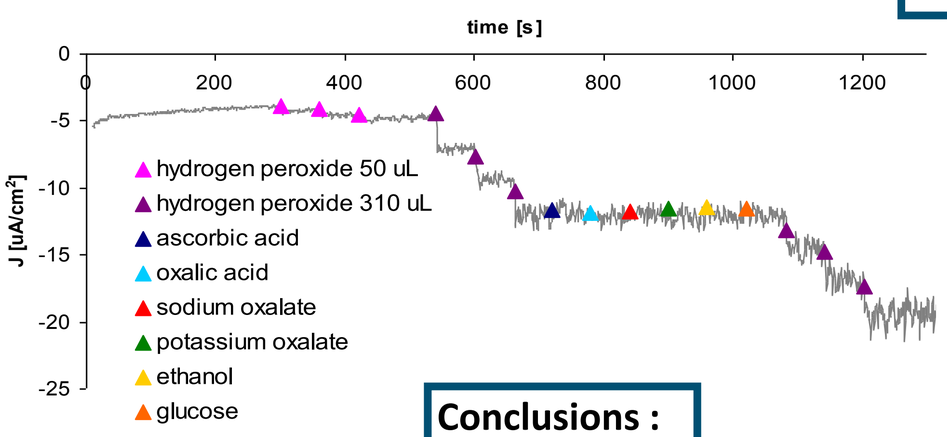
Dependences between current density and H_2O_2 concentration .

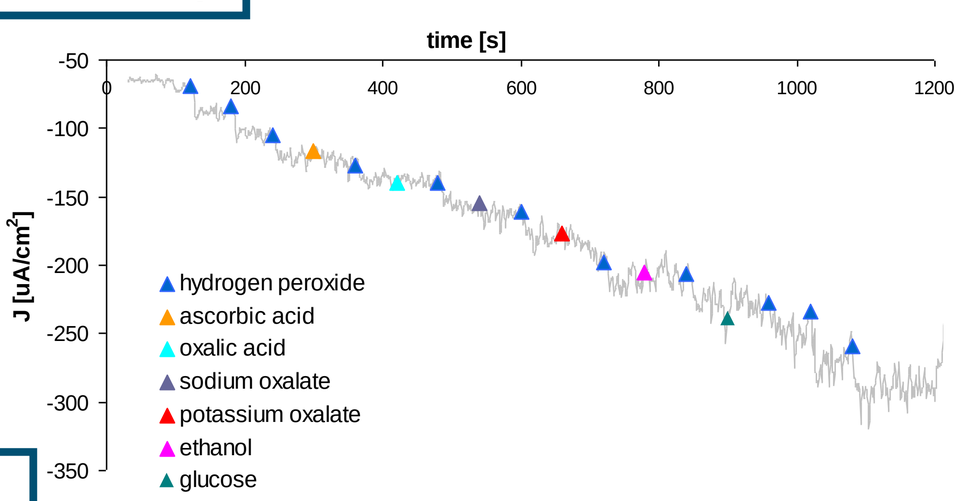




Interference study

Amperometric response of sensors at -0.2 V vs. SCE to successive additions of H_2O_2 and interfering substances.





Conclusions :

- **The electrode reaction is controlled by diffusion of electroactive species**
- **Prepared sensors are relatively stable in time**
- **The presence of common compound (e.g. glucose) in solutions do not interfere the determination of H_2O_2**

Reference

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[2] X. Liu, Y. Xu, X. Ma, G. Li, Sens. Actuators B, 2005 (106) 284–288

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