Chemiresistive sensors based on PEDOT:PSS/PtNPs composite for the detection of lactate in artificial sweat

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Introduction

Organic electronic devices are becoming omnipresent in our daily life, including in healthcare. The advantages of organic conductive polymers in terms of biocompatibility, high conductivity, solution processability, and ease of functionalization[1], make it possible to build highly sensitive biosensors via simple procedures. In this work, we have built chemiresistive based sensors by combining conductive polymers, nanomaterials, and biomolecules[2,3]. The sensors can be incorporated in a platform for building Point-of-Care devices.

Experimental work

- poly(3,4-ethylenedioxythiophene) polystyrene sulfonate (PEDOT:PSS) composite can be prepared either by mixing the conducting polymer with nanoparticles in suspension, or by simultaneous electropolymerization and electrodeposition.
- Catalytic nanomaterials such as graphene, prussian blue, silver nanoparticles, and carbon nanotubes can also be employed to dope the conducting polymer.

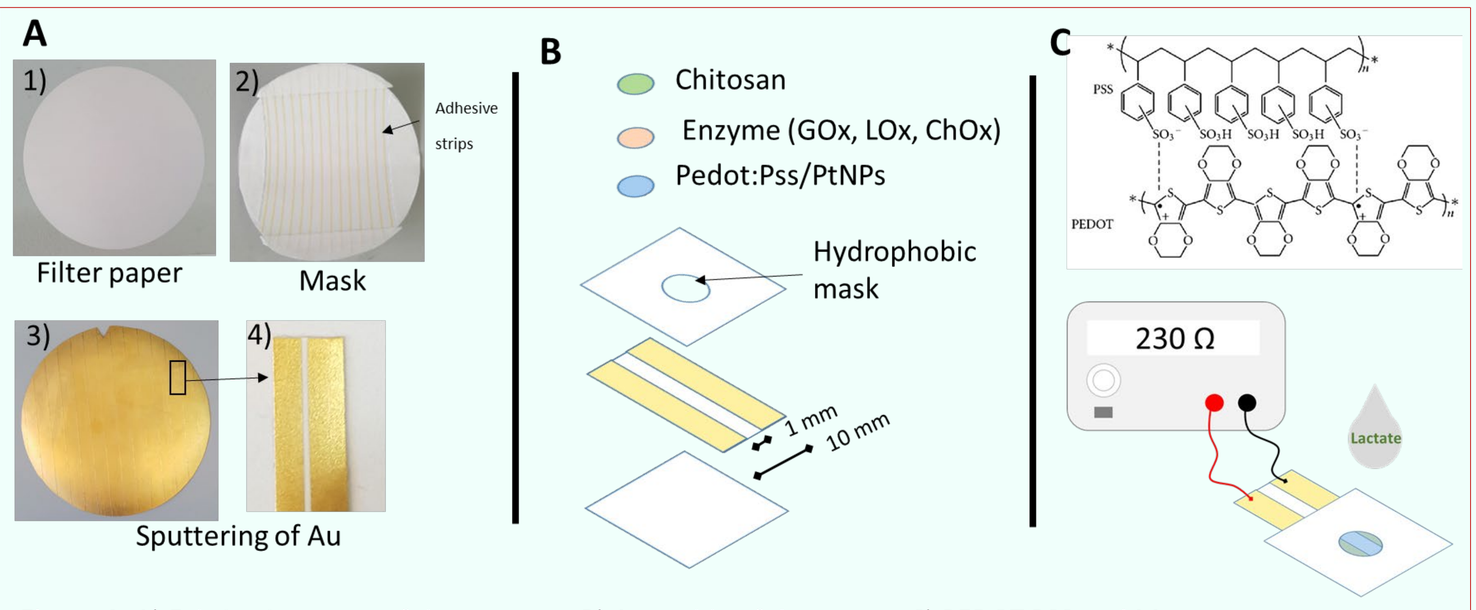

Figure 1. A) Fabrication steps of the patterns. B) Assembly of the sensor. C) PEDOT:PSS and Measurement setup

Results & Discussion

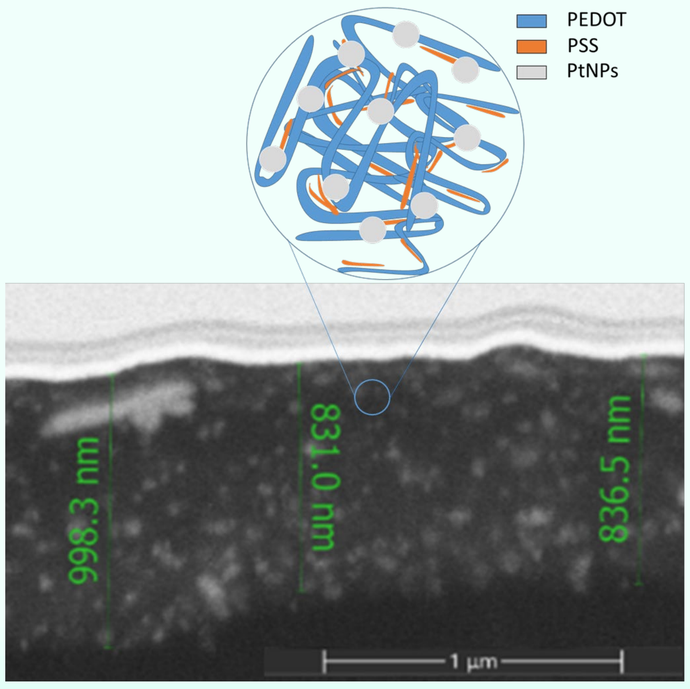

Figure 2. Description A) and FESEM image of PEDOT:PSS/PtNPs

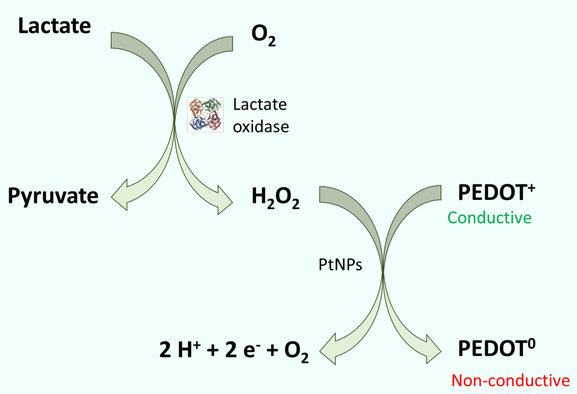

Figure 3. Mechanism of detection of lactate

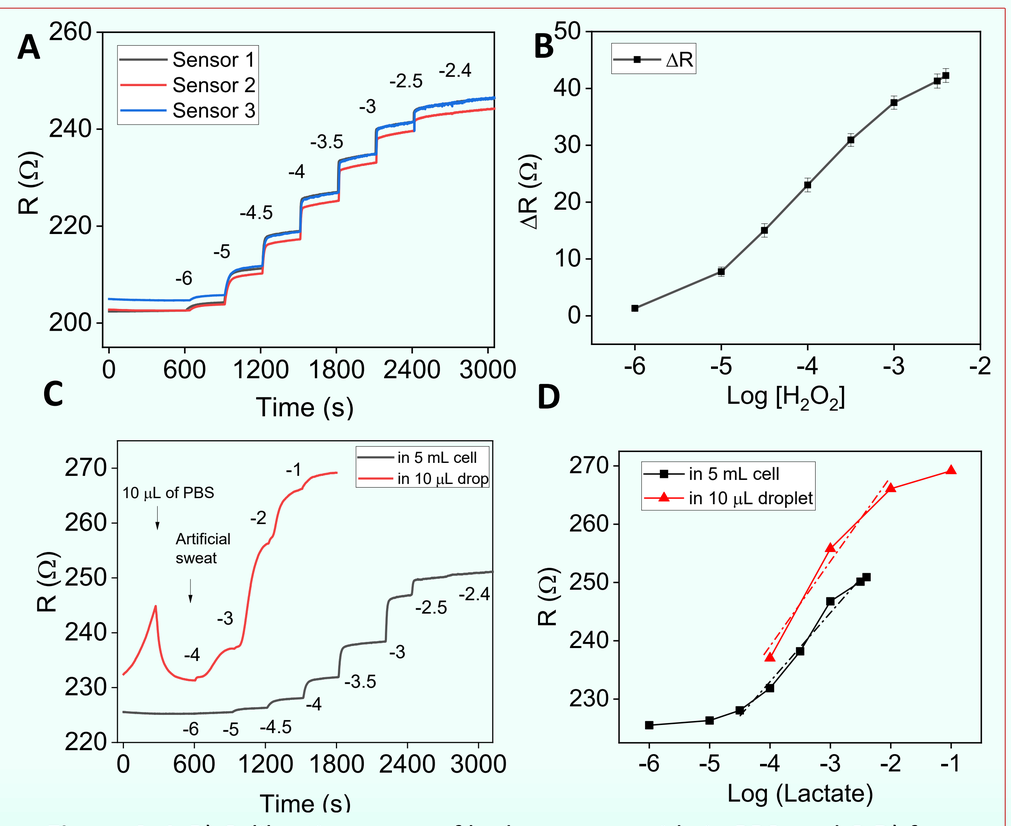

Figure 4. A-B) Calibration curve of hydrogen peroxide in PBS, and C-D) for lactate in artificial sweat

Conclusions

- Simple chemiresistive sensors with PEDOT:PSS/PtNPS were built and successfully tested.
- FESEM images demonstrate unifom dispersion of Pt nanoparticles.
- The device demonstrated high sensitivity to H_2O_2 in PBS, and lactic acid in artificial sweat within clinical range.

Future work

- On-body measurement of lactate in real sweat samples and via wireless system.
- Multiplex chemiresistive array for the monitoring of relevant biomarkers and analytes.

References

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[3] LJ. Currano, F. Connor Sage, M. Hagedon, L. Hamilton, J. Patrone, K. Gerasopoulos. Scientific reports, (2018) 8:15890.

Acknowledgement

We acknowledge financial support from the Spanish ministry of Economy and Competitiveness and European Regional Development Fund and Spanish ministry of Science and innovation and the state agency of research (AEI) (PID2019-106862RB-I00/AEI/10.13039/501100011033).