$ZnM_xFe_{2-x}O_4$ (M = Cr, Bi) Nanoparticles-modified electrochemical sensors: Effect on sensitivity and kinetic rate constant

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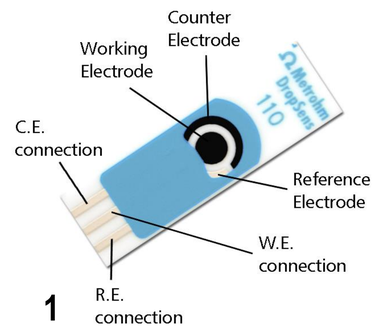
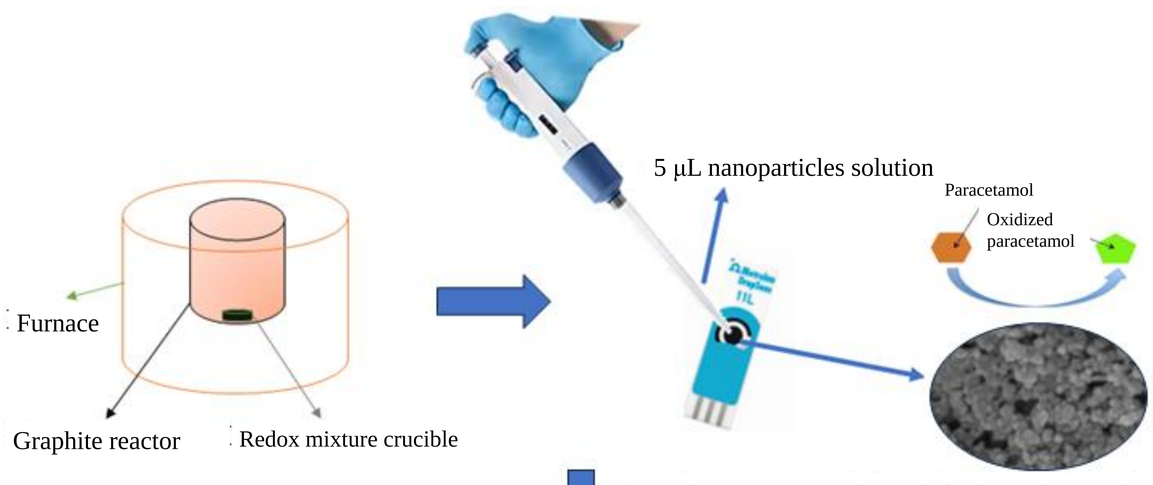
Motivation

- To study the role of **spinel nanomaterials** in electrochemical sensing
- Understand the effect of **trivalent cations** (Fe, Cr, Bi)
- Sensitivity and kinetic rate constant

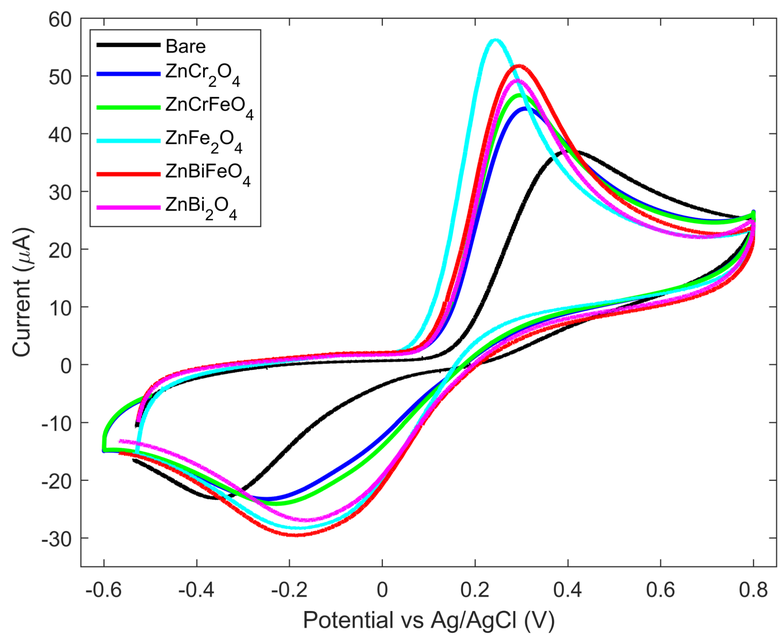


From metrohm dropsens [1], palmsens [2-3].

Methodology



Cyclic Voltammetry

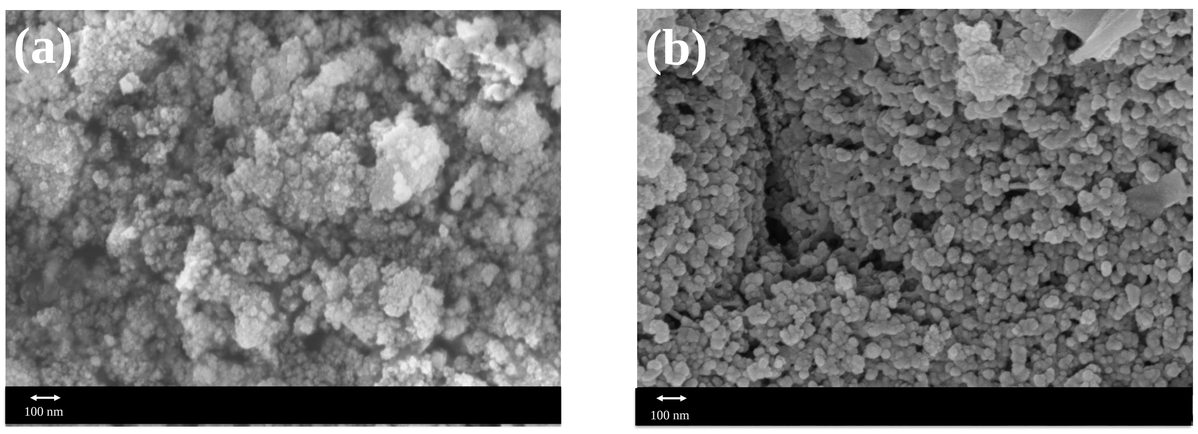


Cyclic voltammograms of 1mM **paracetamol in 0.1M PBS** pH 6.9**.**

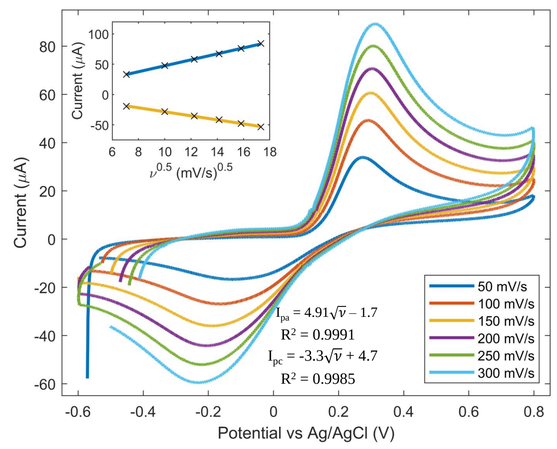
Conclusions

- Successful synthesis of spinel-based nanomaterials
- Electrochemical characterization of 6 different sensors
- Further characterization of materials
- XRD, UV-vis, XPS
- Energy band gap and redox potential analysis
- Other metabolites ex: Glucose

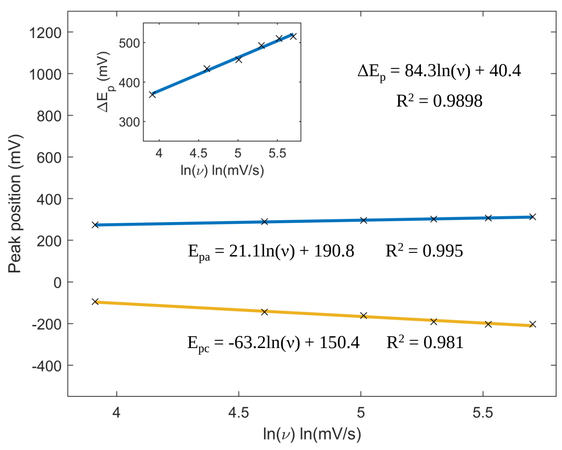
Results



SEM images of $ZnCr_2O_4$ (a) nanomaterial and (b) modified surface.

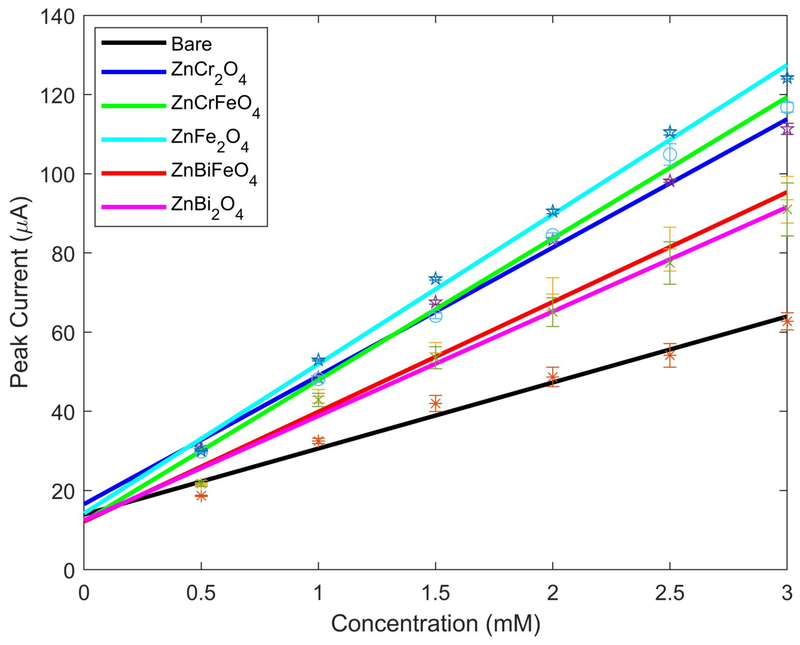


Cyclic voltammograms of $ZnCr_2O_4$ sensor with scan rate.



Cathodic and anodic potentials of $ZnCr_2O_4$ sensor with ln(scanrate).

Freely diffusing quasi reversible electrochemical system.



Calibration of different sensors.

Sensor	Sensitivity (µA/mM)	ΔEp (mV)	Rate constant 'k' (ms^{-1})
Bare	16.68 ± 0.93	746 ± 5.0	$2.29 \pm 0.27 \cdot 10^{-3}$
$ZnCr_2O_4$	32.41 ± 0.54	444 ± 6	3.73 ± 0.55
$ZnCrFeO_4$	35.72 ± 0.11	446 ± 2	4.53 ± 0.54
$ZnFe_2O_4$	37.75 ± 0.17	386 ± 2	13.1 ± 2.8
$ZnBiFeO_4$	27.26 ± 1.64	479 ± 3	1.28 ± 0.18
$ZnBi_2O_4$	26.37 ± 1.91	532 ± 12	0.45 ± 0.16

Different electrochemical parameters. **ΔEp** – peak to peak separation.

References

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