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# Electronic Supplementary Information

## Simultaneous Electrochemical deposition of e-rGO/β-CD/MnO2 ternary composite for self-powered supercapacitor based caffeine sensor

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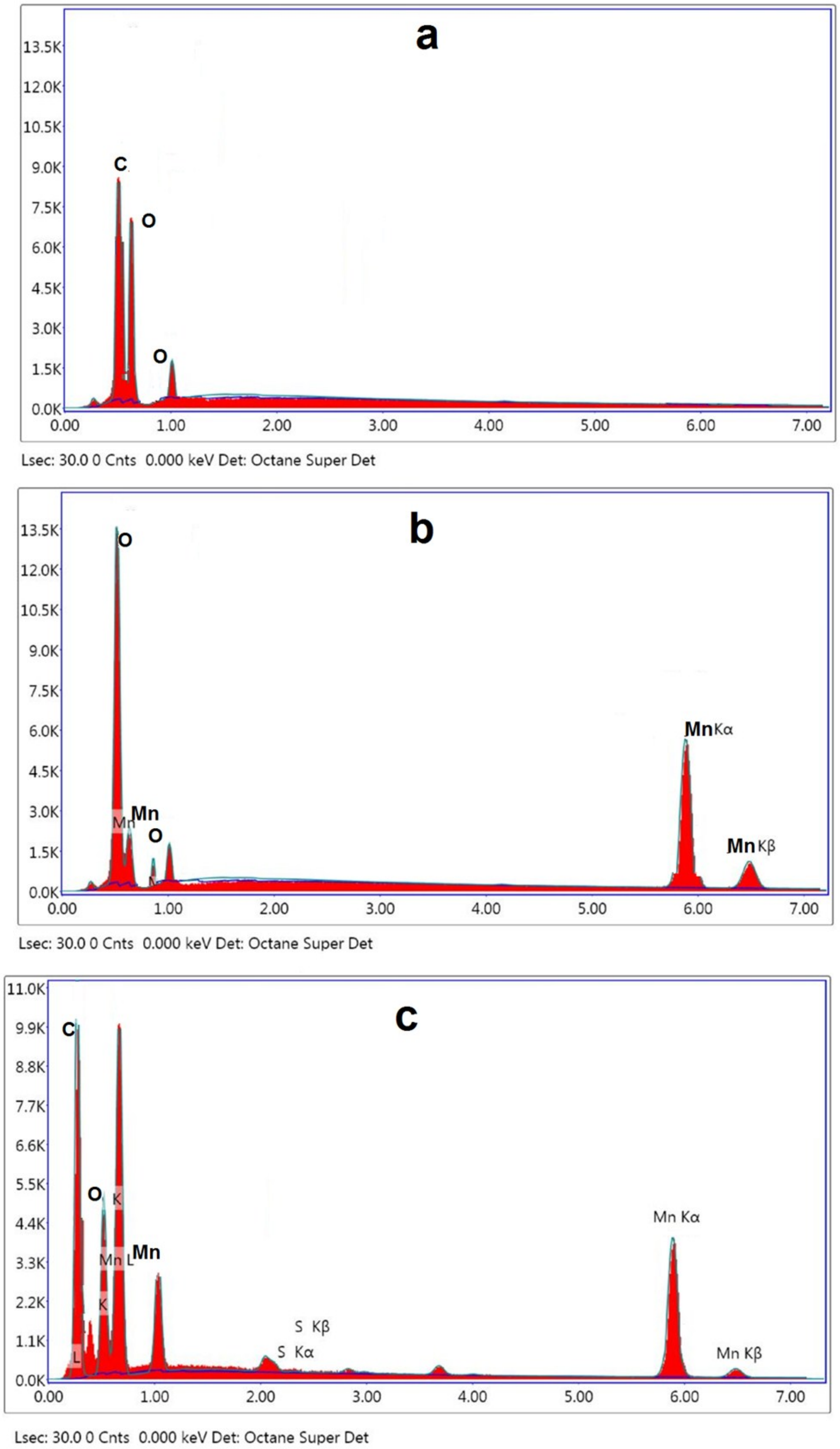


**Fig.1 EDX analysis of rGO, $MnO_2$ and rGO/β-CD/$MnO_2$ composite**

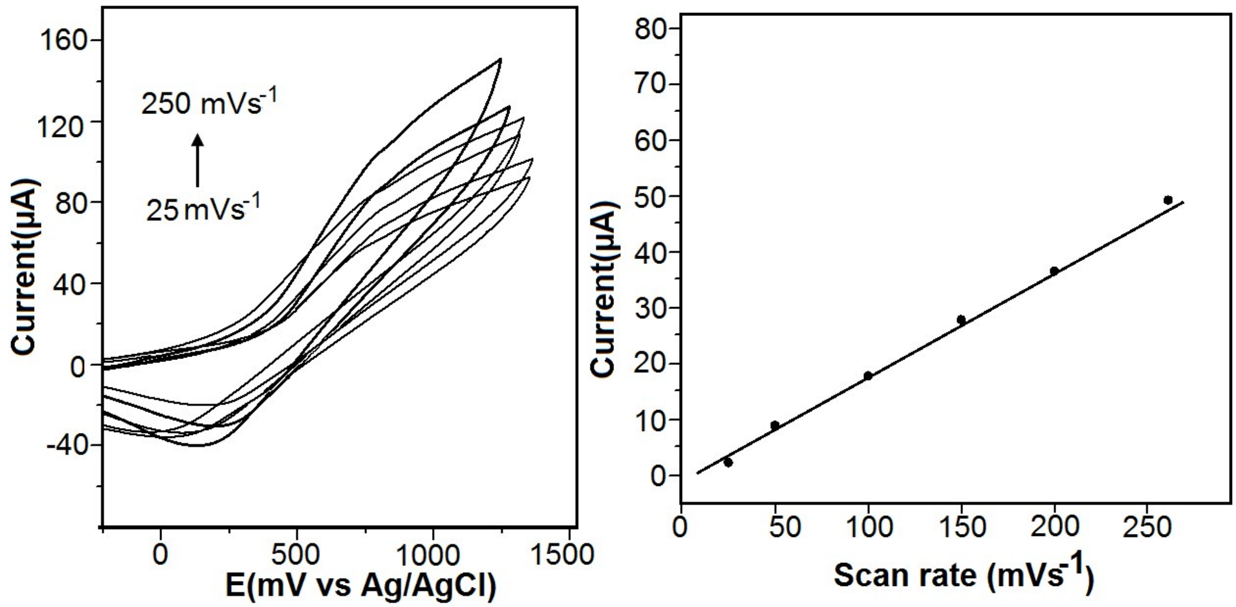


**Fig. 2. Cyclic voltammograms of 0.1mM caffeine at increased scan rate and the linear correlations at pH 4.**

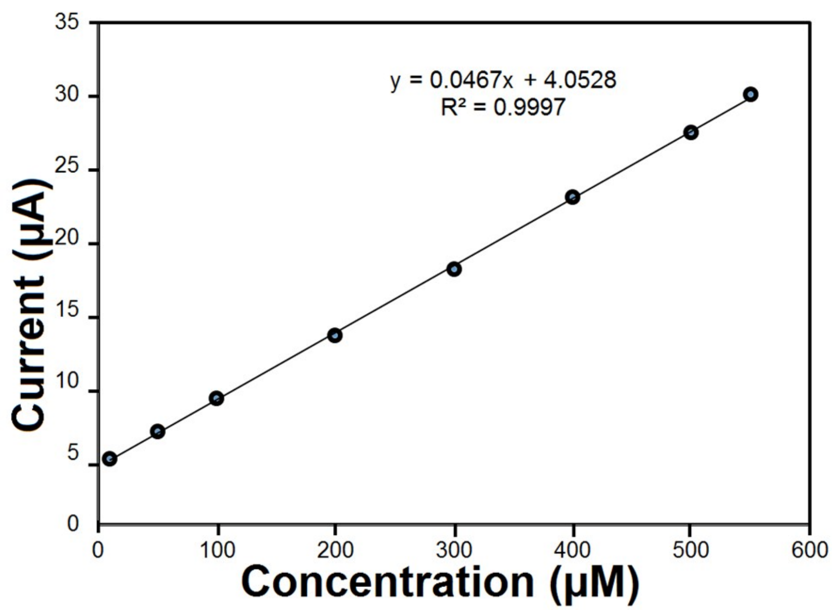


**Fig. 3 Square wave voltammograms Liner correlations of caffeine at various concentrations.**

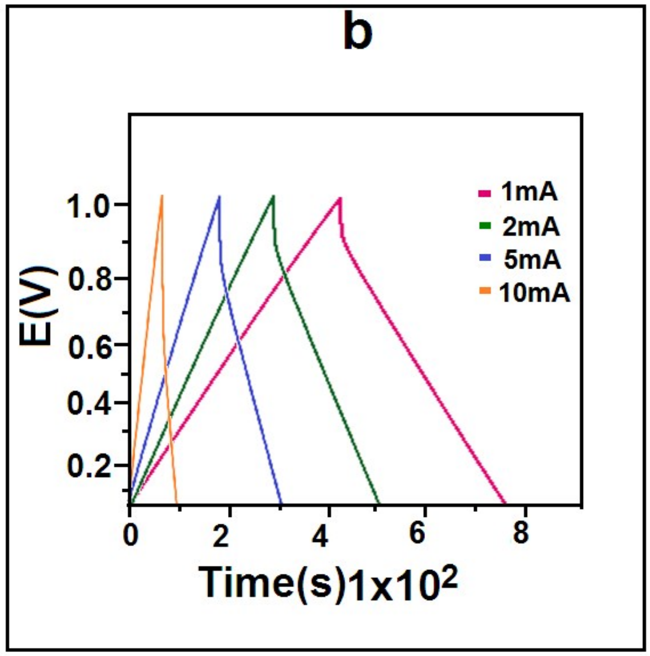


**Fig. 4. Galvanostatic charge-discharge analysis of rGO/β-CD/$MnO_2$ supercapacitor electrode at different currents.**

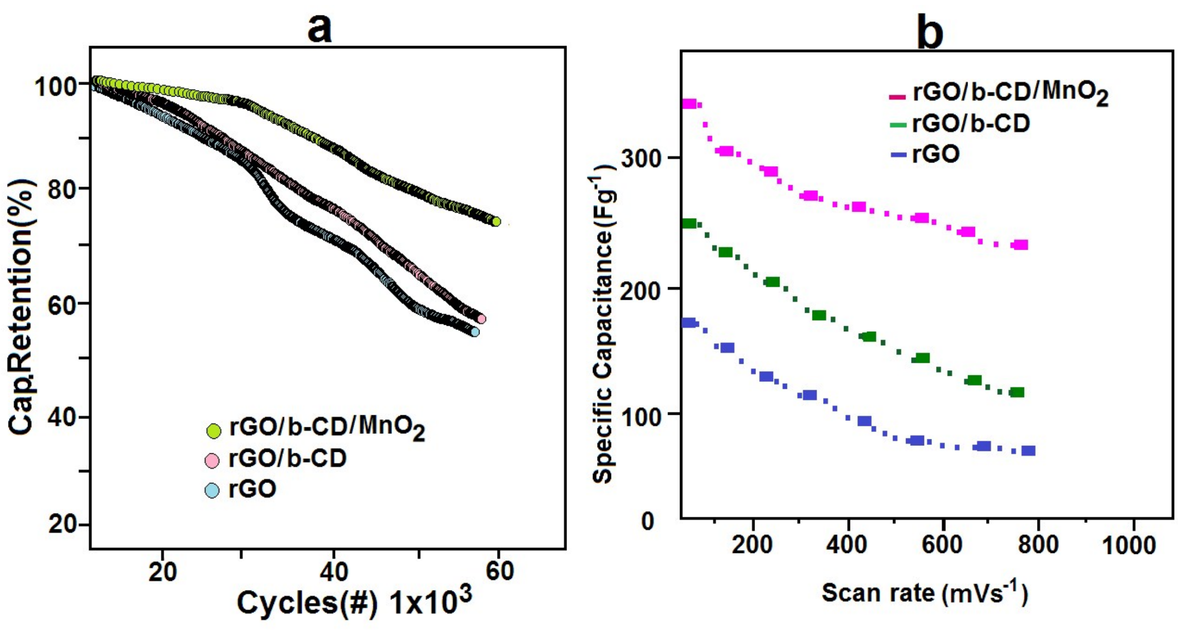


**Fig. 5. Cyclic performance test and specific capacitance profile of rGO, rGO/β-CD and rGO/β-CD/$MnO_2$ supercapacitor electrodes**

**Calculations**

The capacitance of rGO/β-CD/$MnO_2$ composite electrode could be calculated from the galvanostatic discharge curves, using the following equation 1.

$$C = \frac{I\Delta t}{m\Delta V} \quad .....1$$

Where $I$ (A) is charge or discharge current, $\Delta t$ (s) is the time for a full charge or discharge, $m$ (g) indicates the mass of the active material, and $\Delta V$ represents the voltage change after a full charge or discharge. The energy density (E), power density (P), equivalent series resistance (ESR) and columbic efficiency (ɲ) were calculated by following equations (2-4).

$$E = \frac{C(\Delta V)^2}{7.2} Whkg^{-1} \quad ..........2$$

$$P = \frac{E}{\Delta t} \times 3600 Wkg^{-1} \quad ..........3$$

$$ESR = \frac{V_{IR}}{2I} \Omega \quad .........4$$

Where C is the specific capacitance of the active materials, ΔV is the potential window of discharge, ESR is the equivalent series resistance, $V_{IR}$ is the IR drop from charge-discharge current and I is the current.[1, 2]

**References**

1. R. Ananthakumar, S. Balasubramaniam and S.J.Kim, Nano Energy, 2015,15, 587.

2. Z. Xinga, B. Wang, W. Gao, C. Pan, J. K. Halsted, E.S. Chong, J. Lu, X. Wang, W.Luo, C.-H.Chang, Y.Wen, S.Ma, K Amine and X.Ji, Nano Energy, 2015, 11, 600.