Flexible Electrochemical Sensor for Monitoring ROS Realase from Vascular Cells

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The vasculature is always exposed to complex biomechanical stress, abnormal stress would disequilibrate its homeostasis and ultimately trigger a series of vascular diseases, such as atherosclersis[1]. Accumulating evidence suggests that reactive oxygen species (ROS) are intimately involved in the occurrence and development of these diseases induced by stress[2]. Therefore, it is of great significance to obtain the dynamic information of ROS production and metabolism under the pathophysiological conditions. However, its high reactivity and short half-time make it quite diffcult to detect ROS from complicated biological system in real-time, especially released from the cell or tissue in dynamic stretching state. Hence, the development of ROS sensors equipped with both sensitive response and mechanical compliance are rather urgent and challenging.

Flexible electrochemical sensor, as an emerging but attractive technique, possesses many prominent merits in monitoring signalling molecules from deformed cells and curvilinear tissues in real-time and continuously[3]. In this work, we fabricate a flexible electrochemical sensor based on ultra-small Pt NPs inlaid Au NTs networks onto PDMS film (Pt NPs/Au NTs/PDMS) with excellent electrocatalytic performance toward the oxidation of H_2O_2. Furthermore, the as-prepared device remains desirable electrochemical activity even under 50% tensile deformation. These results demonstrate that this sensor can be potentially used to induce and monitor simultaneously H_2O_2 release from vascular cells, thereby providing a better understanding of the role of ROS during various pathophysiological processes.

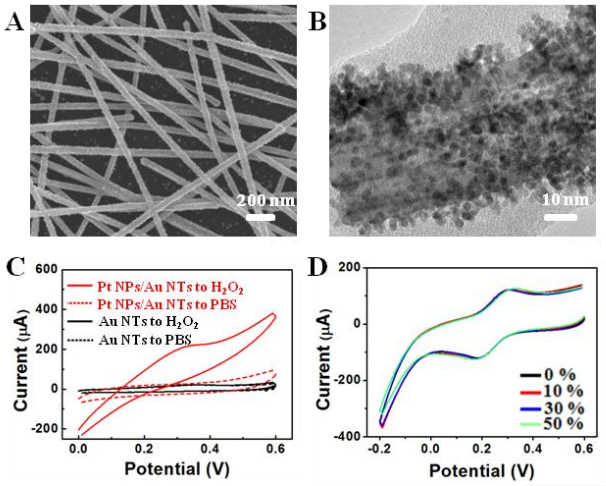

Figure 1: (A) SEM image and (B) TEM image of Pt NPs inlaid Au NTs; (C) Cyclic voltammograms recorded for PBS without or with 2 mM H_2O_2 at Pt NPs/Au NTs/PDMS and Au NTs/PDMS electrodes; (D) Cyclic voltammograms recorded for $K_3[Fe(CN)_6]$ at Pt NPs/Au NTs/PDMS electrodes at different tensile states.

References

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