

ELECTROCHEMICAL SENSOR FOR WORKER SAFETY IN MANUFACTURING INDUSTRIES

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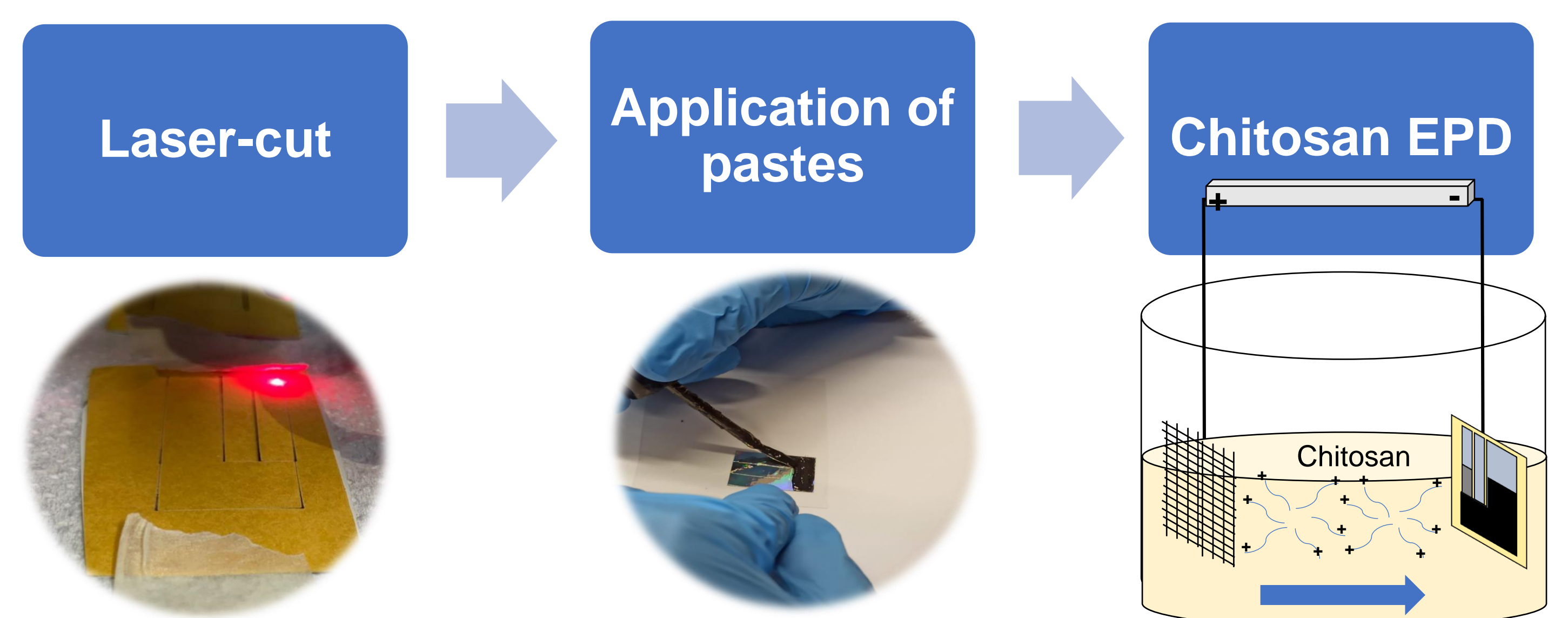
Introduction

Most **occupational lung diseases** of industrial workers are attributed to excessive exposure to dangerous substances, such as dust particles and gases [1]. This work involves the development of a smart mask implemented with an electrochemical sensor for real-time detection of **hydrogen peroxide** in **exhaled breath (EB)**. The presence of a high concentration of this biomarker in EB, known as **oxidative stress**, can be associated with serious diseases.



Fabrication

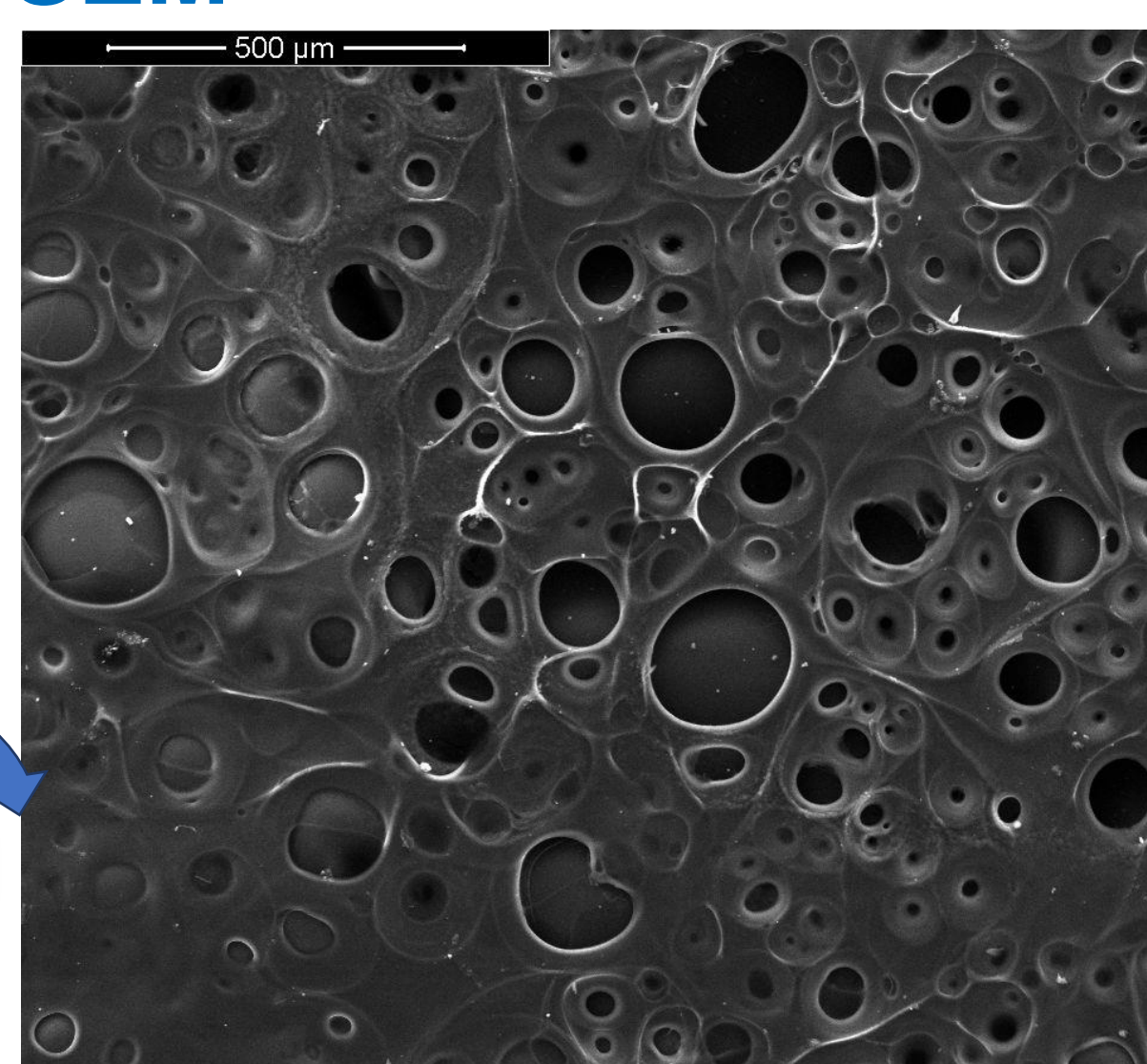
The sensors, with a three-electrode configuration, were fabricated from the **silver layer** of wasted compact discs (CDs) [2].



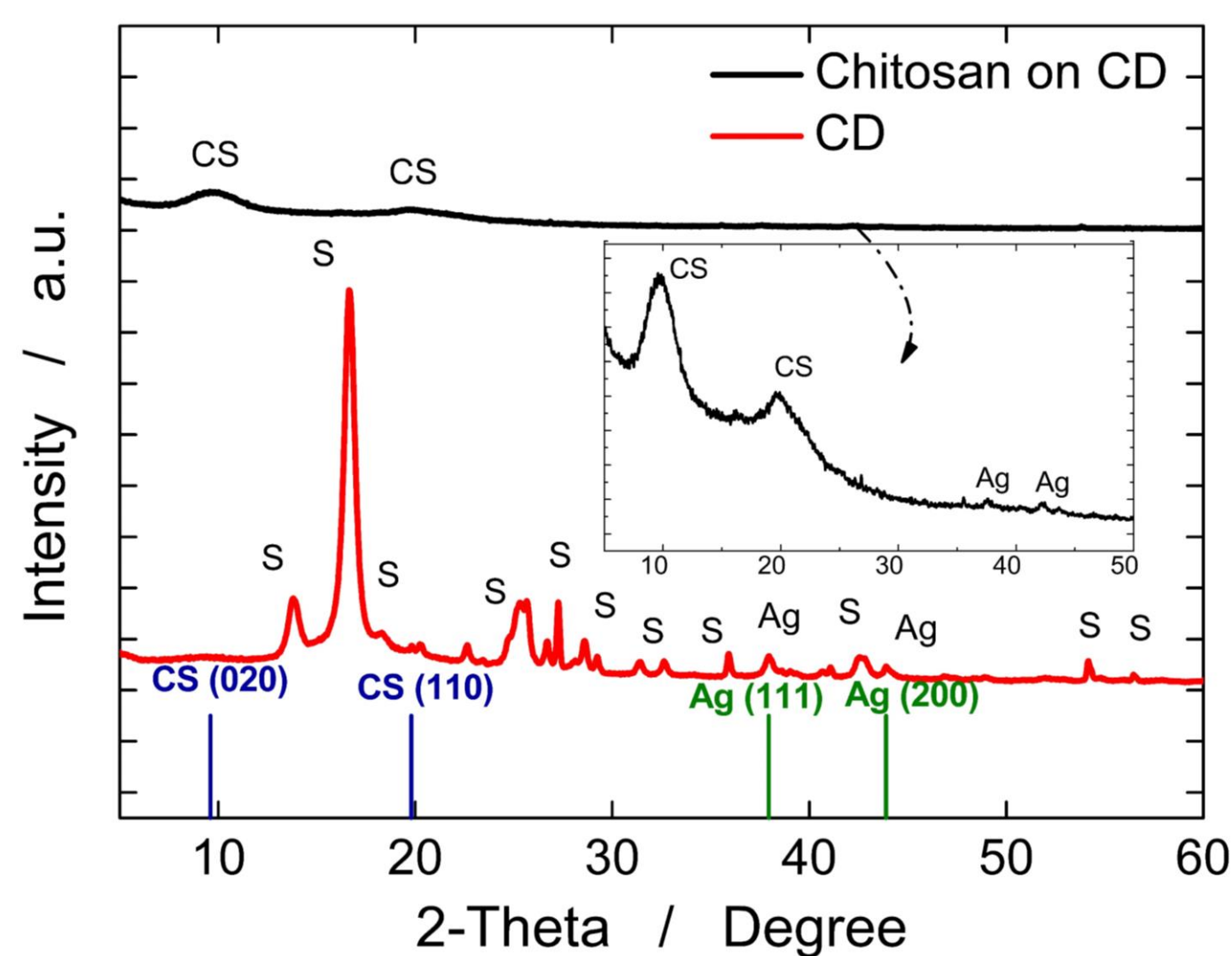
Characterization

All characterization techniques confirm the presence of chitosan layer on the surface of the sensor [3].

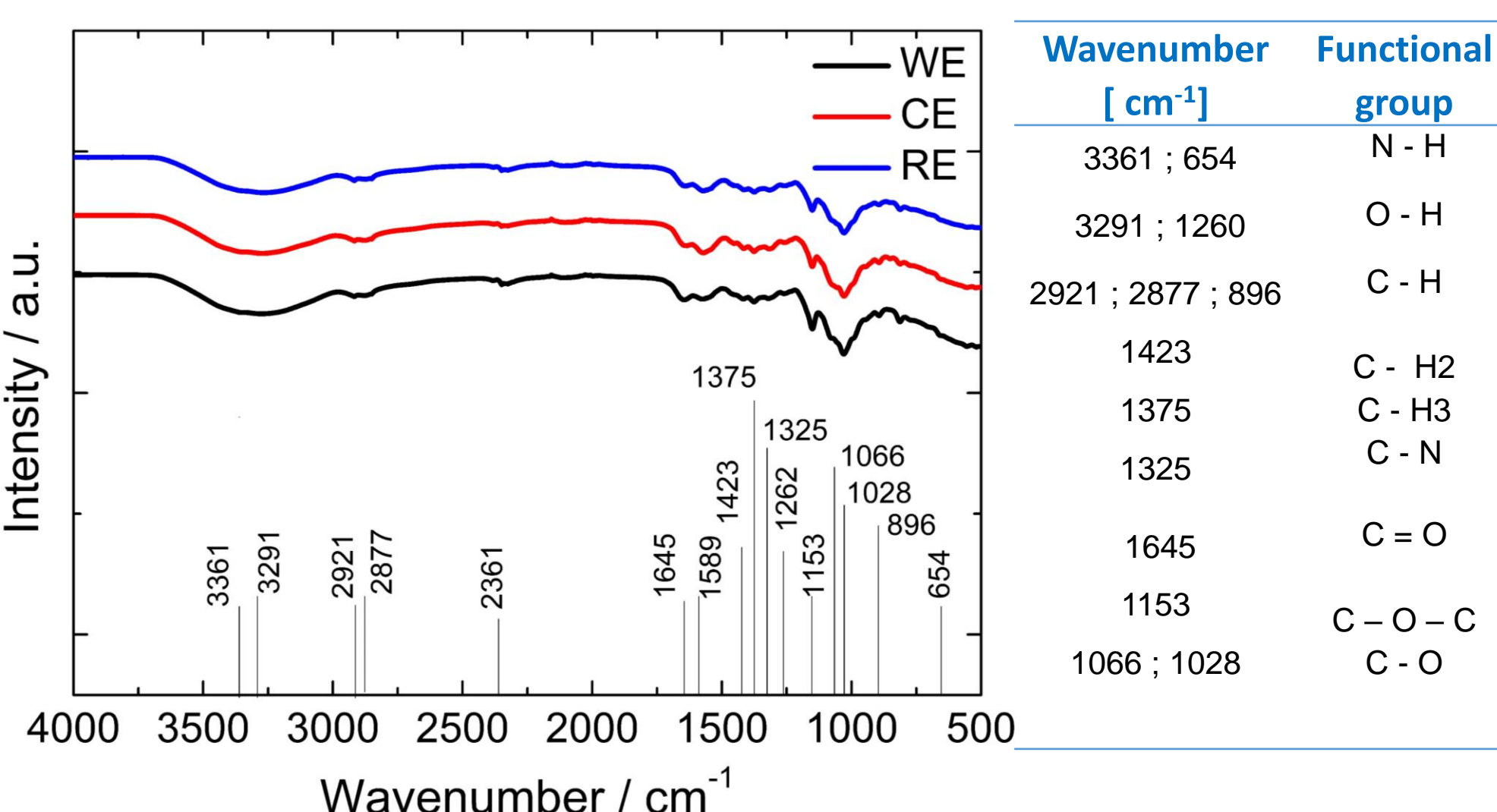
SEM



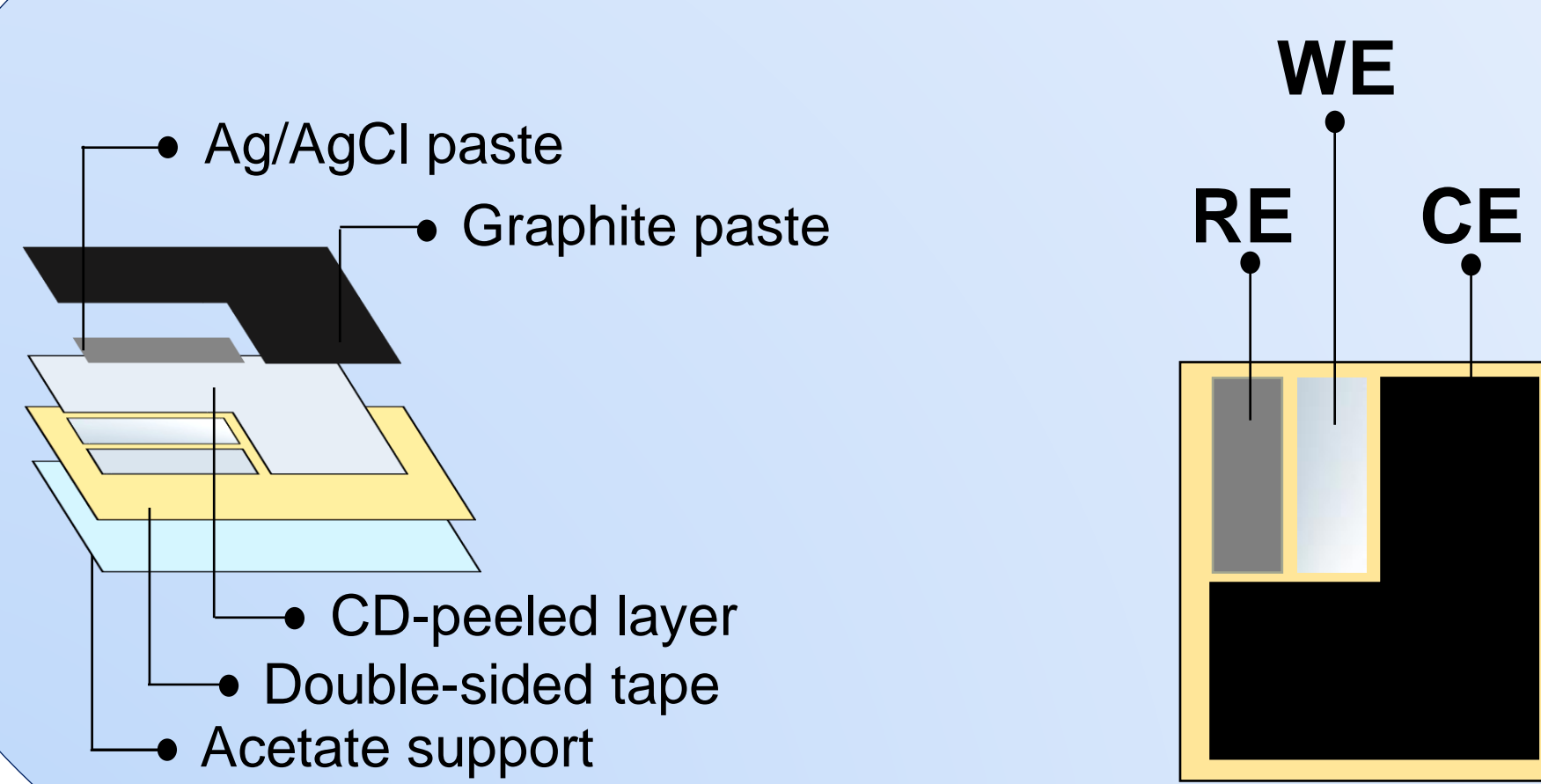
XRD



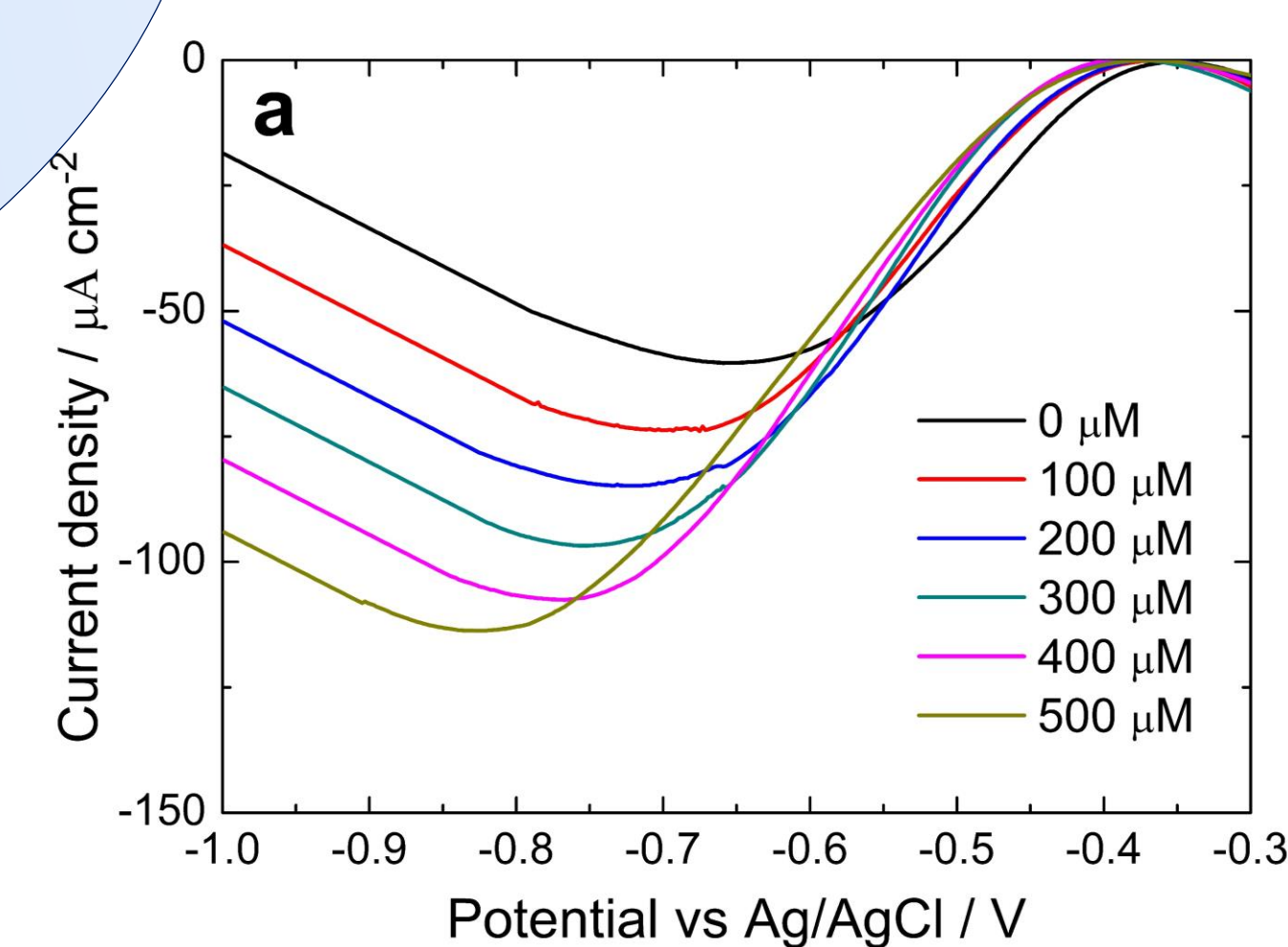
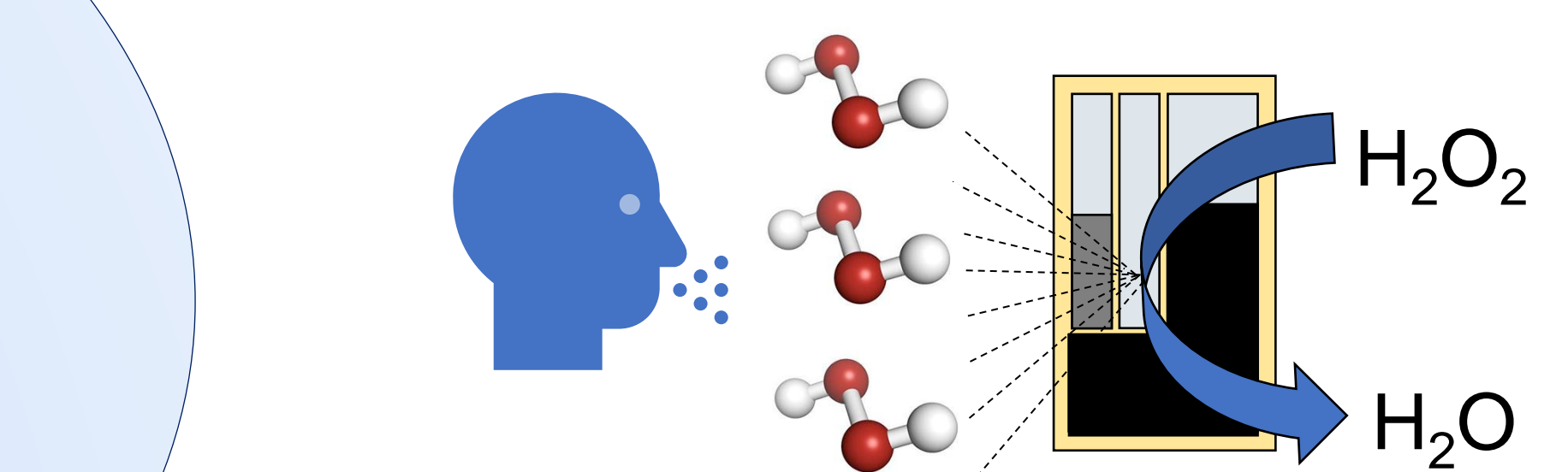
FT-IR



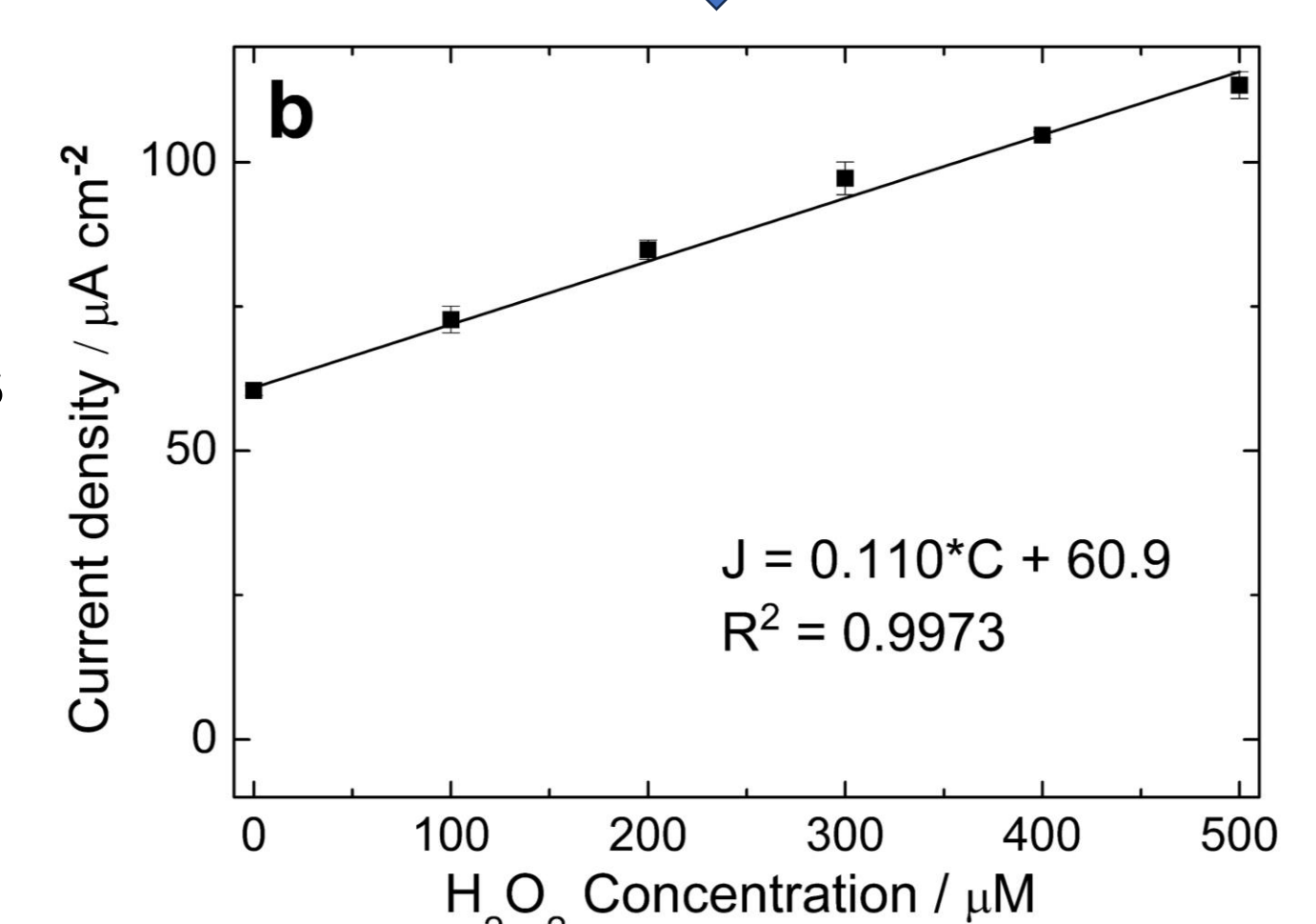
Sensor Design



Sensor performance

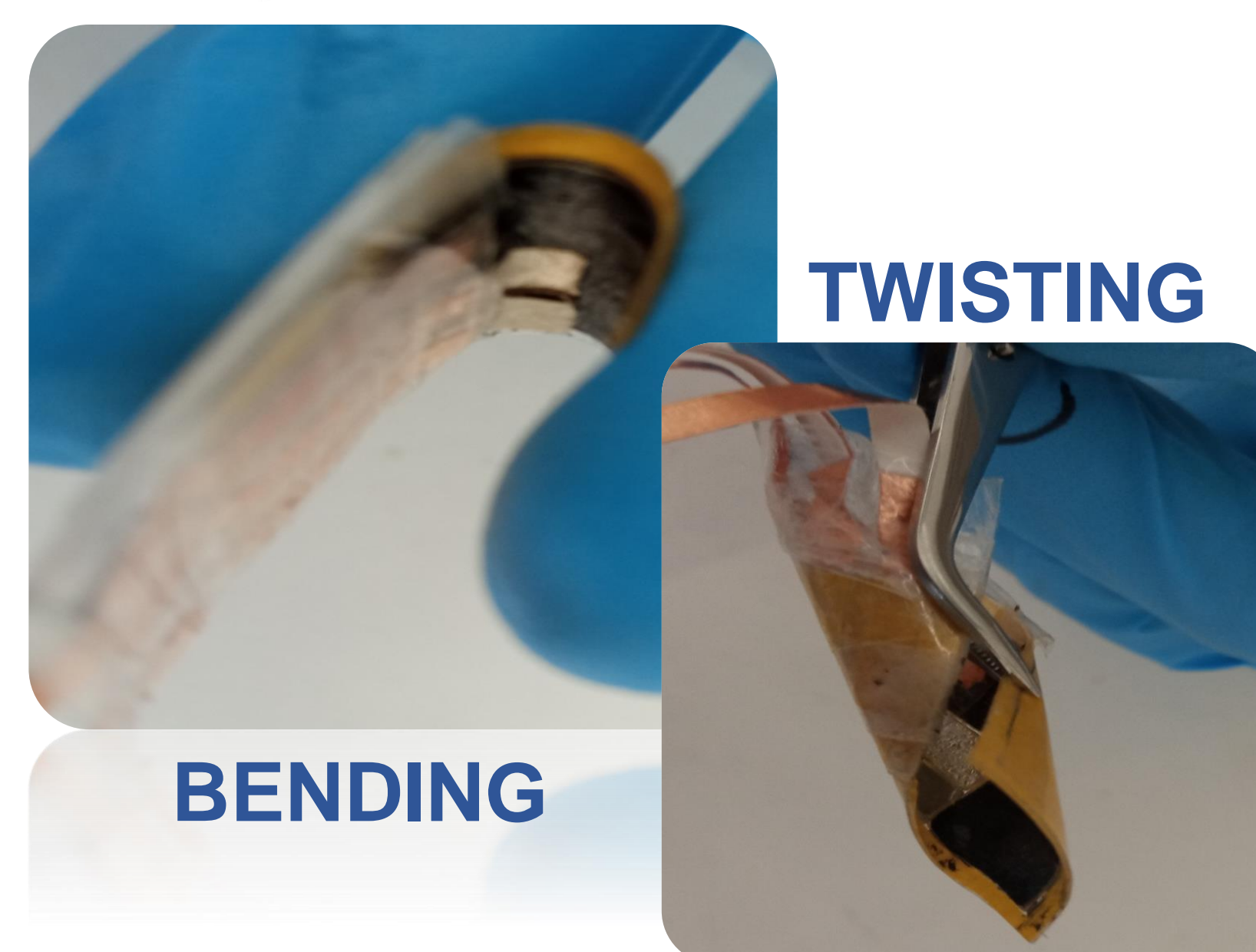
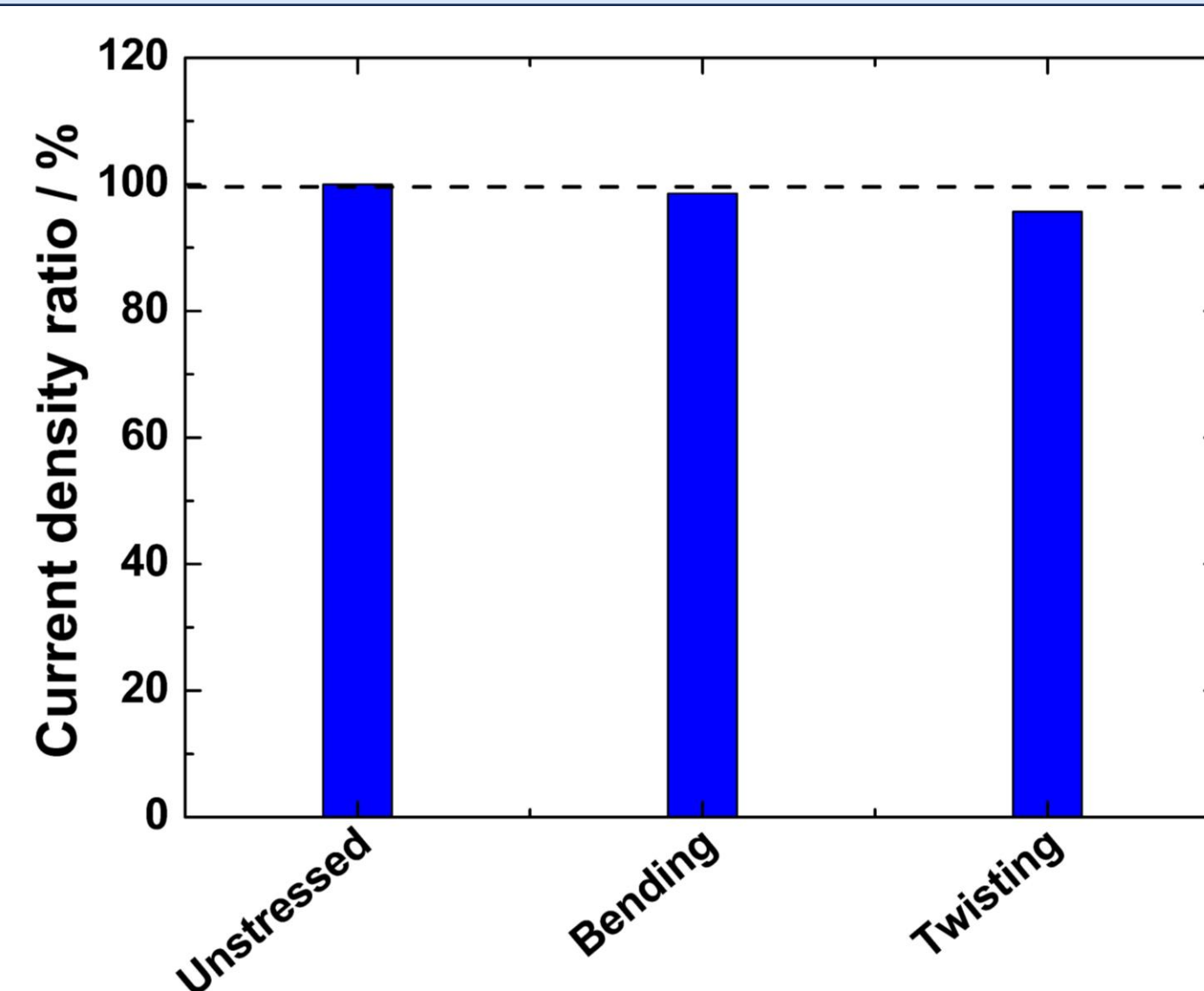


CALIBRATION LINE



LSV (Linear Sweep Voltammetry) tests were carried out in aerosol phase to simulate the exhaled breath.

Flexibility test



Conclusions

This work reported the development of a **wearable** sensor for the detection of **H₂O₂** in exhaled air in real-time. The sensor is able to detect H₂O₂ in the **aerosol phase** with a linear range from 100 to 500 μM and a sensitivity of 0.108 μA μM⁻¹ cm⁻². It was also tested after different deformations with successful results, so this test verify that the sensor is **flexible**.

References

- [1] Atsumbe et al. "Occupational diseases and illnesses in manufacturing industries in Adamawa State: Causes and effects", *J Environ Sci Toxicol Food Tech*, 2013, vol.3, p.7
- [2] Bruno Maria G. et al., «Wearable Sensor for Real-time Monitoring of Hydrogen Peroxide in Simulated Exhaled Air», *Chemical Engineering Transactions*, vol. 100, pp. 655–660, giu. 2023
- [3] A.B. Vino, P. Ramasamy, V. Shanmugam, A. Shanmugam, Extraction, characterization and in vitro antioxidative potential of chitosan and sulfated chitosan from Cuttlebone of Sepia aculeata Orbigny, 1848, *Asian Pac. J. Trop. Biomed.* 2 (2012) S334–S341

Acknowledgements

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