

Free-standing MXene/chitosan/Cu₂O electrode: an enzyme-free and efficient biosensor for simultaneous determination of glucose and cholesterol

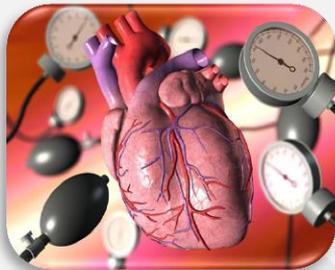
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Metabolite Detection



Diabetes

Glucose

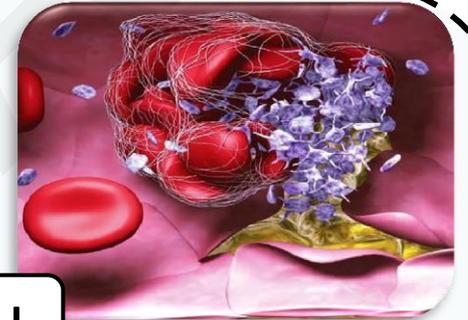


Renal failure

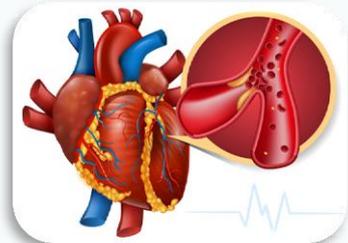


Atherosclerosis

Cholesterol



Thrombus



Coronary heart disease

Illustration for Fabrication Process

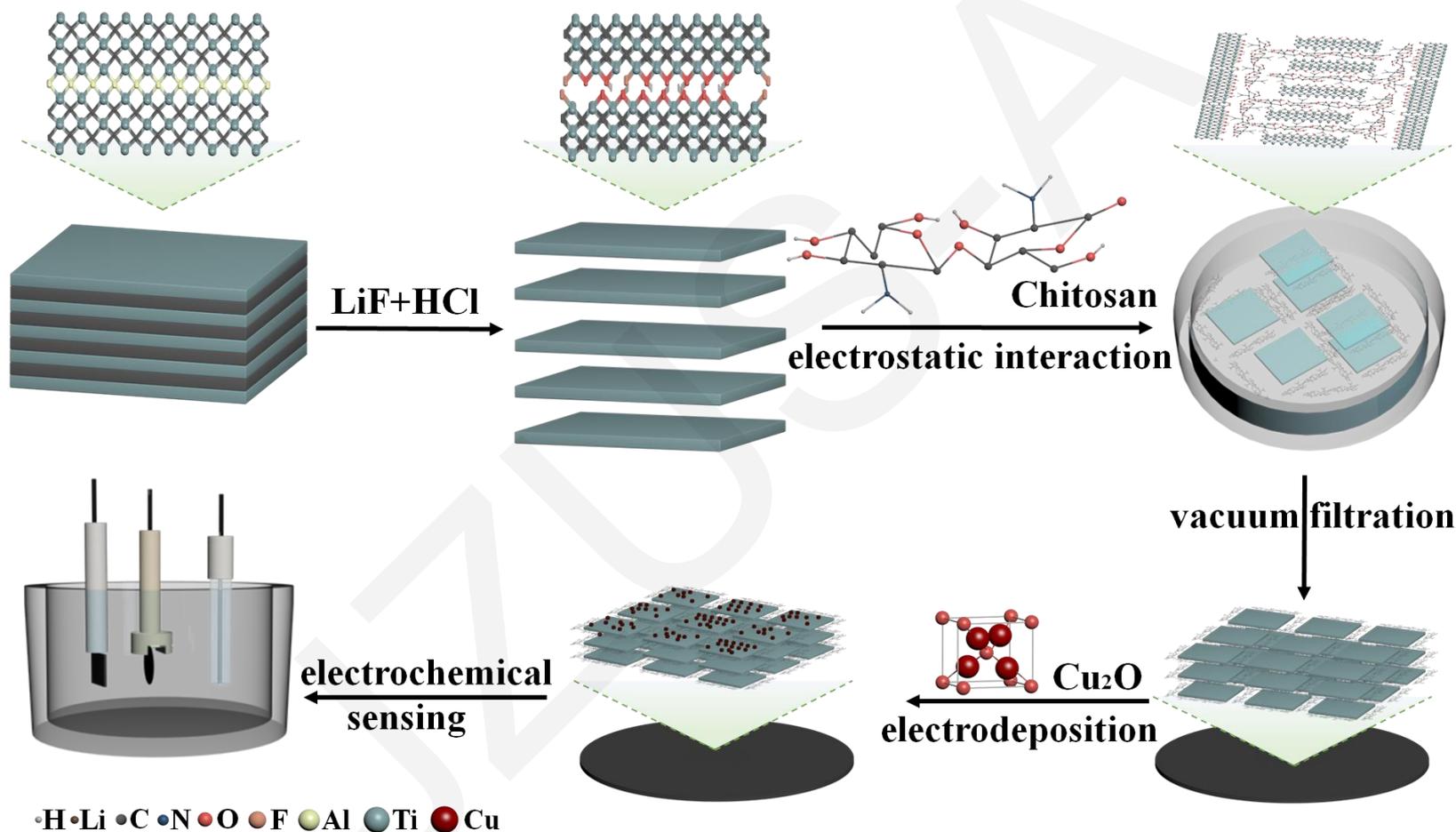


Fig. 1 Schematic illustration for the fabrication process of the self-assembled MXene/CTS/Cu₂O

Detection Mechanism

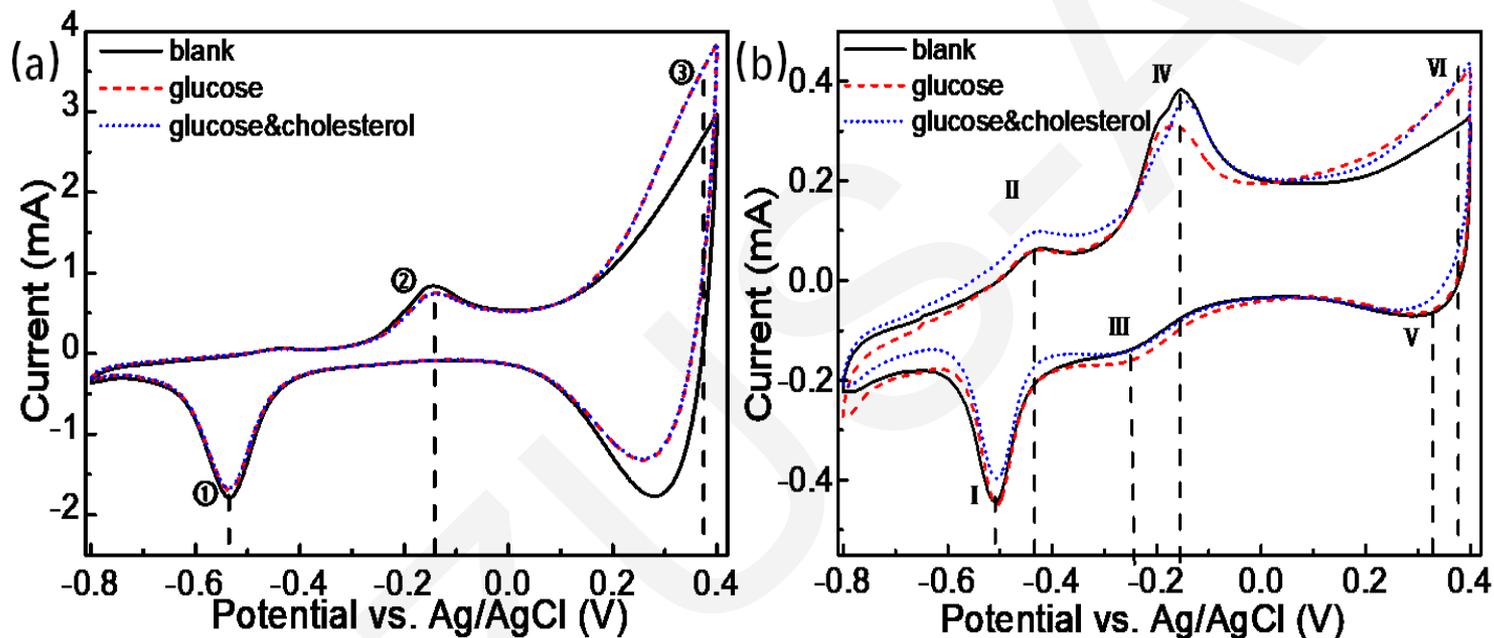


Fig. 2. CV curves of MXene/CTS (a) and MXene/CTS/Cu₂O (b) electrodes for 1 mmol/L glucose and 0.2 mmol/L cholesterol detecting with labelled peaks

Detection Mechanism

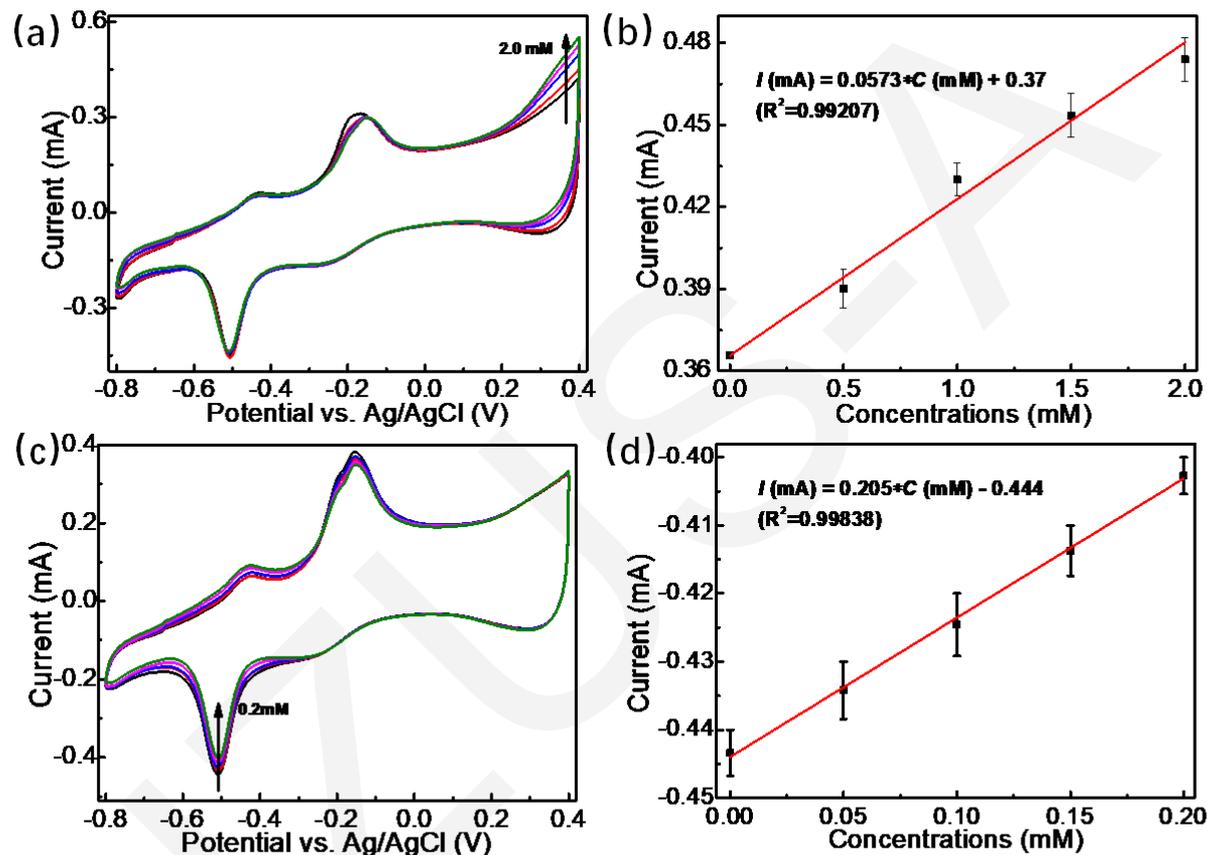


Fig. 3 CV curves of MXene/CTS/Cu₂O with 0.1 mmol/L cholesterol towards glucose sensing (a) and with 1 mmol/L glucose towards cholesterol sensing (c); plotted relationship curve of MXene/CTS/Cu₂O between electrocatalytic current and glucose concentration (b), and between electrocatalytic current and cholesterol concentration (d)

Simultaneous Detection

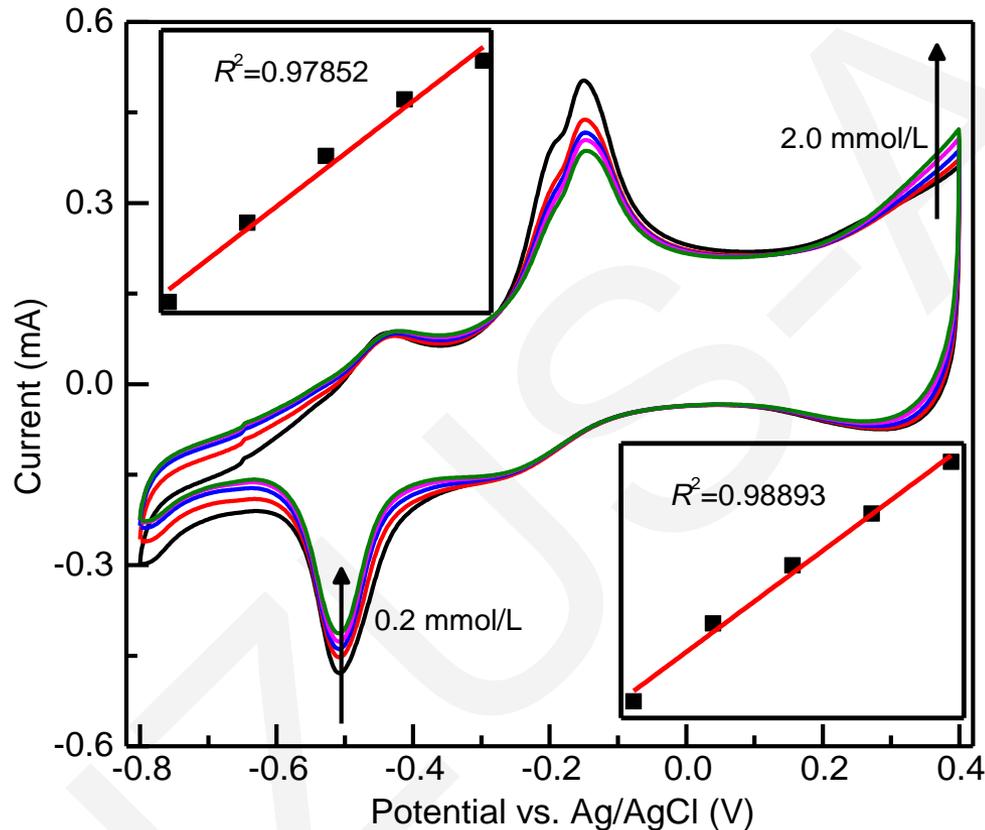


Fig. 4 CV responses of MXene/CTS/Cu₂O for simultaneous detection of glucose and cholesterol (adding 0.5 mmol/L glucose and 0.05 mmol/L cholesterol each time). The inset plots are corresponding peak current fitted lines (Top:glucose; Bottom:cholesterol)

Conclusions

- A free-standing MXene/CTS/Cu₂O electrode was formed. Taking advantage of the synergistic function of MXene/CTS layers and Cu₂O nanoparticles, this ternary electrode exhibits excellent sensing capabilities for glucose and cholesterol with preferable linear ranges that can cover the full concentration range in clinical diagnosis. This work has proposed a versatile strategy for designing and fabricating self-assembled nanocomposite materials with tuned structural and functional properties. It is a first attempt which could be easily integrated into portable electrochemical devices, facilitating effective routine monitoring of blood metabolites and paving the way for commercialization and point-of-care testing.