ВОЛТАМЕТРИСКИ СЕНЗОРИ ЗА ДЕТЕКЦИЈА НА ВОДОРОД ПЕРОКСИД

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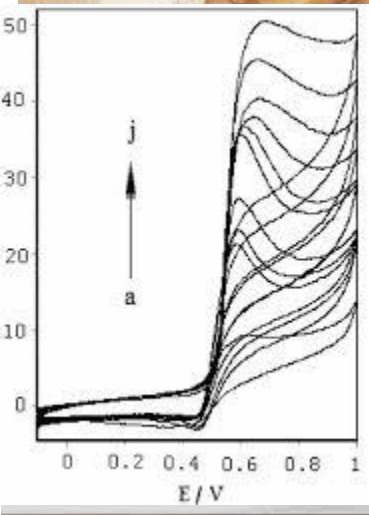
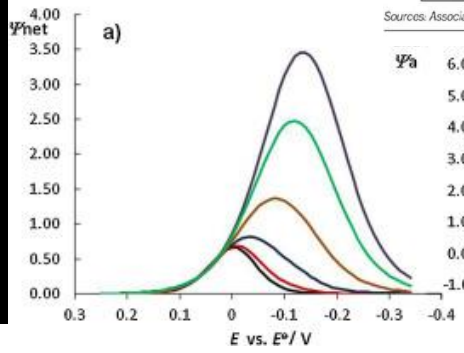
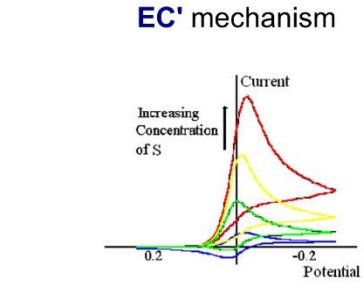
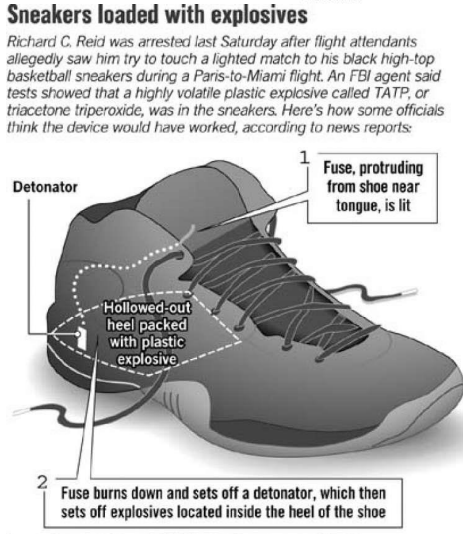
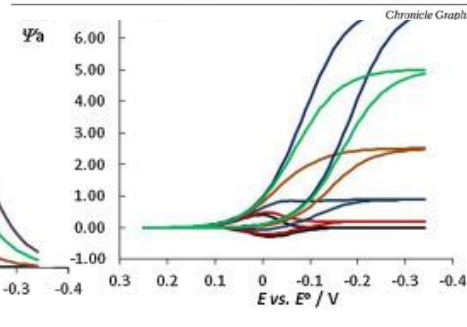




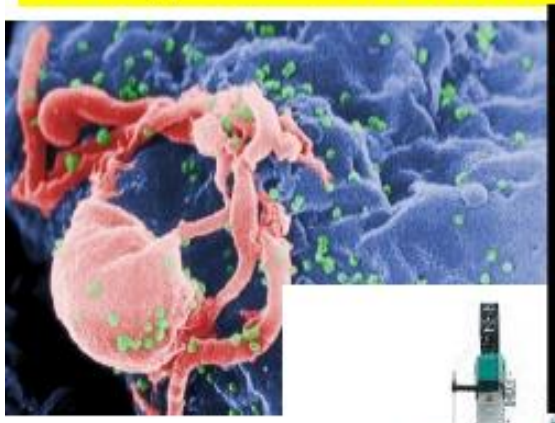


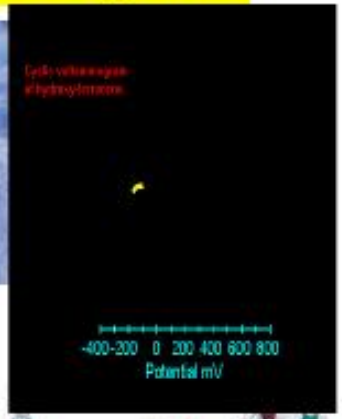




AIDS CURED!

...by Voltammetry!!!





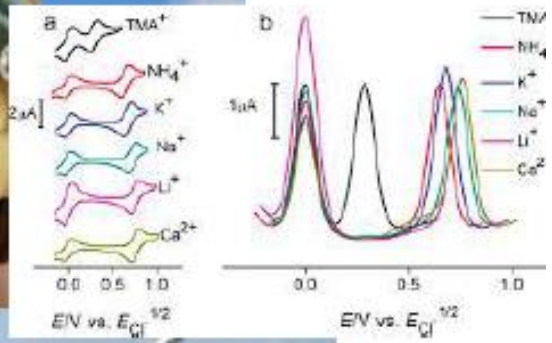
Two Macedonian Scientists

Together with

D-r Kim Jong Un have

Explored Voltammetry to

Tackle AIDS and Ebola at once



That was to be expected...

Gulaboski, Mirceski and

Kim Jong Un have

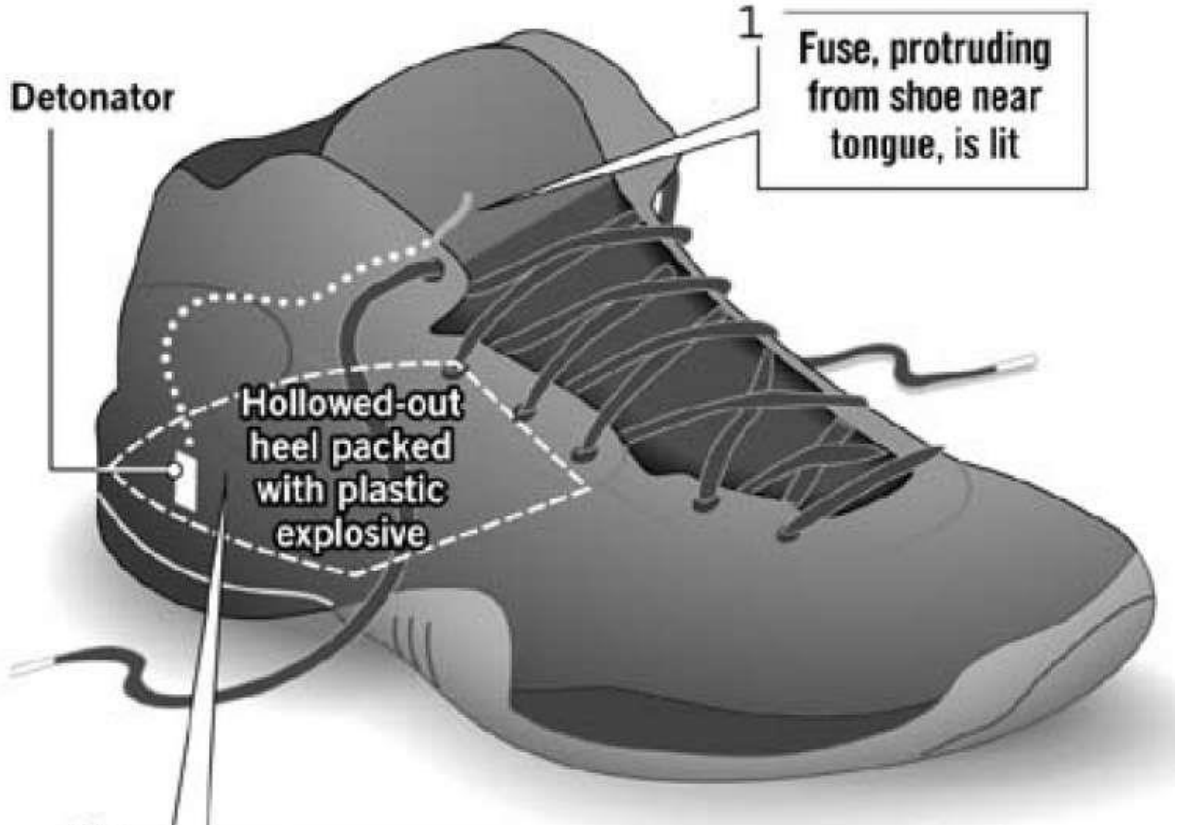
Explored Voltammetry to

Build an Atomic Bomb

- First Atomic Bomb Used – Uranium
- Detonated over Hiroshima Aug. 6, 1945
- Weighs 9,000 pounds

Sneakers loaded with explosives

Richard C. Reid was arrested last Saturday after flight attendants allegedly saw him try to touch a lighted match to his black high-top basketball sneakers during a Paris-to-Miami flight. An FBI agent said tests showed that a highly volatile plastic explosive called TATP, or triacetone triperoxide, was in the sneakers. Here's how some officials think the device would have worked, according to news reports:



Sources: Associated Press, MSNBC, The Guardian newspaper (Britain)

Chronicle Graphic

2009 "UNDERPANTS BOMBER" PLOT

The Obama administration said on Monday that authorities in the Middle East recently seized an underwear bomb which had design features which were somewhat more sophisticated than a bomb used in two attempted attacks in 2009

Dec. 25, 2009

Northwest Airlines
Airbus
A330-300

◄ *Exit*
G *Galley*
T *Toilet*

Economy class

2
SEAT 20J
Passenger notices smoke and dives across to restrain Abdulmutallab

19A

Economy class

Business class

Seat 19A

1 Nigerian Umar Farouk Abdulmutallab tries to detonate a bomb which is stitched inside his underwear after covering himself with a blanket

Explosives
Around 80g of PETN in a 15cm package stitched into underwear

Syringe
Filled with chemicals to detonate explosives

Blanket

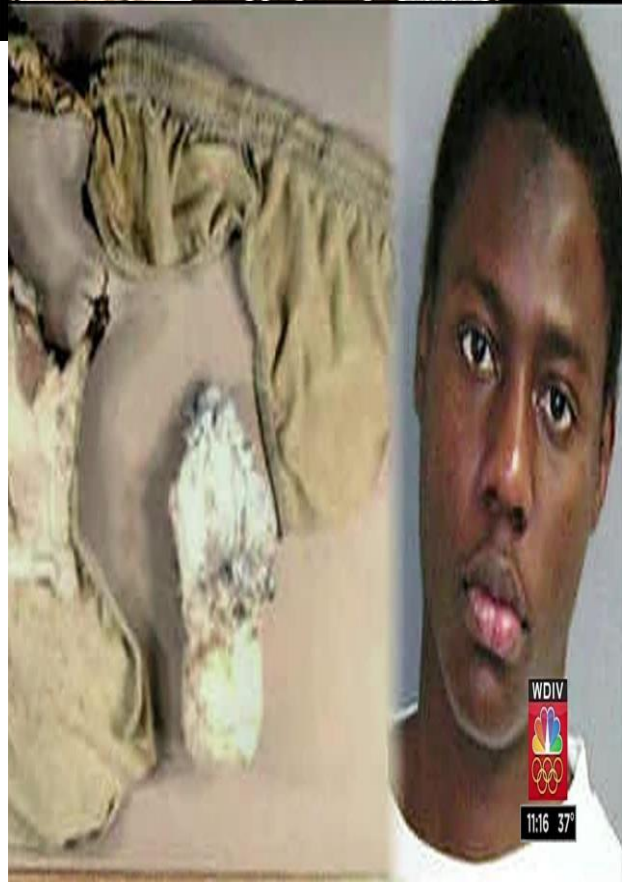
3 The passenger and a flight attendant move to the front row where he is secured. Meanwhile a team of flight attendants extinguish the flames at his seat

PETN

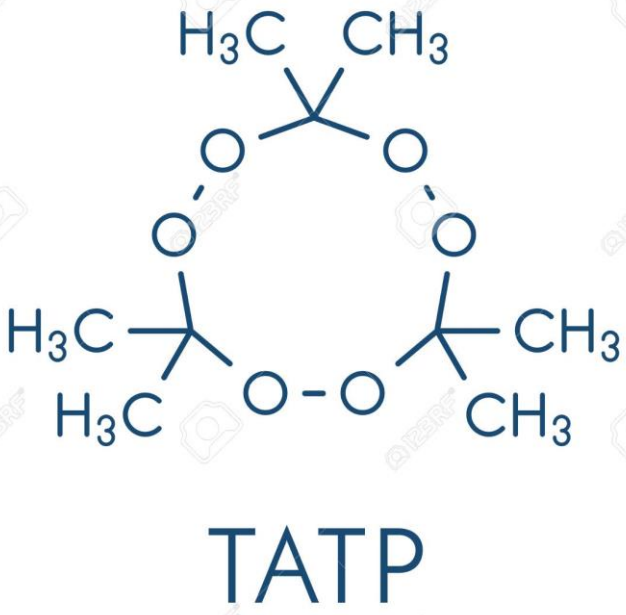
- Also known as pentaerythritol
- Aug. 27, 2009 - a man with a bomb in his underwear tried to attack Prince Mohammed bin Nayef, a senior Saudi Arabian counter-terrorism official

Source: FBI

REUTERS



Paris Attack in 2015
-130 victims
Suicide bomber
wore SHOES filled with
Triacetone-Triperoxide
, or TATP



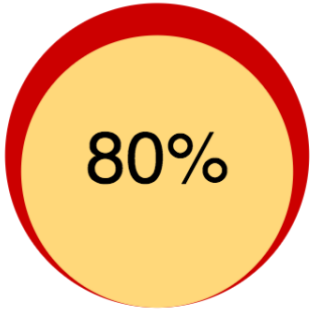
TATP

Triacetone triperoxide (TATP)

Can be made with

Nail Polish Remover

Hydrogen Peroxide



the strength of TNT

Cannot be detected with conventional TSA equipment

Was also used in 2015 Paris attacks

(U//FOUO) General information on TATP

(U//FOUO) TATP Hazards:

— (U//FOUO) Extremely sensitive to impact, friction, static/sparks, and heat.

— (U//FOUO) May react violently to illegal-drug field testing if large amounts are tested at once.

(U//FOUO) Key Identifiers:

— (U//FOUO) Crystals or powder

— (U//FOUO) Colorless or white

— (U//FOUO) Fruity smell; old TATP smells like bad vinegar.

— (U//FOUO) May be stored in refrigerator or freezer.

(U//FOUO) Chemical Components:

— (U) Acetone (nail polish remover, paint remover)

— (U) Acid (sulfuric, nitric, hydrochloric)

— (U) Hydrogen peroxide

(U//FOUO) Lab Equipment:

— (U) Glassware

— (U) Distillers

— (U) Mixers

— (U) Ice Bath

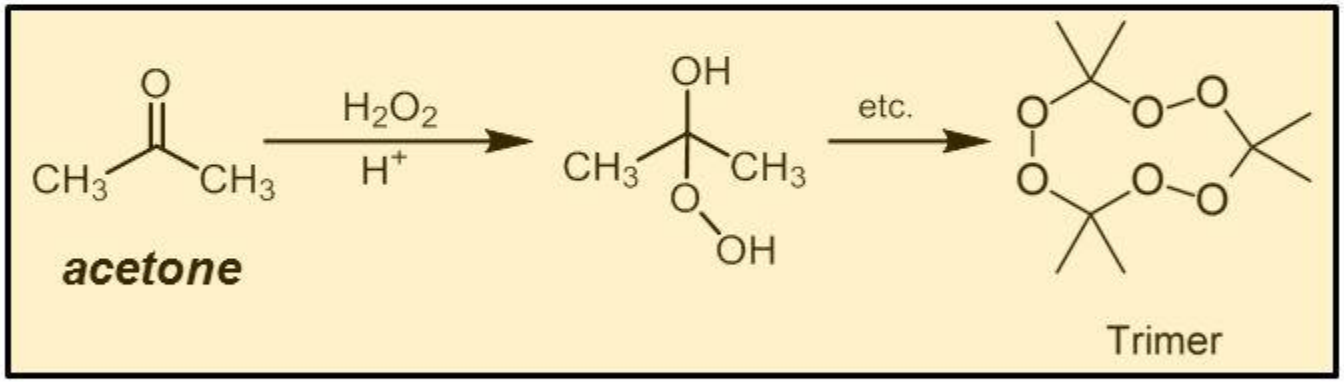
— (U) Filters

(U//FOUO) Photo of fine TATP.

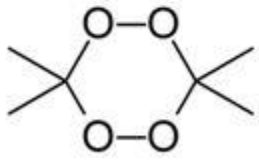
(U//FOUO) Photo of crude TATP.

TATP ("*triacetone triperoxide*")

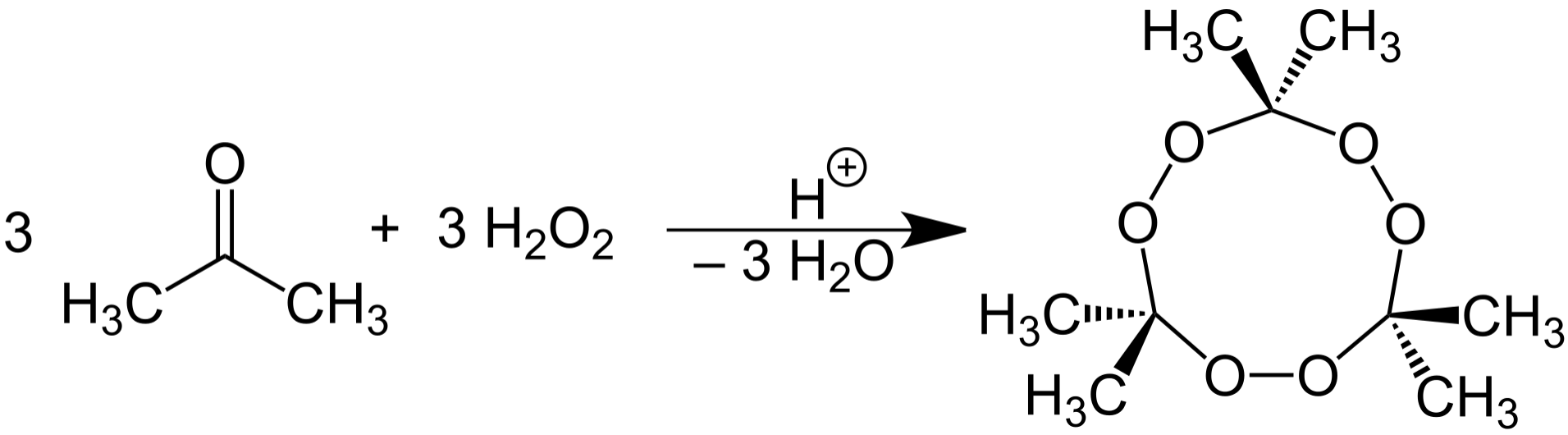
1. One of the most unstable of explosives
2. Readily made from acetone (ADDITION of hydrogen peroxide)
3. Commonly used by terrorists; difficult to detect
4. Explosive used in the London subway bombings (July 7, 2005)



White crystalline powder with bleach odour



Dimer



BUT…..Hydrogen peroxide (H2O2) is a synthetic precursor and degradation product of peroxide-based explosives, such as TATP.

The substrate: hydrogen peroxide

- Hydrogen peroxide is toxic to cells
  - Produced as a waste product during the reactions that occur in the body.
- Body needs way to remove it quickly so cells don't die
  - H_20_2 ---> $H_2O + O_2$. The products water and oxygen are not harmful.
  - Body can remove it quickly with enzyme called CATALASE. CATALASE changes H_20_2 into water and oxygen.

H2O2 може да биде и ОКСИДАЦИСКО и РЕДУКЦИСКО СРЕДСТВО

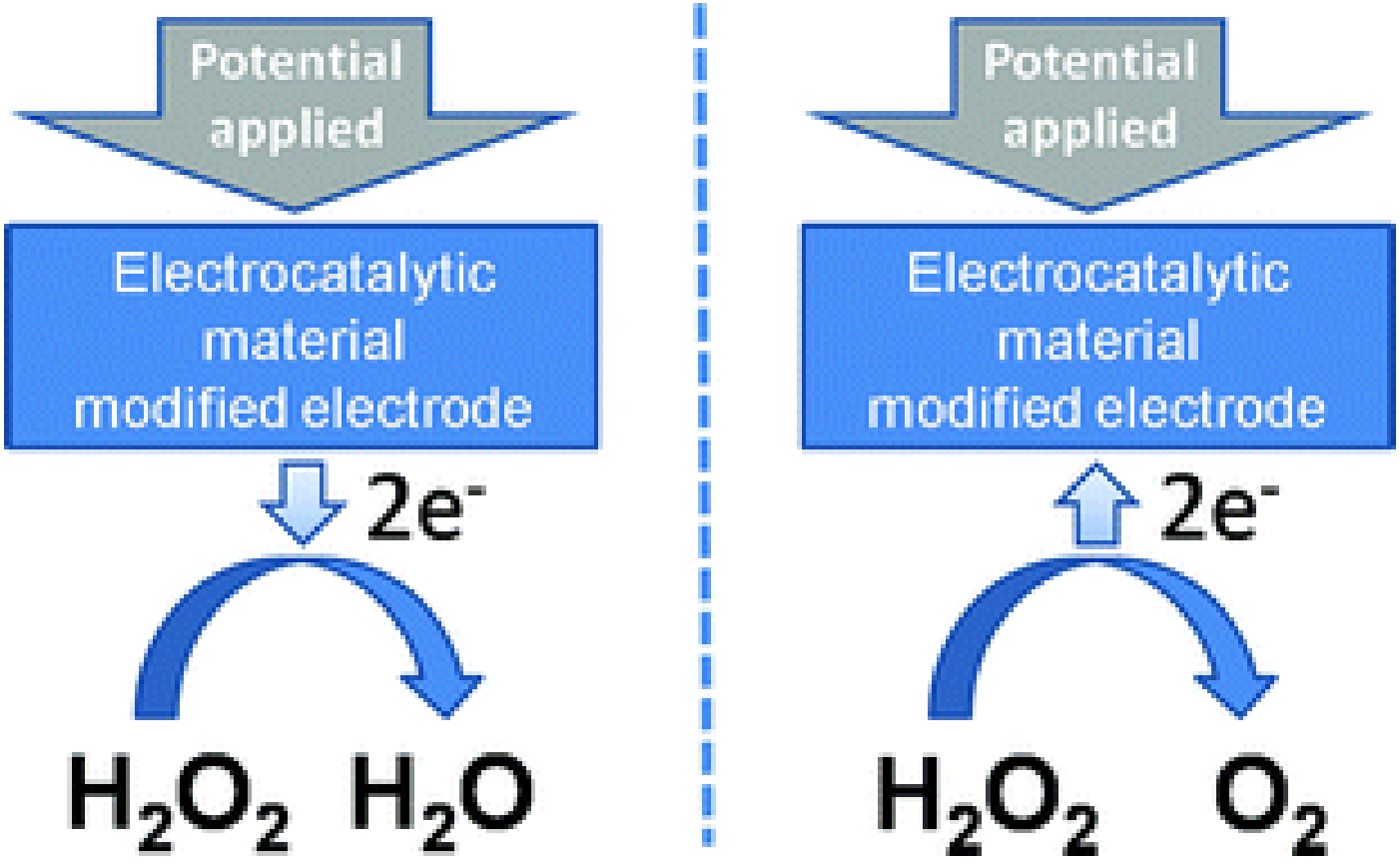
Две наједноставни сценарија за редукција и оксидација на H_2O_2

(I) $H_2O_2+2H^++2e^-\longrightarrow 2H_2O$ ---ОКСИДАЦИСКО СРЕДСТВО

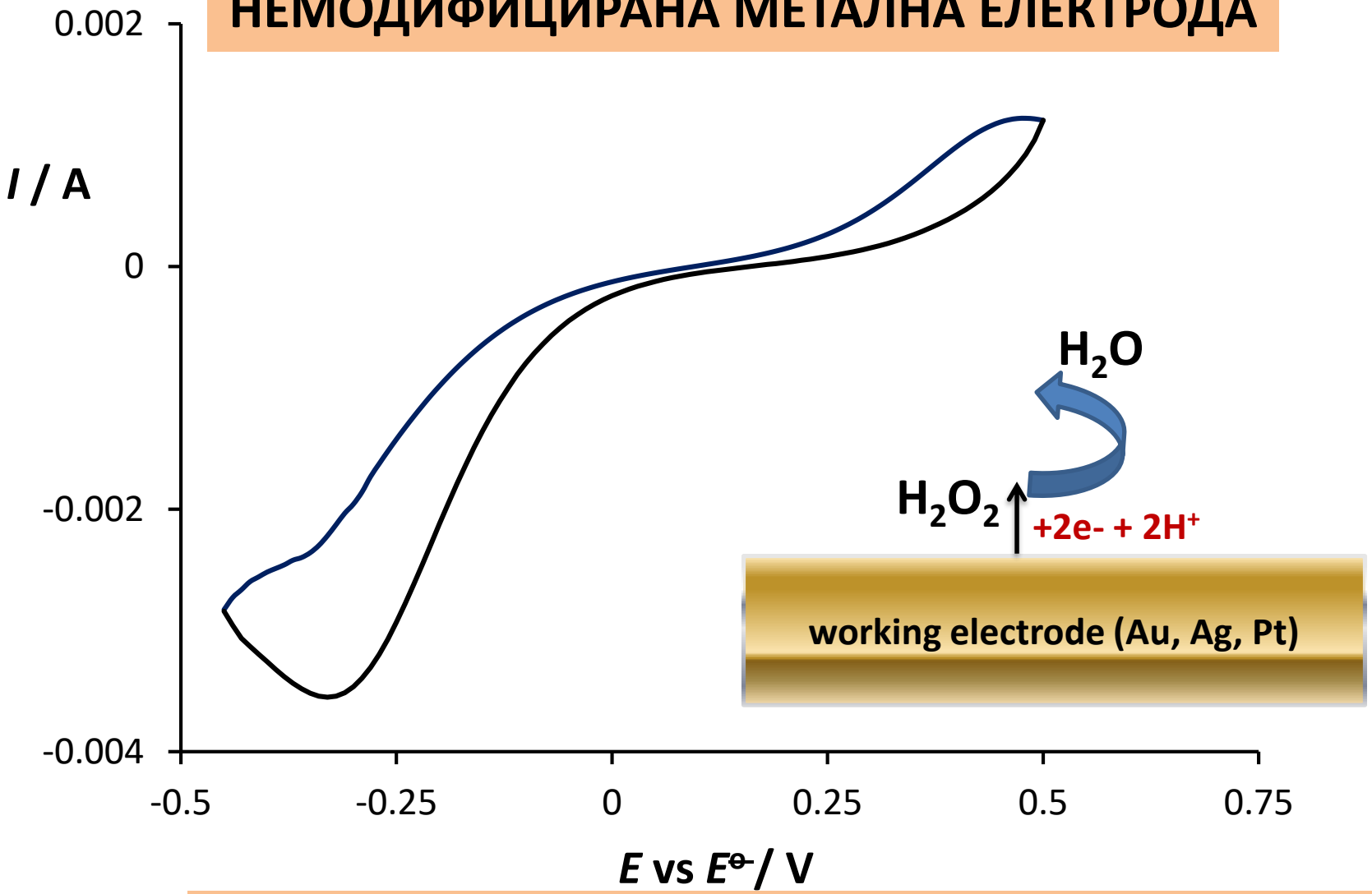
$E°$= +1.534 *V vs. SCE* (at pH of 7.00)

(II) $2H^++O_2+2e^-\longrightarrow H_2O_2$ РЕДУКЦИСКО СРЕДСТВО

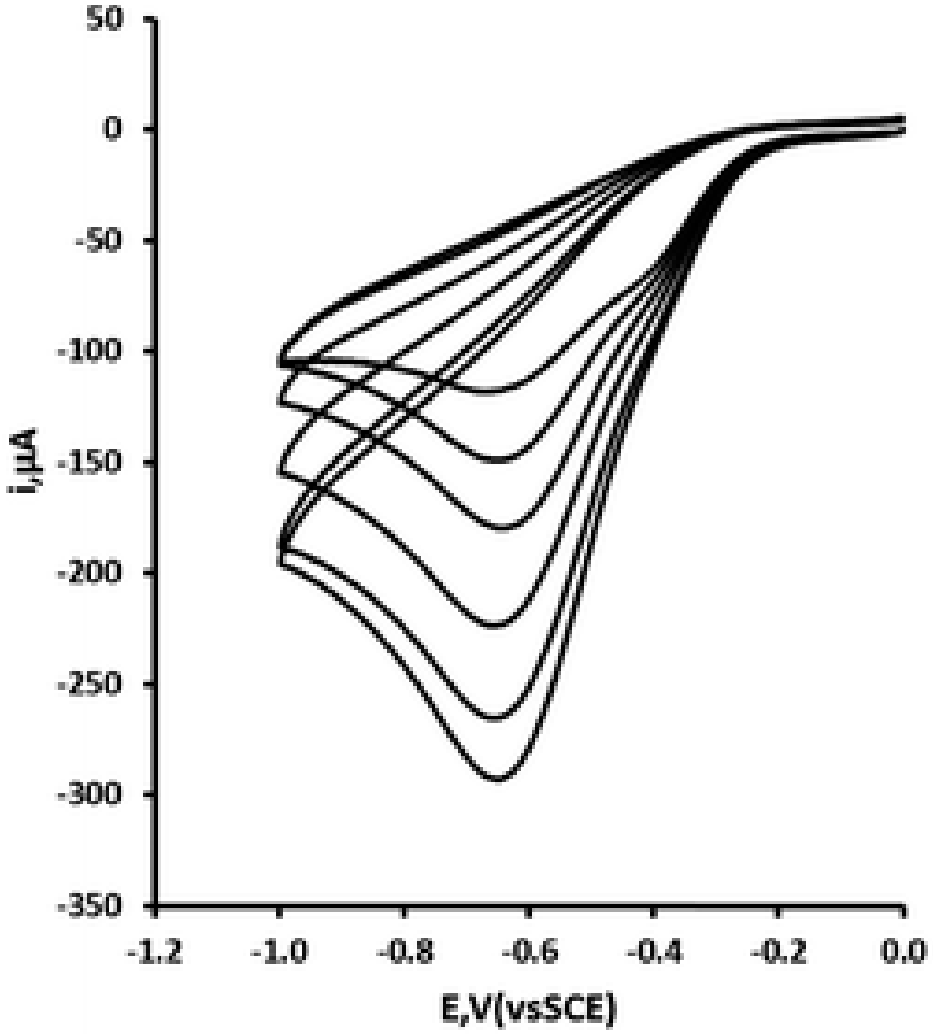
$E°$= +0.440 *V vs. SCE* (at pH of 7.00)

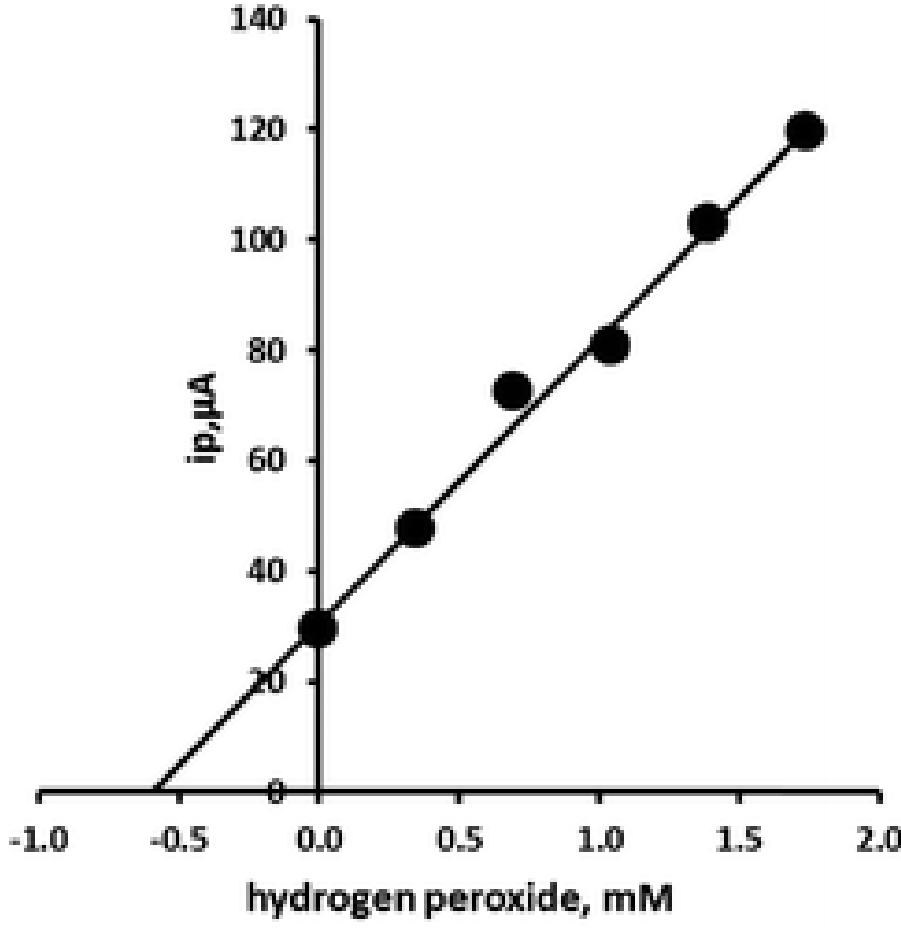

Potential applied
Electrocatalytic material modified electrode
2e-
H2O2 H2O
Potential applied
Electrocatalytic material modified electrode
2e-
H2O2 O2

H2O2 сензори на НЕМОДИФИЦИРАНА МЕТАЛНА ЕЛЕКТРОДА



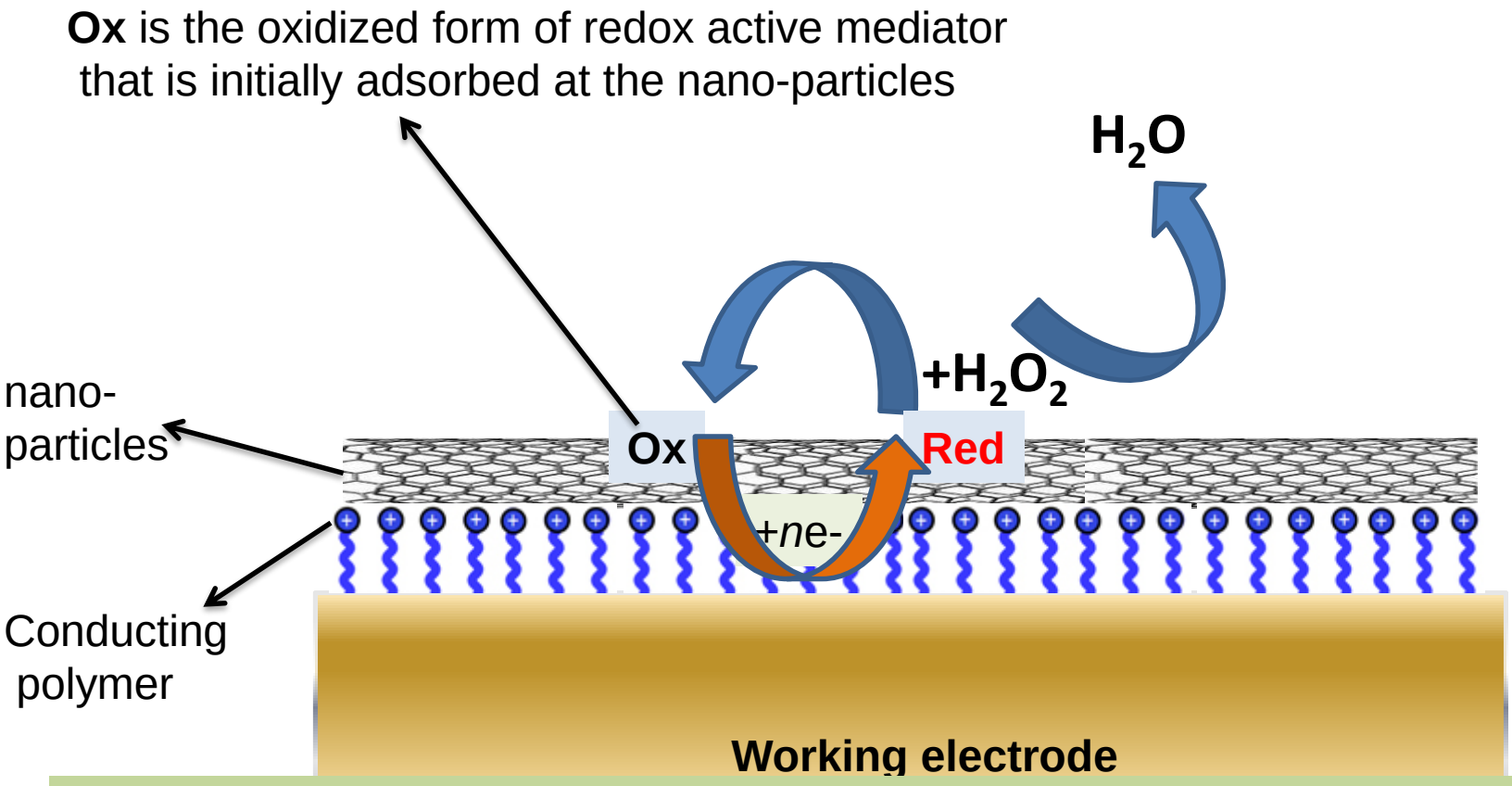
Features of the cyclic voltammogram showing the process of reduction of H_2O_2 at bare metallic electrodes



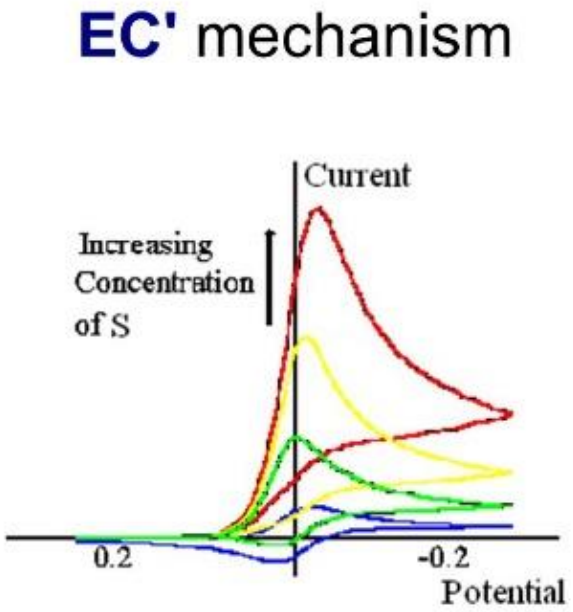


Директно определување на H2O2 на ПЛАТИНСКА ЕЛЕКТРОДА

2. СЕНЗОРИ за H2O2 со модифицирана работна електрода и со РЕДОКС МЕДИЈАТОР кој е ШАТЛ за електрони помеѓу H2O2 и Модифицираната работна електрода



working electrodemodified with conducting polymer and nano-particles, designed for hydrogen peroxide voltammetric detection. The Ox is the redox mediator adsorbed at the modified-electrode surface



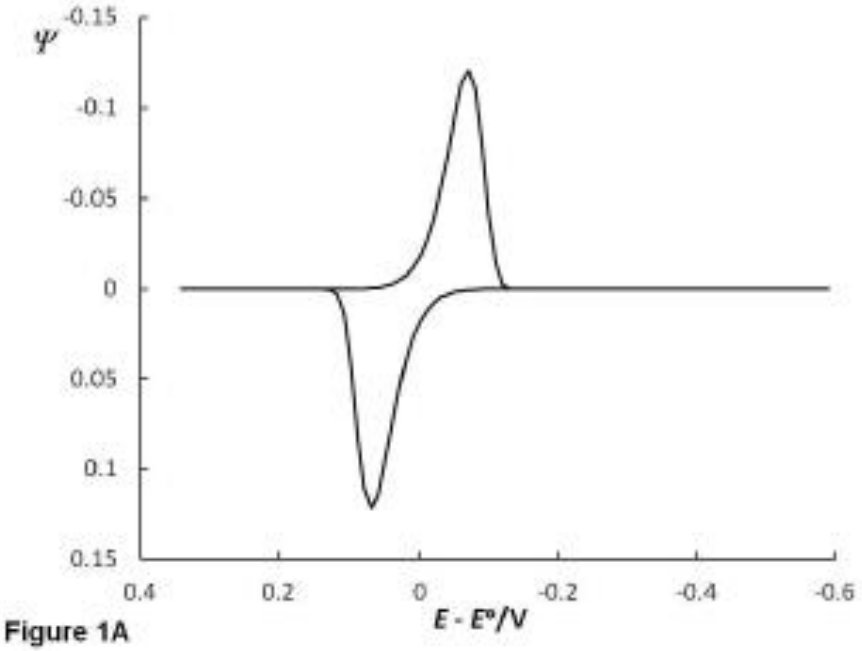
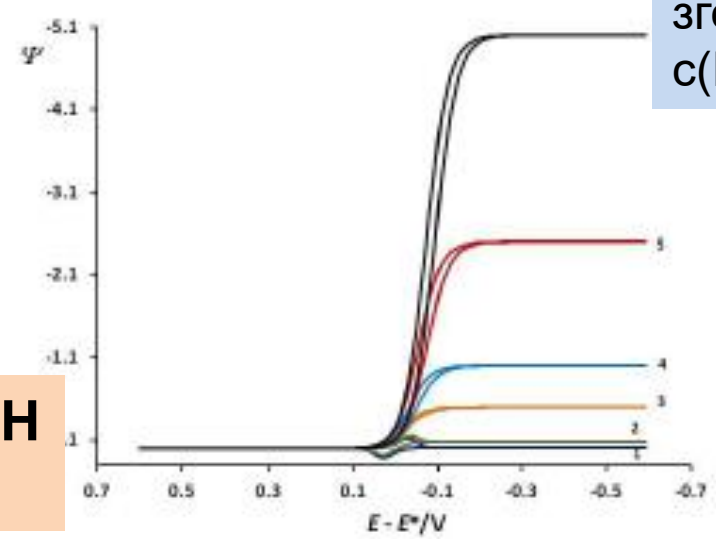


Figure 1A

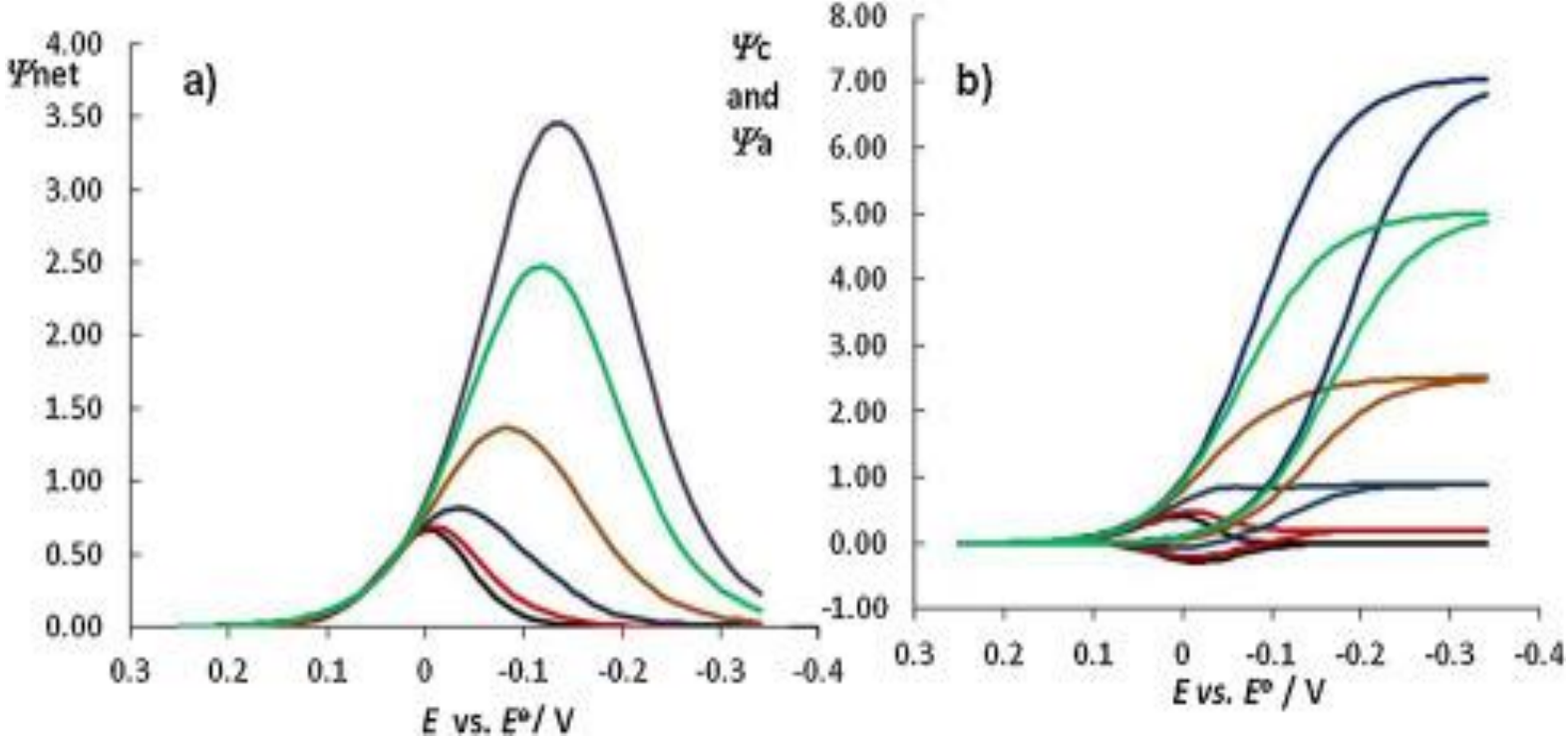
$$Ox + ne \rightleftharpoons Red$$

$$Red + H2O2 \xrightarrow{k_{catalysis}} Ox$$



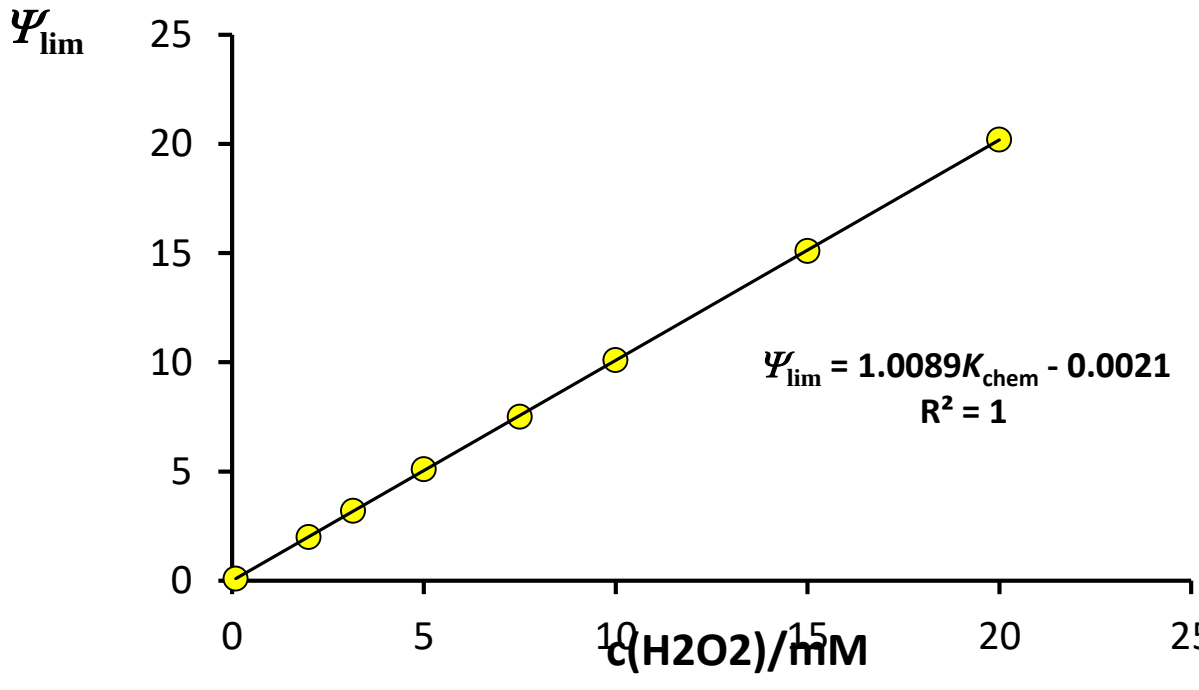
Се зголемува с(H2O2)

ЕЛЕКТРОХЕМИСКИ-РЕГЕНЕРАТИВЕН ЕЛЕКТРОДЕН МЕХАНИЗАМ



Квадратно БРАНОВА ВОЛТАМЕТРИЈА

Електрохемиски РЕГЕНЕРАТИВЕН МЕХАНИЗАМ



Графитна електрода
Модифицирана со
МЕКРАПТО-УНДЕКАНОИЧНА
Киселина и со
ЗЛАТНИ НАНОЧЕСТИЧКИ
-Сензор за H2O2 со
Редокс медијатор комплекс на
железо

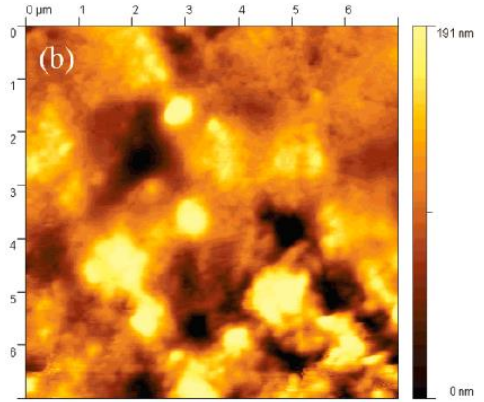


Figure 2. Topographic tapping mode AFM image of bare carbon electrode (a) and carbon electrode modified with Au-MUA NPs of 3.0 nm average diameter (b). Image sizes were 1.5 × 1.5 μm (a) and 7 × 7 μm (b), respectively.

Gulaboski et al

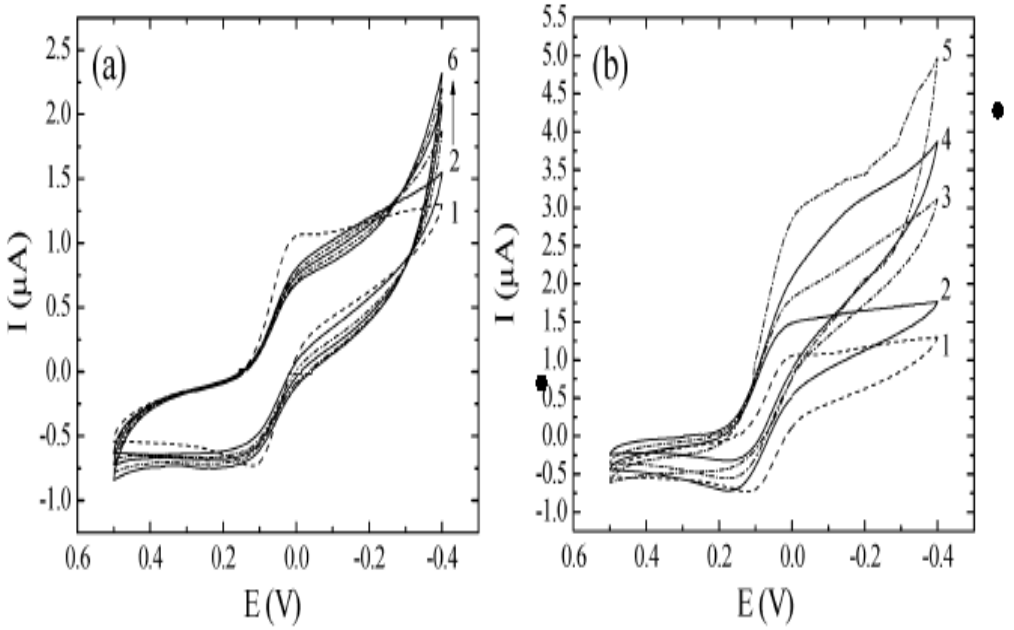


Figure 7. (a) Cyclic voltammograms showing the effect of hydrogen peroxide by the regeneration reaction of $K_3[Fe(CN)_6]$ at the bare graphite electrode. $c([Fe(CN)_6]^{3-})$ = 0.25 mmol/L; $c(H_2O_2)$/mmol L^{-1} = 0 (1), 0.1 (2), 0.2 (3), 0.3 (4), 0.4 (5), and 0.5 (6). (b) Cyclic voltammograms recorded at Au-MUA NP modified graphite electrode (adsorption time of 4 h): $c(H_2O_2)$/mmol L^{-1} = 0 (1), 0.1 (2), 0.2 (3), 0.3 (4), and 0.4 (5). The scan rate was 50 mV/s, while the supporting electrolyte was 0.1 mol/L acetate buffer (pH 4.70).

Волтаметриски сензор за квантификација на H2O2 со Атсорбиран Азобензен на живина електрода Мирчески, Гулабоски, ElectroANALYSIS 2001

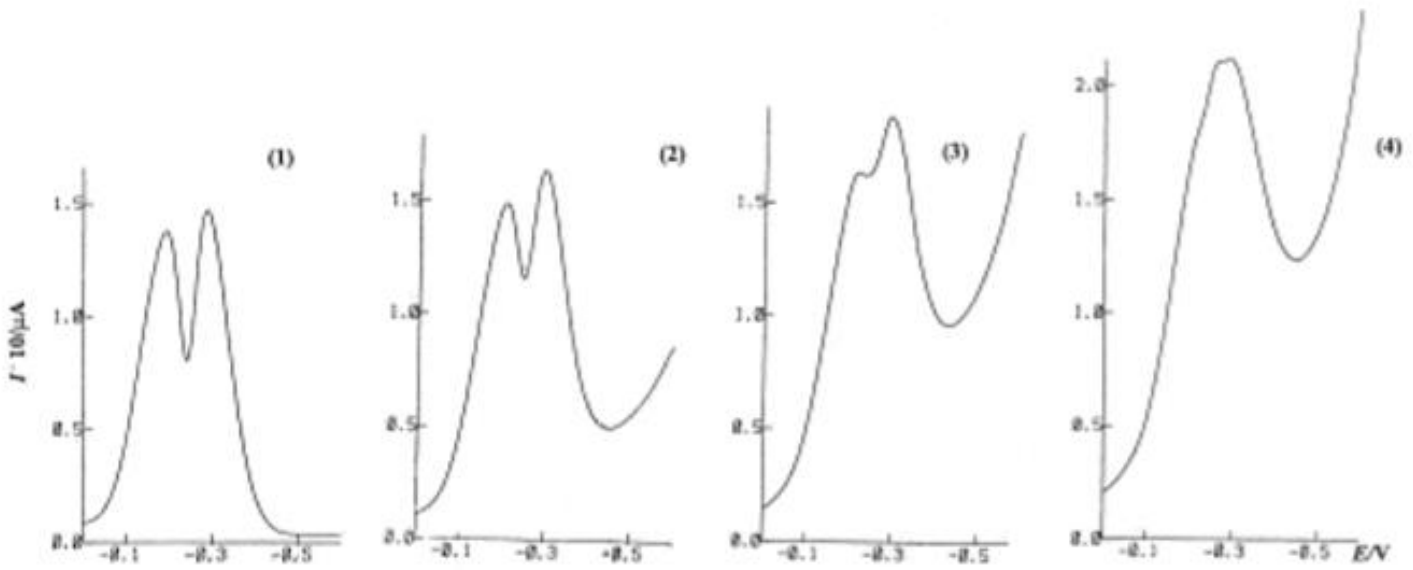
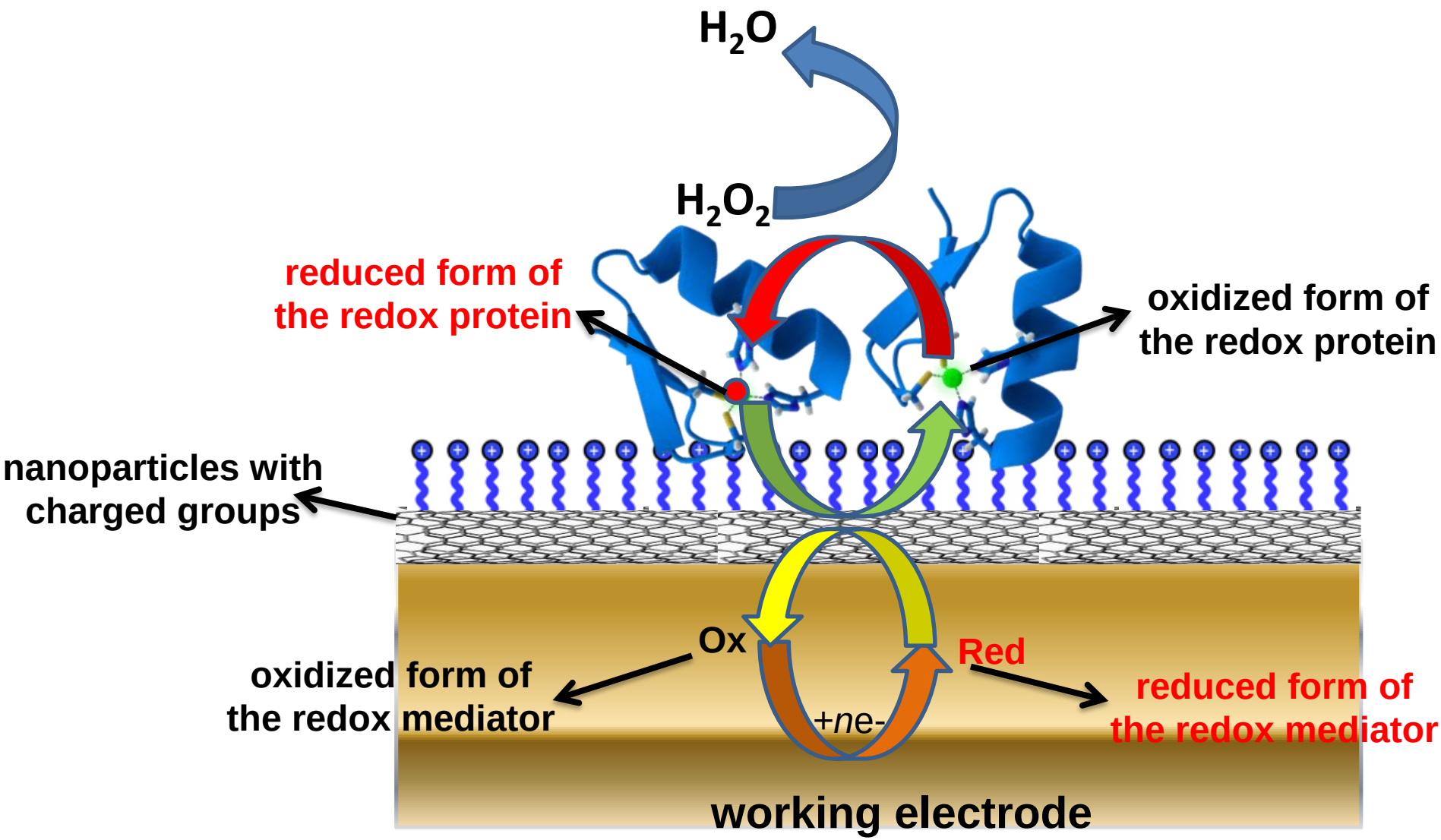


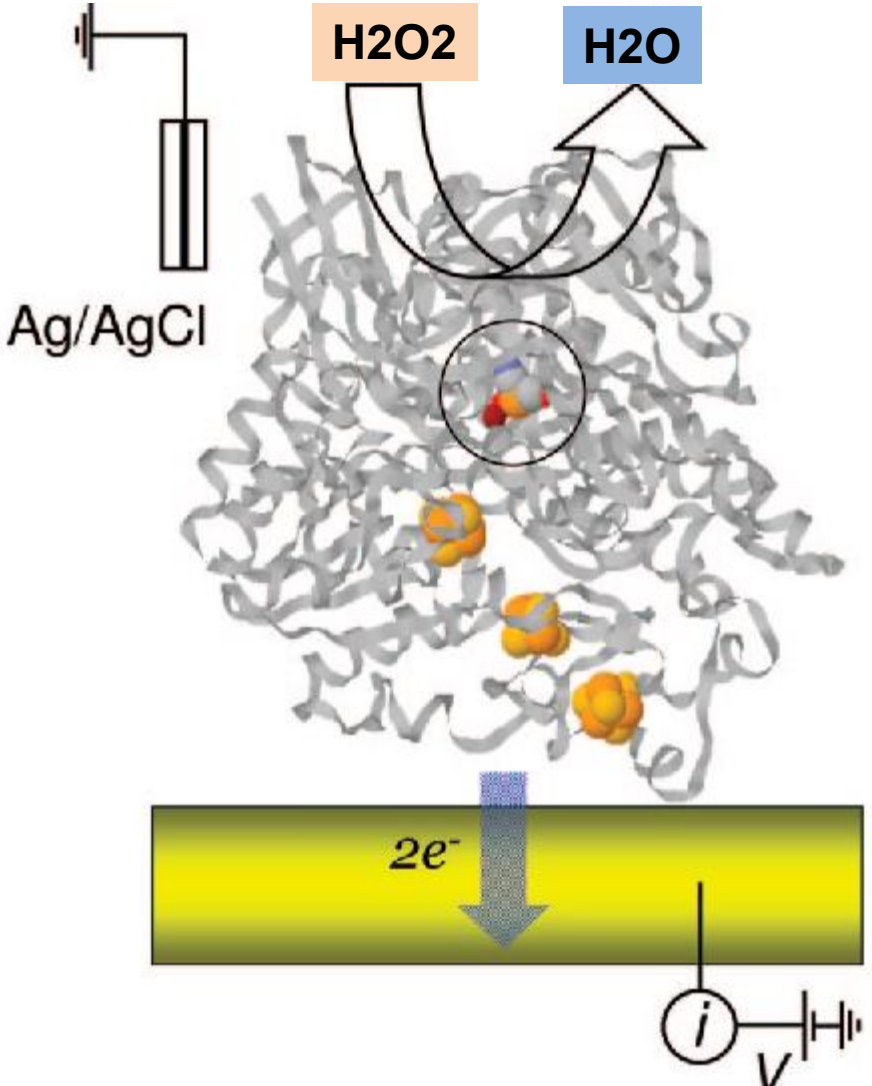
Fig. 12. Influence of hydrogen peroxide on the split SW response of azobenzene. The experimental conditions are: c(azo) = 5×10^{-5} mol/L, pH 4.2 (acetate buffer), t_{acc} = 15 s, E_{acc} = 0.0 V, E_{sw} = 150 mV, f = 40 Hz, dE = 2 mV and c(H_2O_2)/mol L^{-1} = 0 (1), 0.0116 (2), 0.0231 (3) and 0.0571 (4).

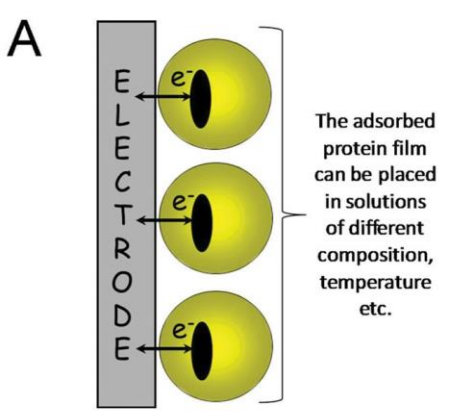
Electroanalysis 2001, 13, No. 16

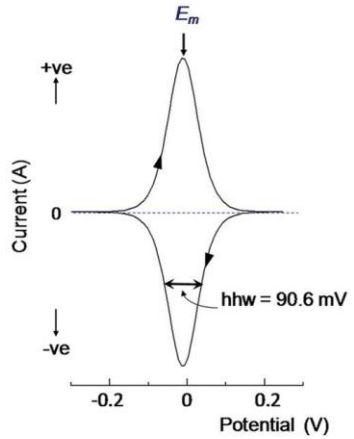
3. ЕНЗИМАТСКИ СЕНЗОРИ ЗА ДЕТЕКЦИЈА на H2O2

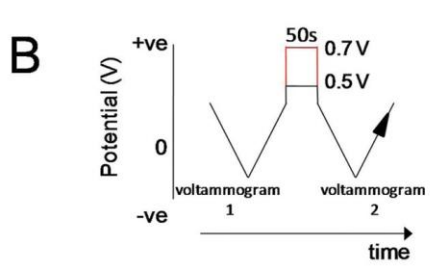


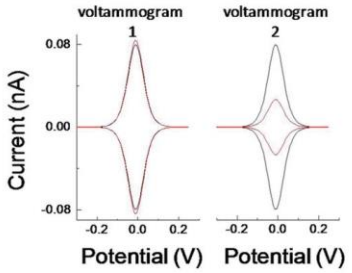
ДЕТЕКЦИЈА НА H2O2 со ПРОТЕИН-ФИЛМ ВОЛТАМЕТРИЈА



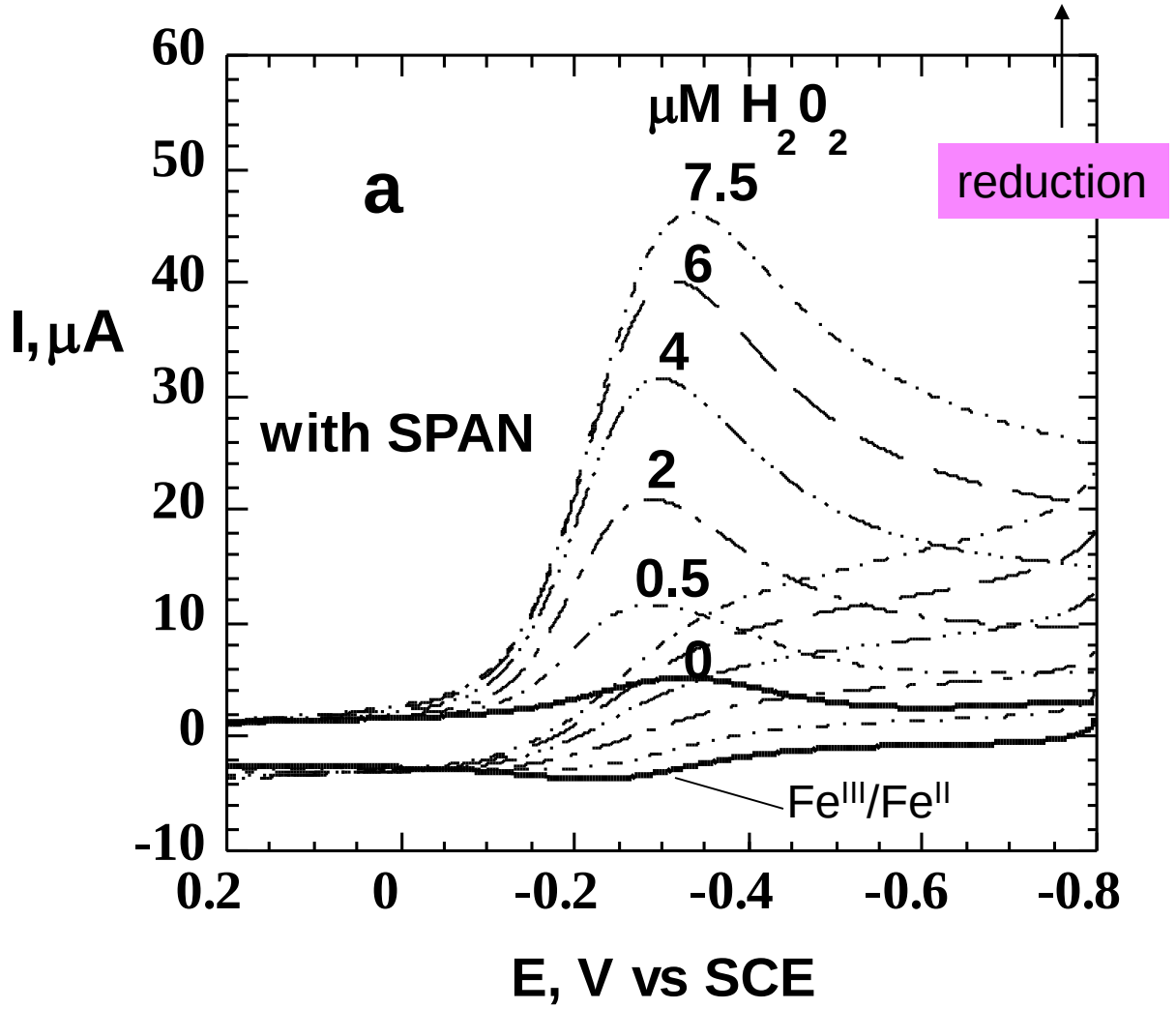




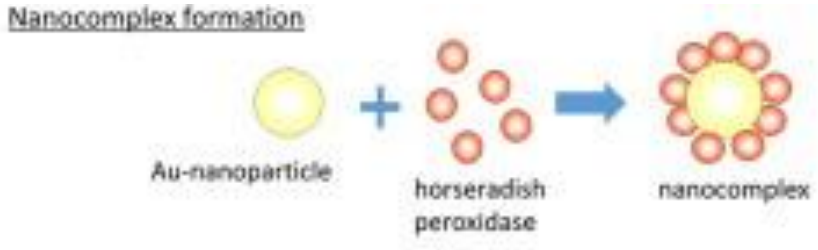


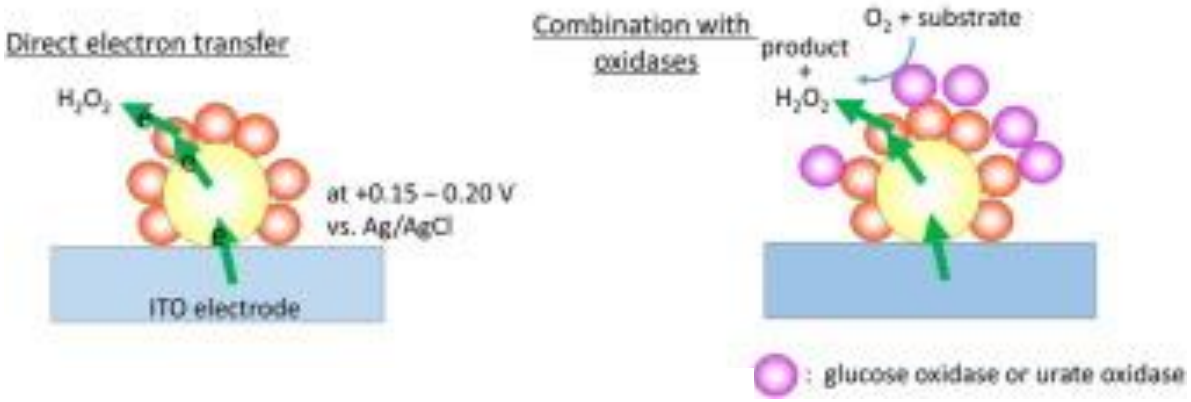


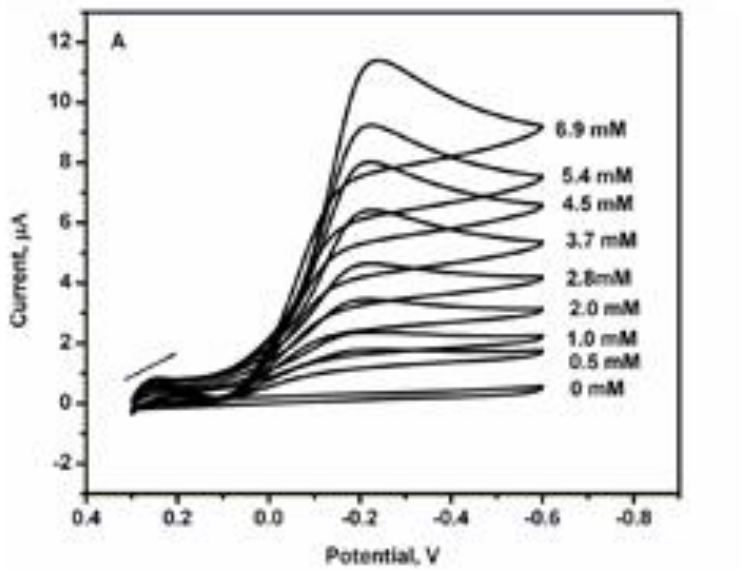
Catalytic reduction of H_2O_2 by peroxidase films
Catalytic cycles increase current

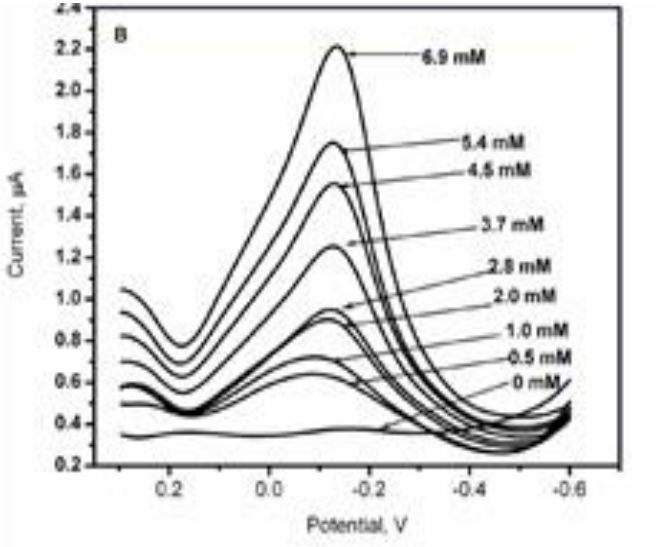


Малку различно Сценарио.... Au-комплекс со пероксидаза Ензим...

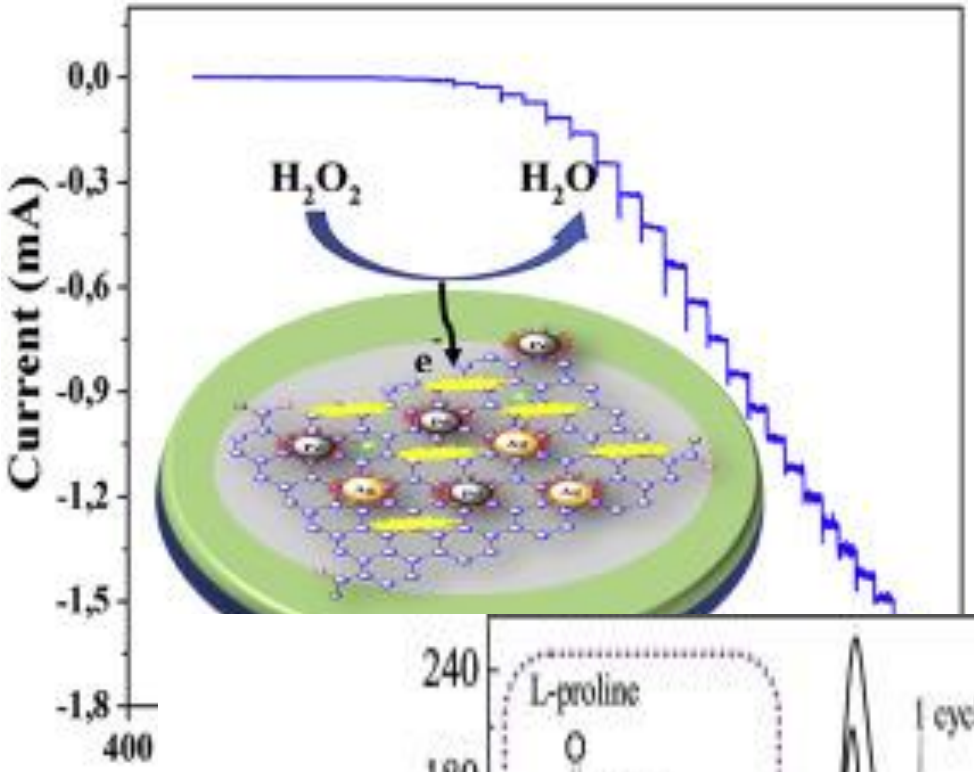


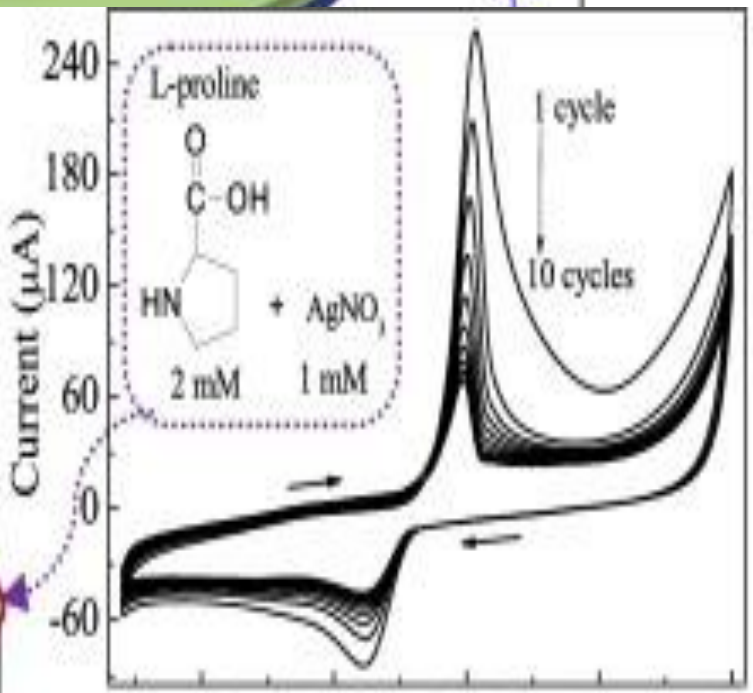


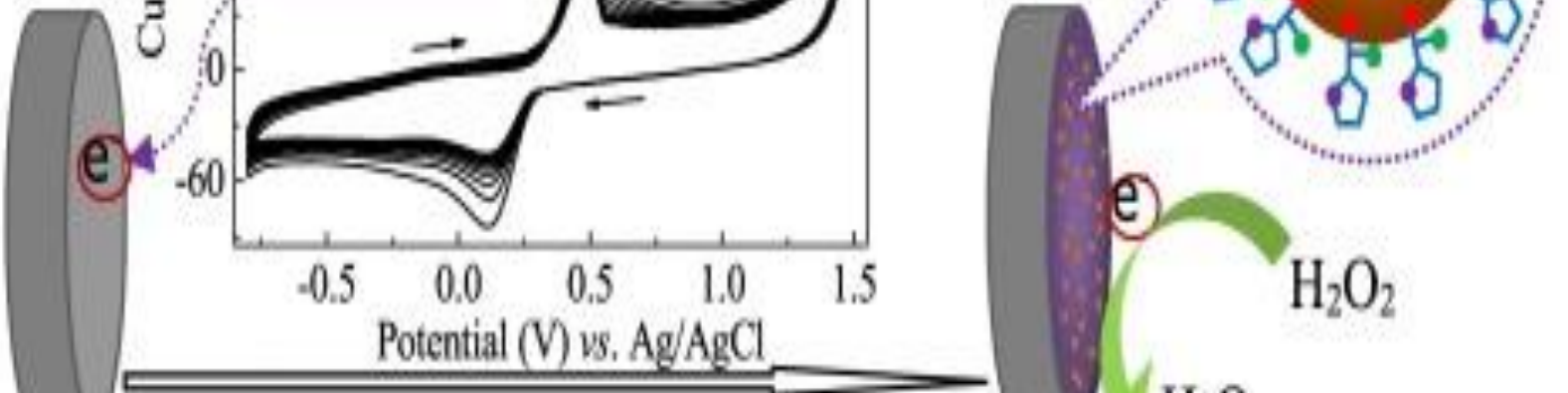


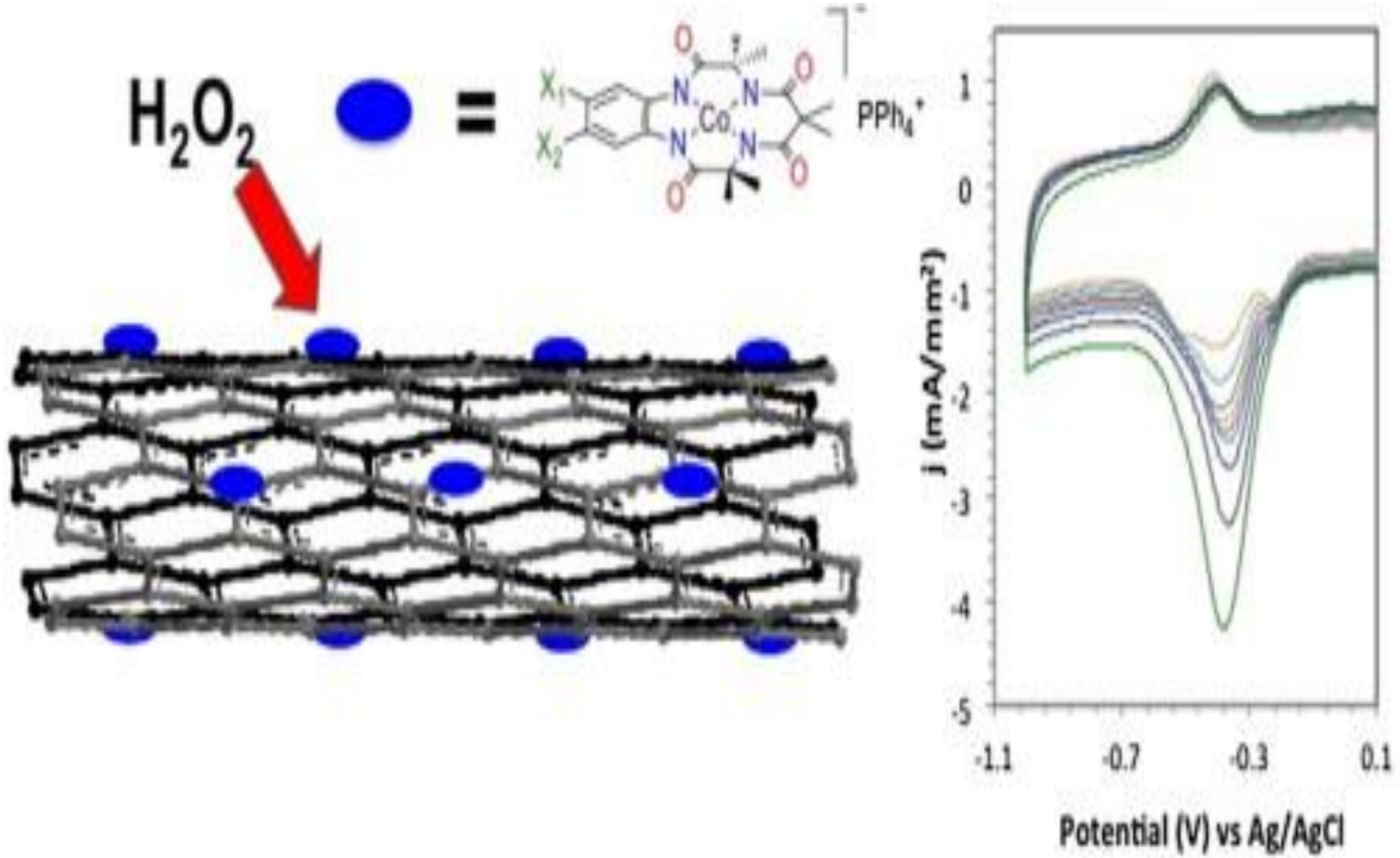


4. НЕ-ЕНЗИМСКИ СЕНЗОРИ
За детекција на H2O2

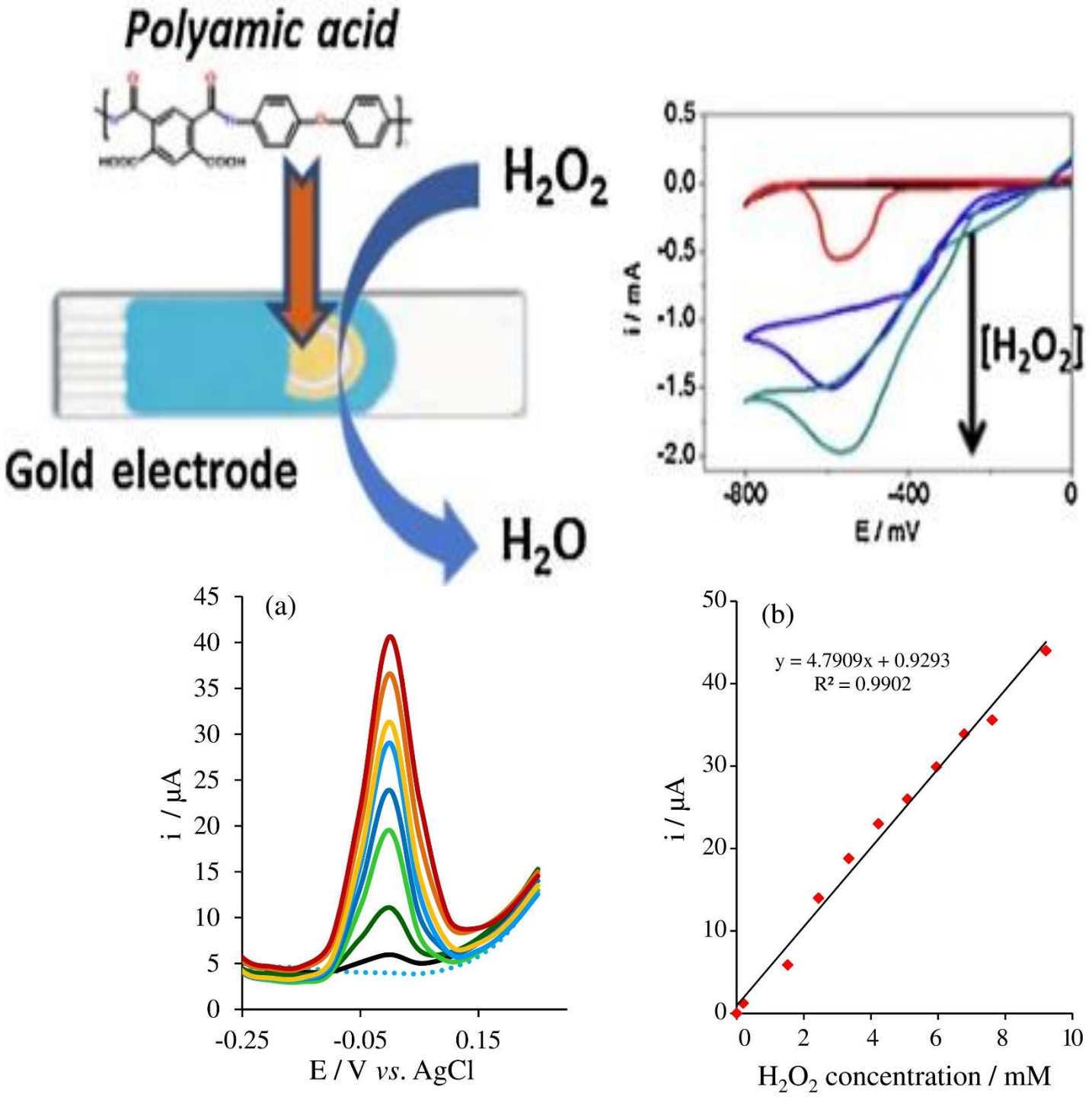


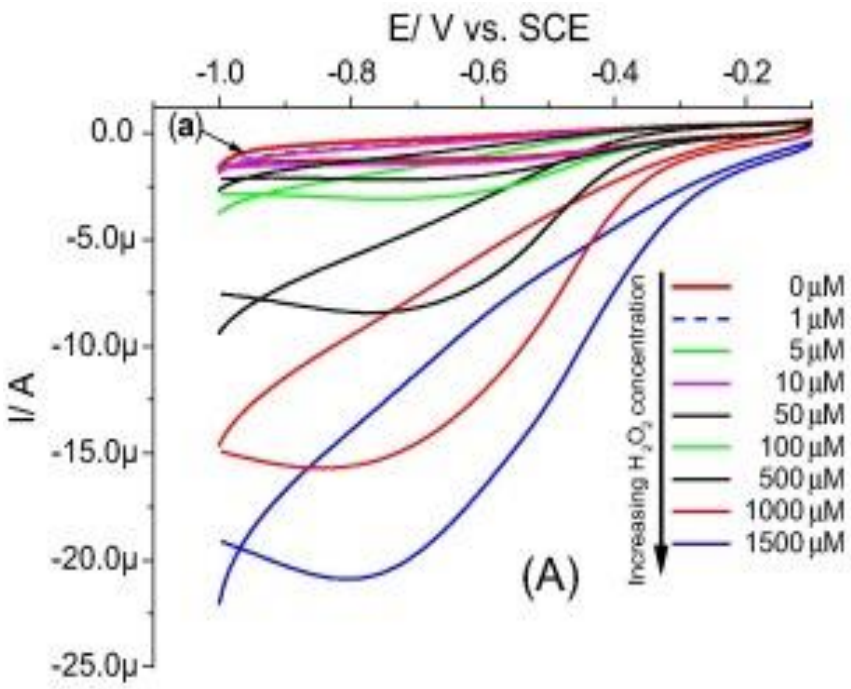


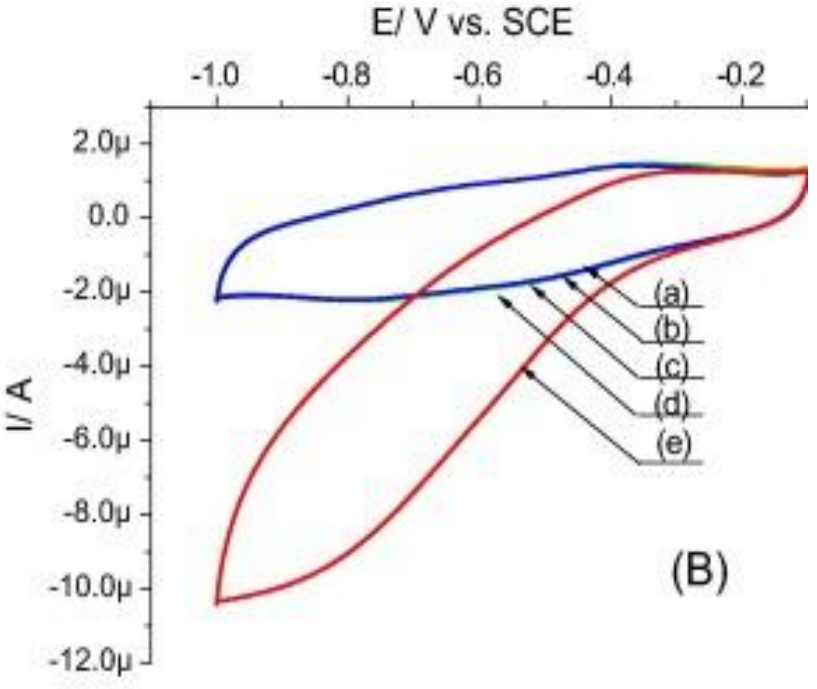


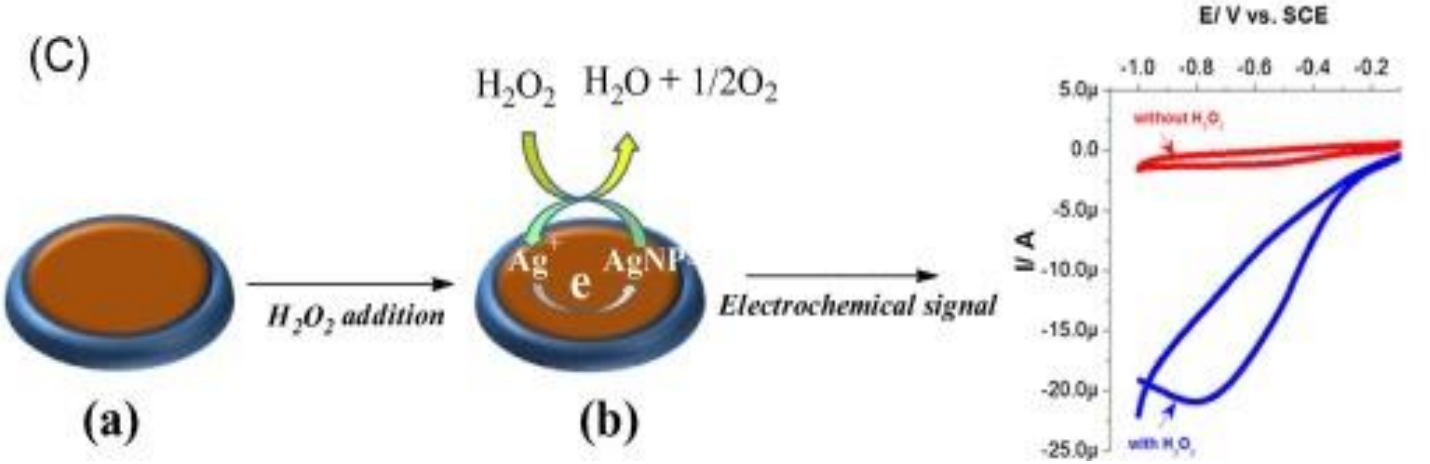


Hydrogen peroxide (H_2O_2) detection using a non-enzymatic cobalt(III) complex (**2**) of an amidomacrocyclic ligand

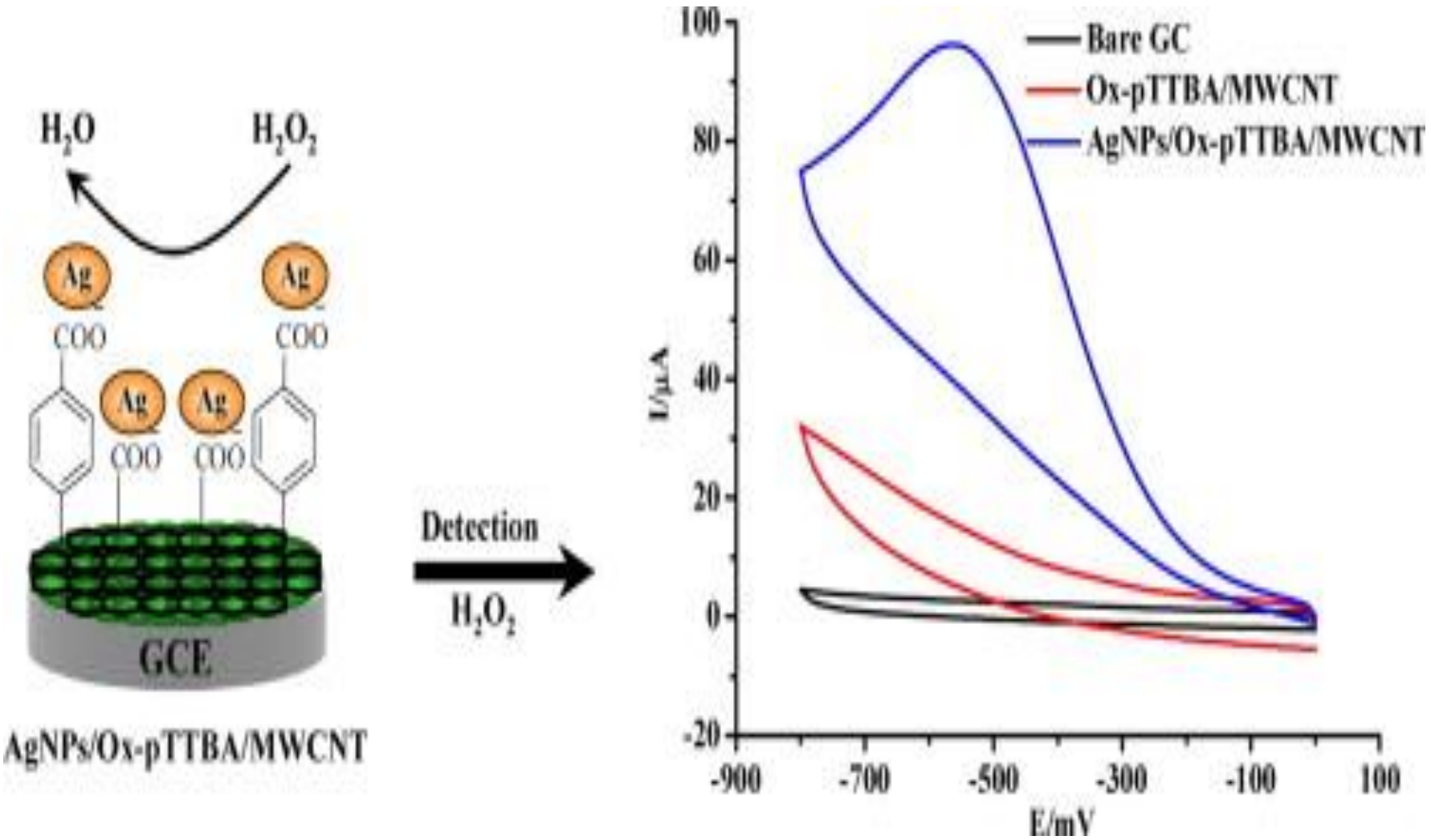

Polyamic acid
H_2O_2
Gold electrode
H_2O
i / mA
E / mV
$[H_2O_2]$
(a)
i / µA
E / V *vs.* AgCl
(b)
y = 4.7909x + 0.9293
R² = 0.9902
i / µA
H_2O_2 concentration / mM

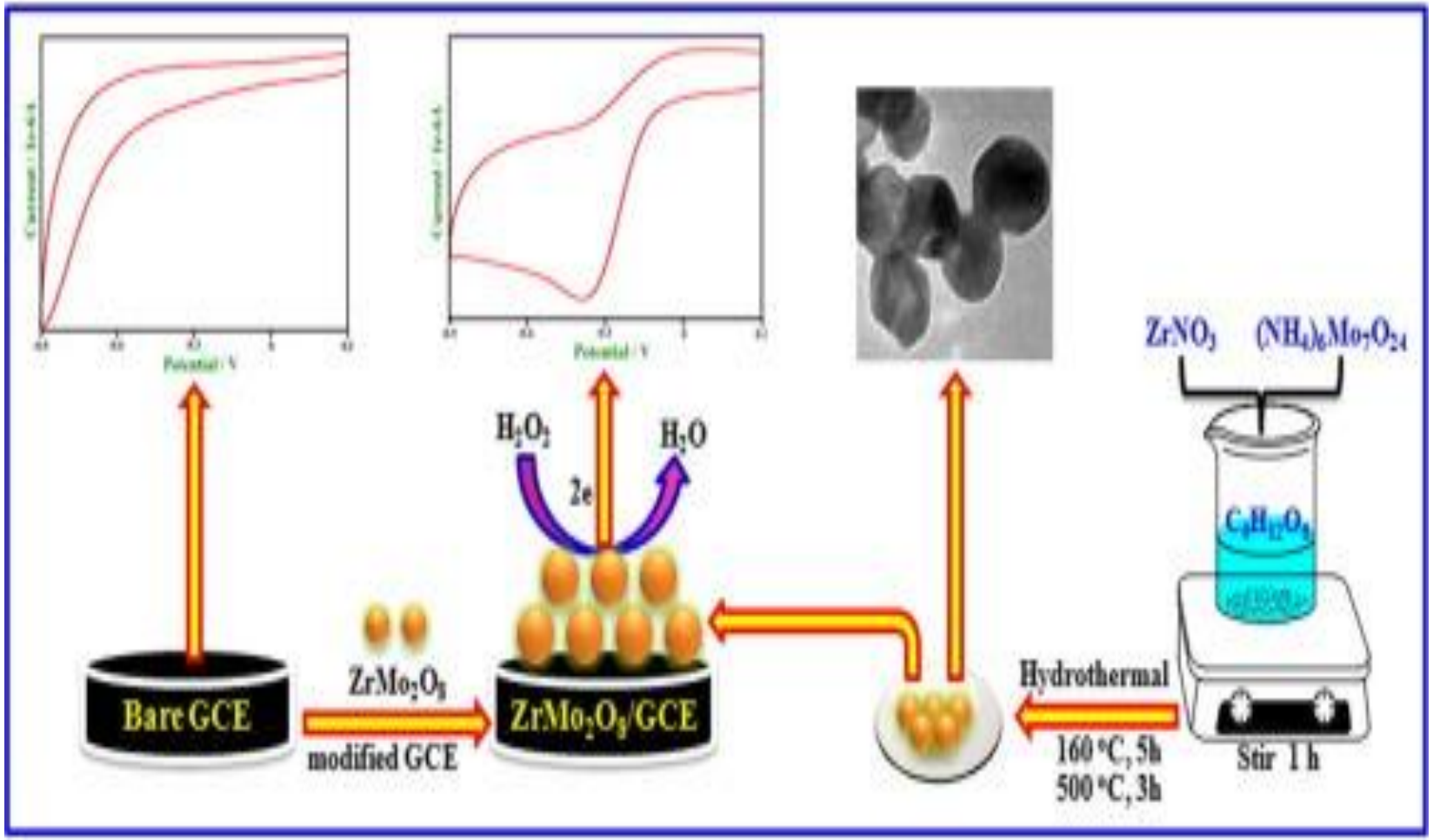




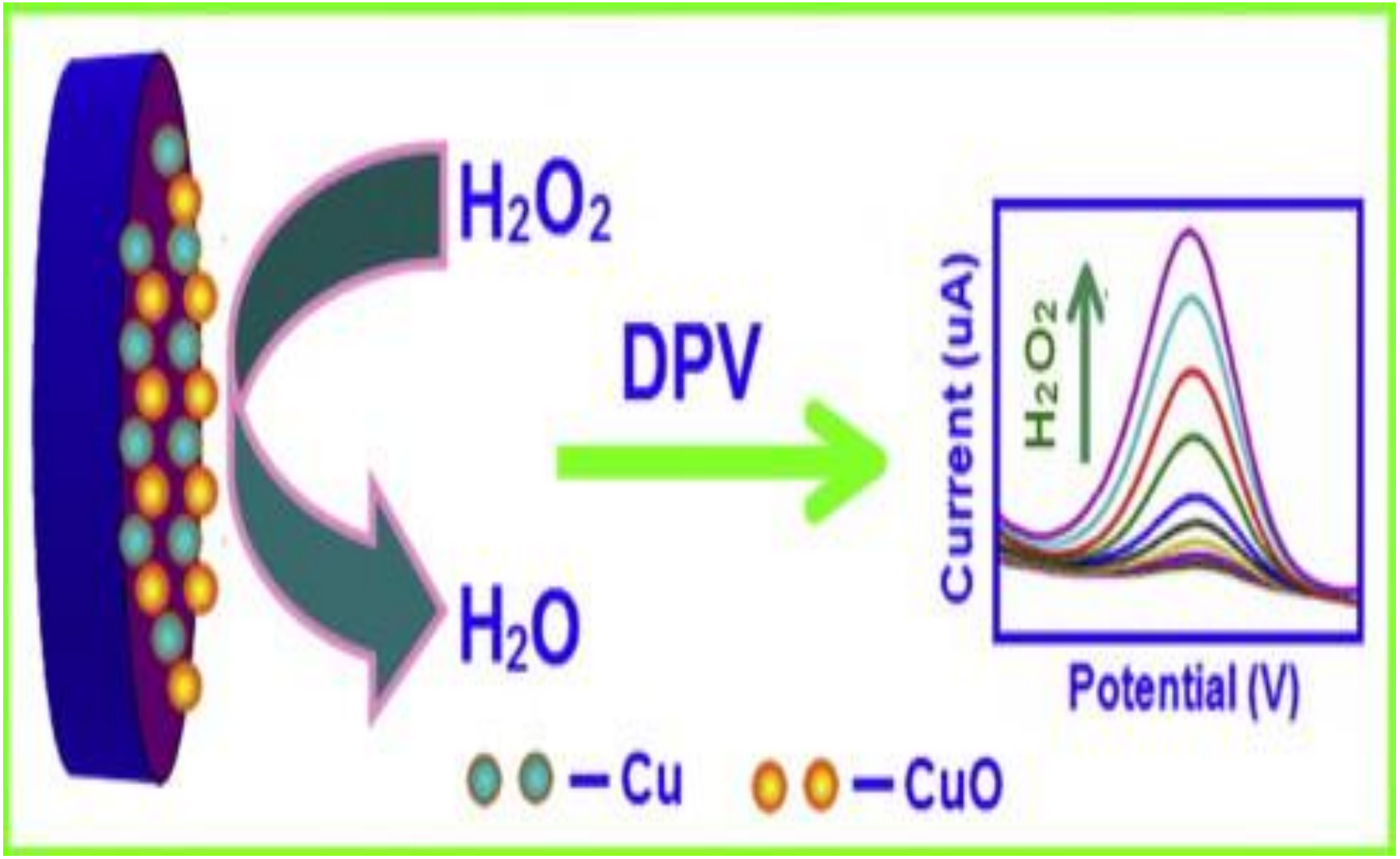


НЕ-ЕНЗИМСКИ СЕНЗОРИ за детекција и квантификација на H2O2 со Сребрени наночестички


H2O
H2O2
Ag
COO
GCE
AgNPs/Ox-pTTBA/MWCNT
Detection
H2O2
Bare GC
Ox-pTTBA/MWCNT
AgNPs/Ox-pTTBA/MWCNT
I/μA
E/mV
100
80
60
40
20
0
-20
-900
-700
-500
-300
-100
100

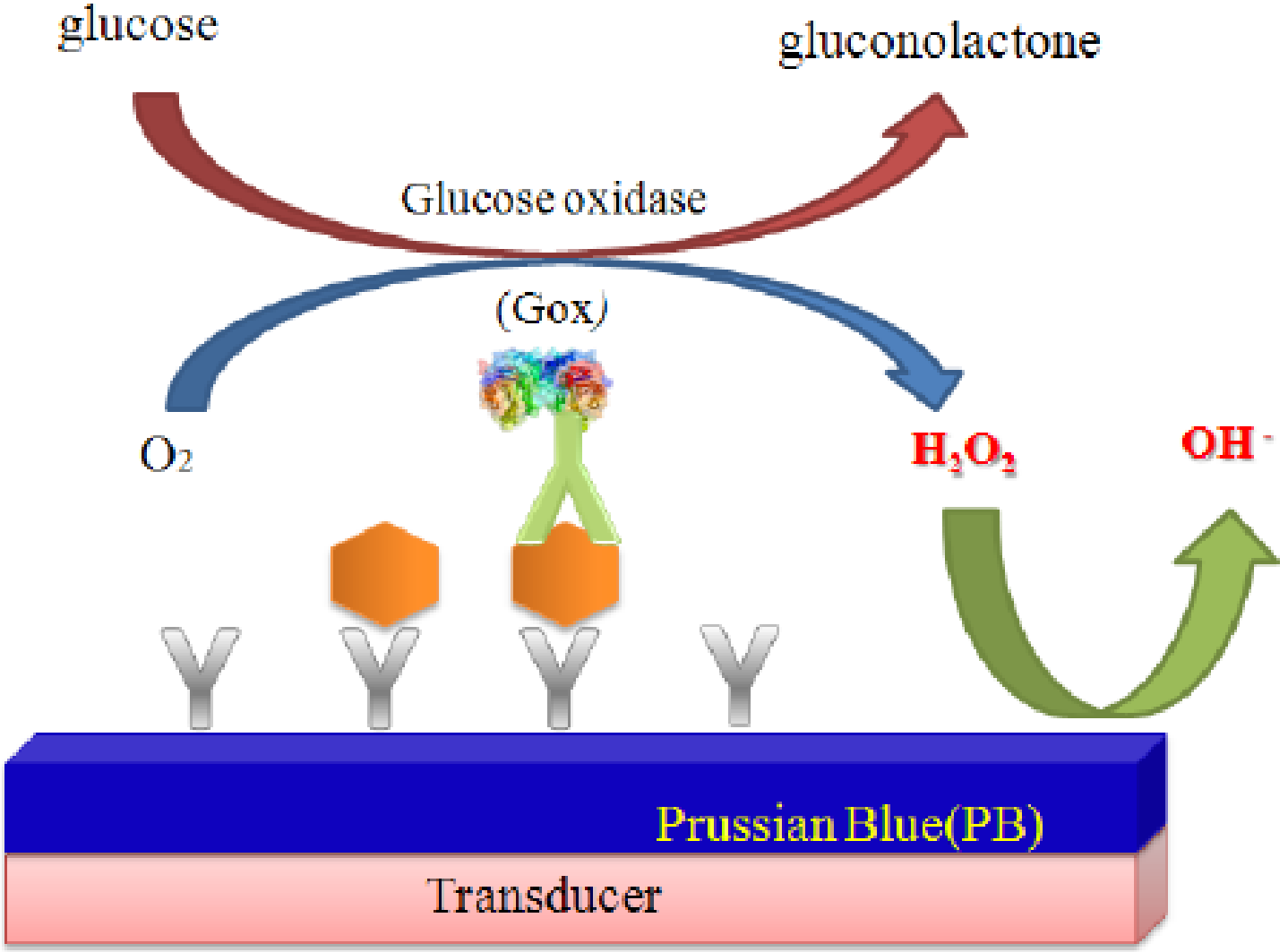


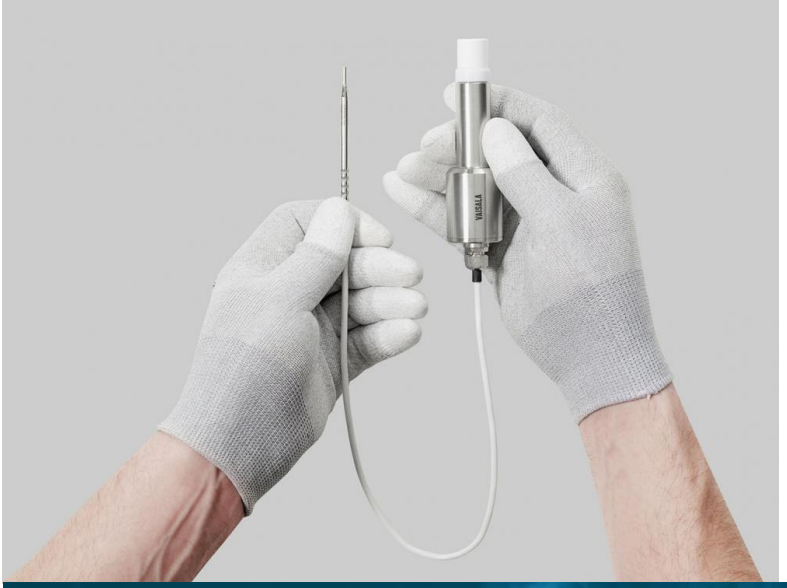
НЕ-ЕНЗИМСКИ СЕНЗОРИ за детекција и квантификација на H2O2 со мешани наночестички од циркониум и молибден



НЕ-ЕНЗИМСКИ СЕНЗОРИ за детекција и квантификација на H2O2 со БАКАРНИ наночестички

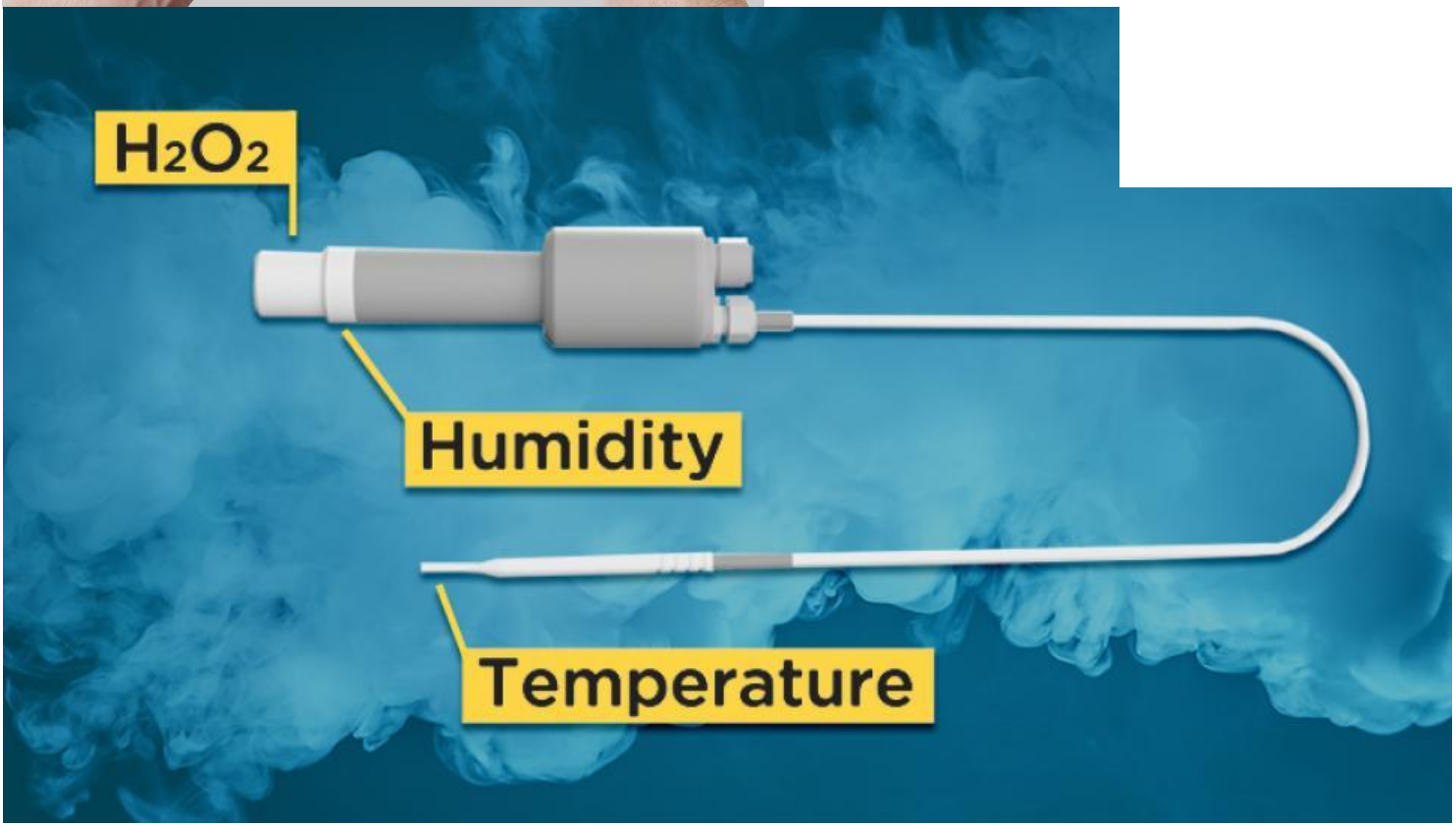
ЕНЗИМАТСКИ СЕНЗОРИ ЗА КВАНТИФИКАЦИЈА НА H2O2
---------Индиректни методи--------






ANALYTICAL TECHNOLOGY, INC.
050
2-Wire Transmitter
ATi


ANALYTICAL TECHNOLOGY, INC.
2-Wire Transmitter
ATi


H2O2
Humidity
Temperature

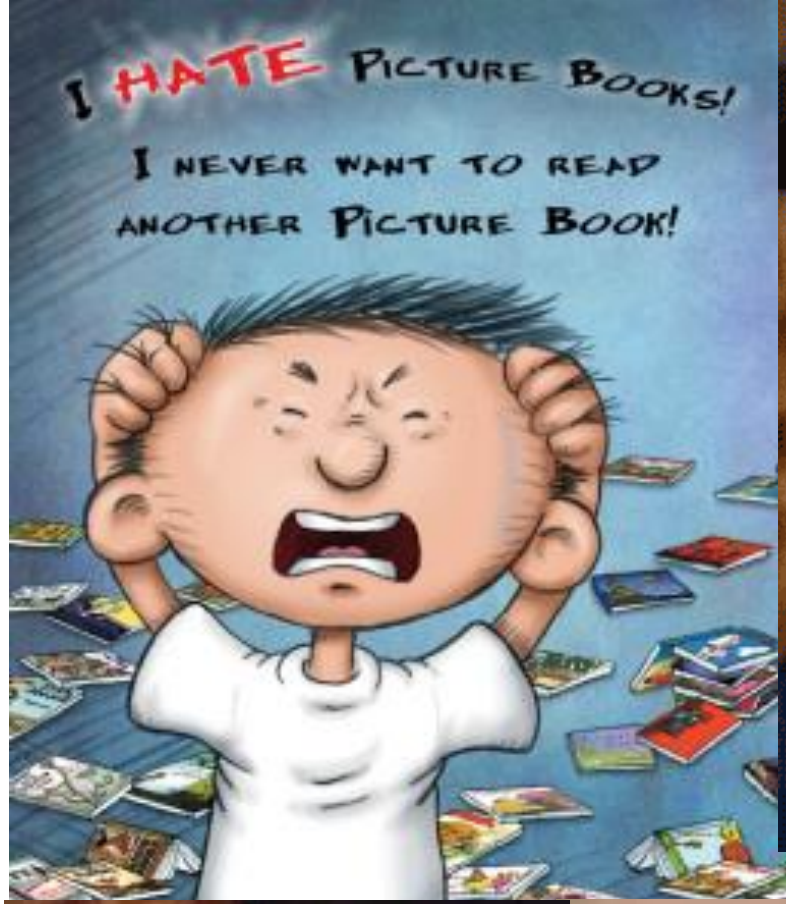
ДОБРИ И ЛОШИ СТРАНИ НА ВОЛТАМЕТРИСКИТЕ СЕНЗОРИ ЗА ДЕТЕКЦИЈА И КВАНТИФИКАЦИЈА НА H2O2

-ефтини
-брзи
-дизајни достапни во разни варијанти и модификации
-во различни примероци може да се определува H2O2

НО....!!!

-сензорите со редокс медијатори-НАЈЧЕСТО СЕ - ----------
----------***НЕСЕЛЕКТИВНИ СЕНЗОРИ***
-осетливи во високо микро и милимоларно подрачје на H2O2

---во единечни клетки може да се врши детекција и квантификација на H2O2 со т.н. Скенинг електрохемиска Микроскопија---топографија на клетка



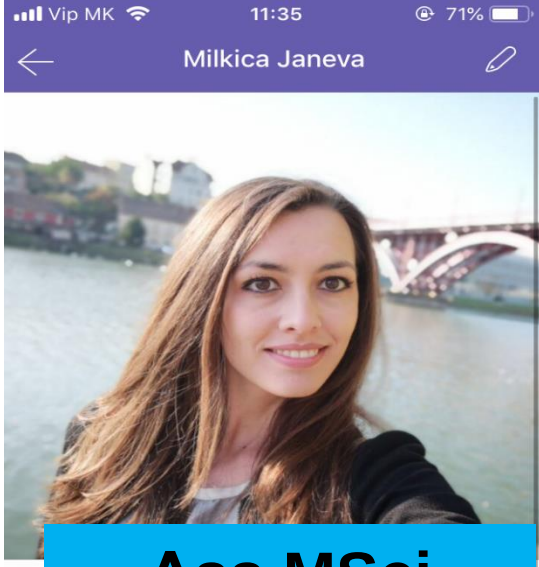
ATE VOLTAMMETRYYYY!...

Docent

Viktorija Maksimova

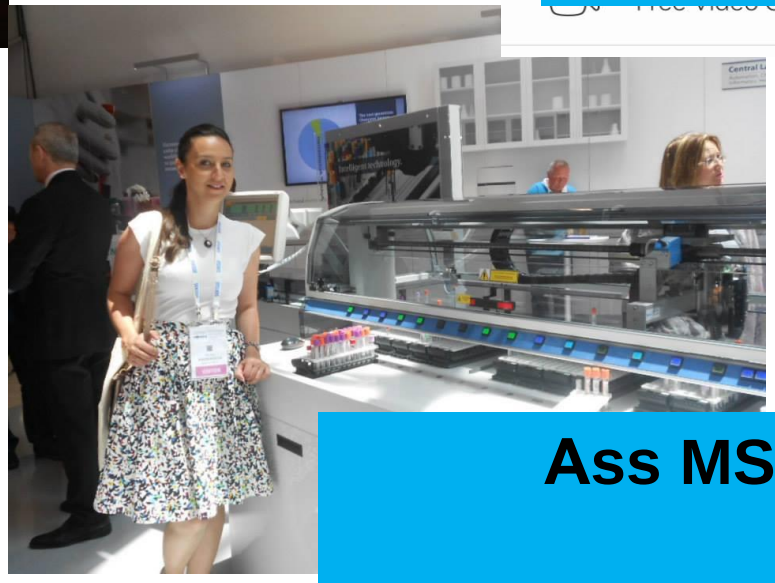
Ass Msci

Sofija Petkovska



Ass MSci

Milkica Janeva



Ass MSci

Pavlinka kokoskarova

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