Synthesis of Copper Selenide Nanobelts for Electrochemical Detection of Hydrogen Peroxide

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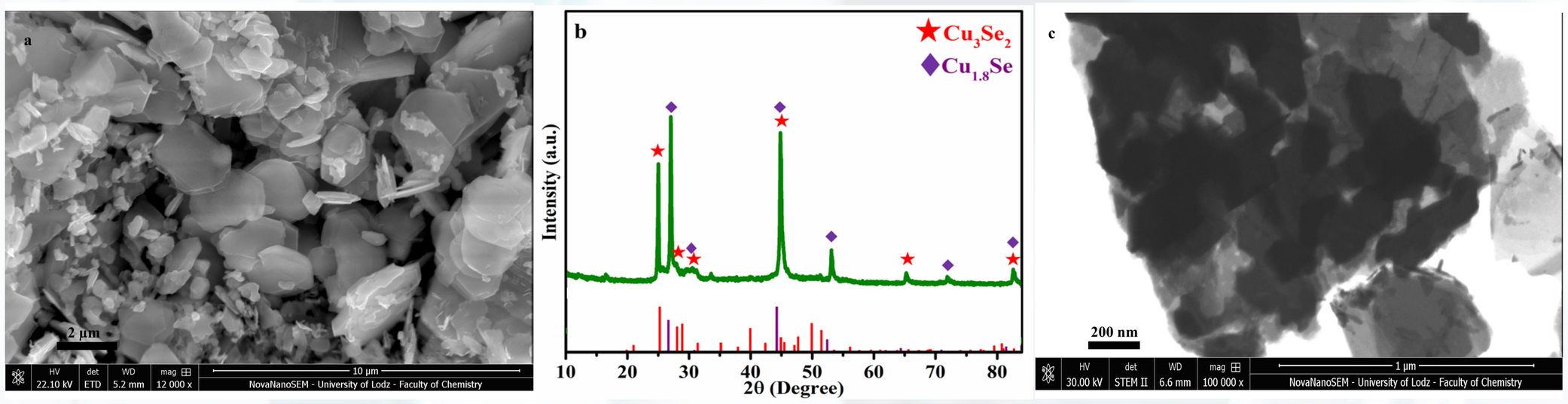
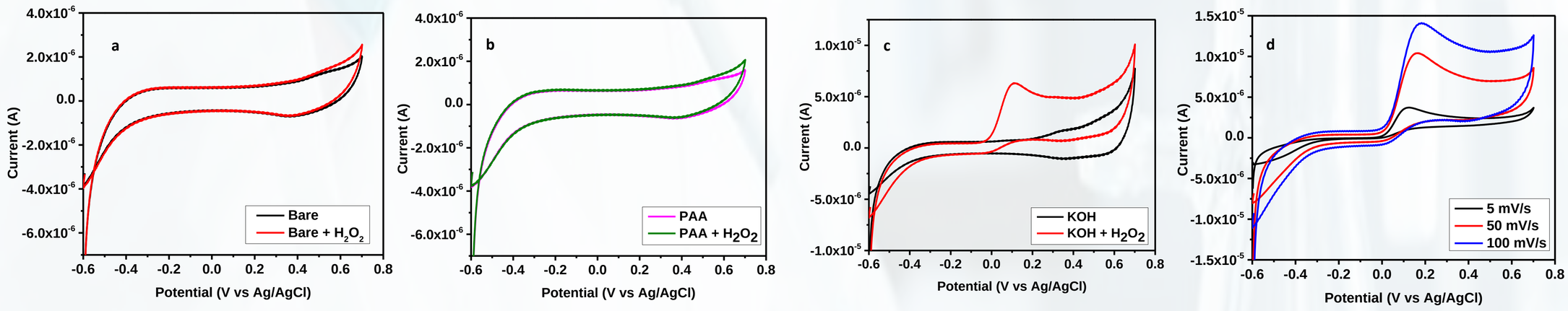
Abstract

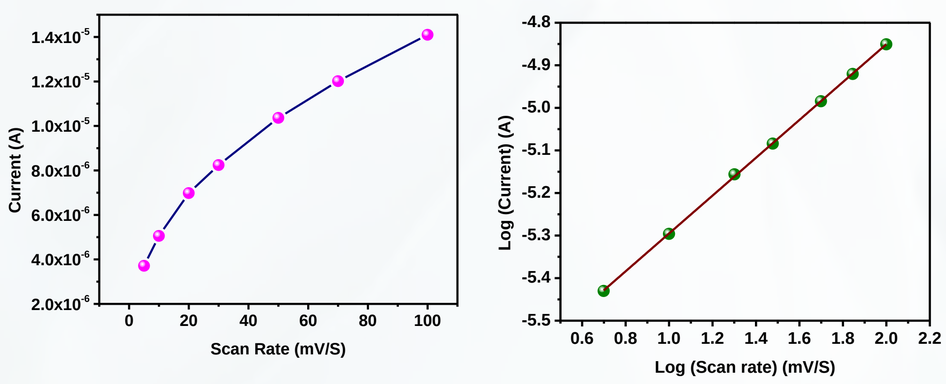
Hydrogen peroxide is a byproduct of many physiological reactions in living organism. Thus, its concentration can help determine certain diseases, for example lung cancer or asthma. [1, 2]. Additionally, its detection is in the center of interest for security reason, as it is part of homemade peroxo-explosive materials [3, 4]. copper selenide was synthesized using simple solvethermal method with nanobelt morphology, which was characterized by XRD, SEM and TEM. Copper selenide, as an electrocatalyst, was used for hydrogen peroxide determination in electrolyte of 0.1M KOH, and 0.25% PAA, covering a detection range from 0.03 to 1 mmol. The catalyst showed LOQ (2.49×10^{-5} mol/L) and LOD (7.48×10^{-6} mol/L) for hydrogen peroxide detection. Under optimized reaction conditions in SWV, it exhibited LOQ and LOD of 2.75×10^{-5} and 8.18×10^{-6} mol/L, respectively.



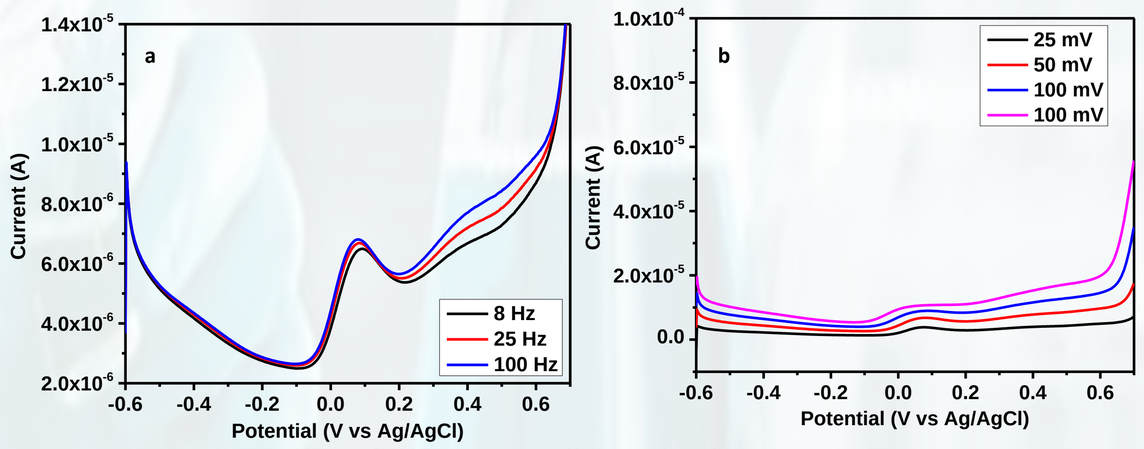
(a) SEM, (b) XRD, and (c) TEM data for copper selenide nanobelts.



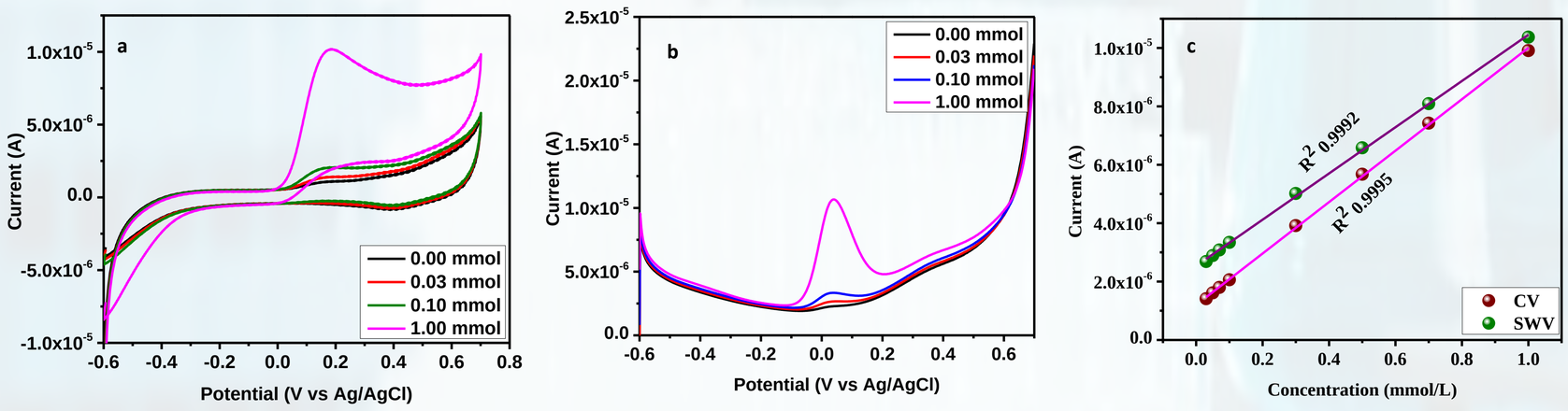
Effect of (a) bare electrode, (b) PAA, (c) KOH (supporting electrolyte), and Scan rate on hydrogen peroxide detection (oxidation) .



Scan rate and current peak relation confirmed diffusion control mechanism (Slope = 0.44)



Effect of (a) Frequecny (b) amplitude on H2O2 detection in SWV



Detection of hydrogen peroxide under optimize condition via (a) CV, (b) SWV, and its calibration line

Conclusion

copper selenide was synthesized using simple solvethermal method with nanobelt morphology. Copper selenide, as an electrocatalyst, was used for hydrogen peroxide determination in electrolyte of 0.1M KOH, and 0.25% PAA, covering a detection range from 0.03 to 1 mmol. The catalyst showed LOQ (2.49×10^{-5} mol/L) and LOD (7.48×10^{-6} mol/L) with R^2 value of 0.9995 for hydrogen peroxide detection. Under optimized reaction conditions in SWV, it exhibited LOQ and LOD of 2.75×10^{-5} and 8.18×10^{-6} mol/L with R^2 value of 0.9992, respectively.

References

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