Supplementary Information

Small biomolecules sensor based on an innovative MoS_2-rGO heterostructure modified electrode platform: A binder-free approach

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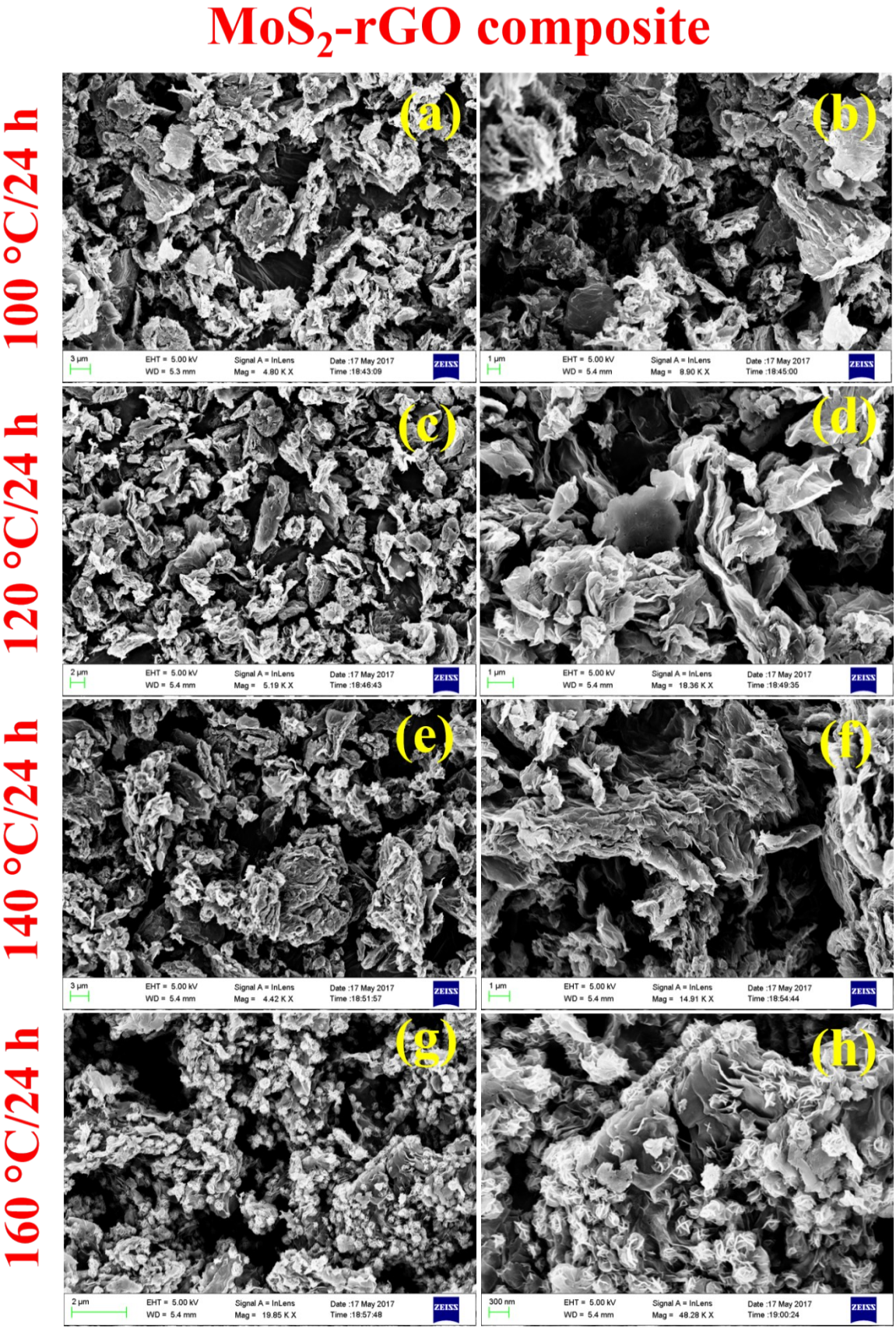


Fig. S1 SEM images of MoS_2-rGO at different reaction temperatures by keeping the reaction time constant.

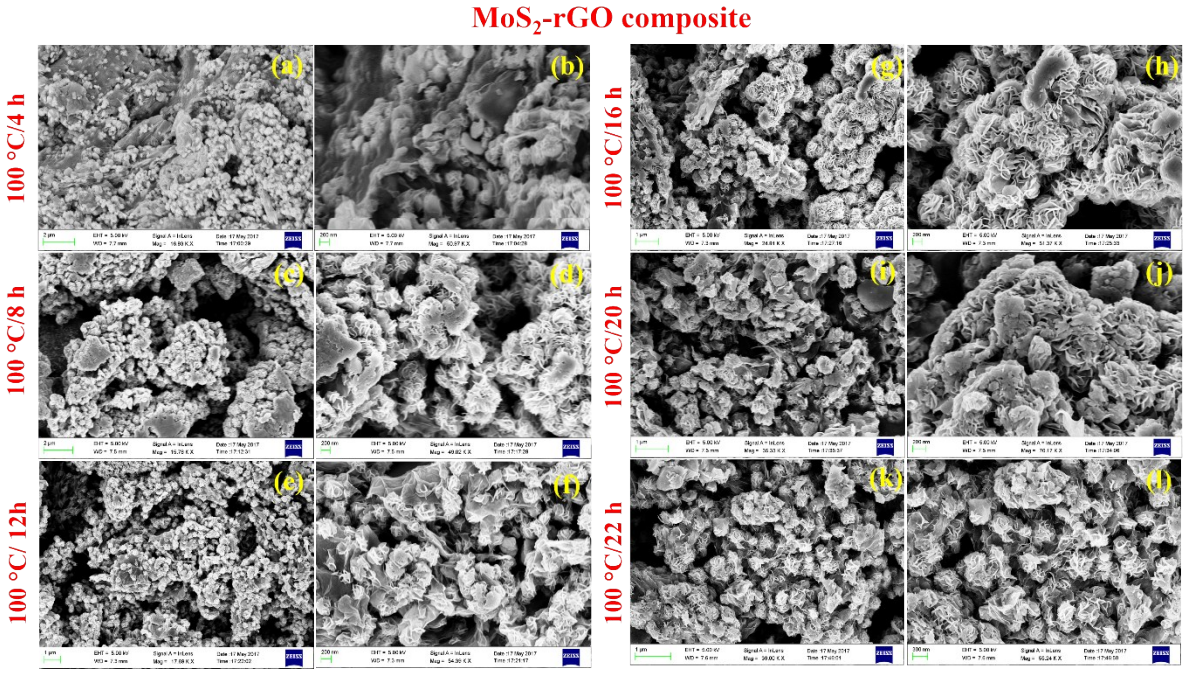


Fig. S2 SEM images of MoS_2-rGO at different reaction time by keeping the reaction temperature constant.

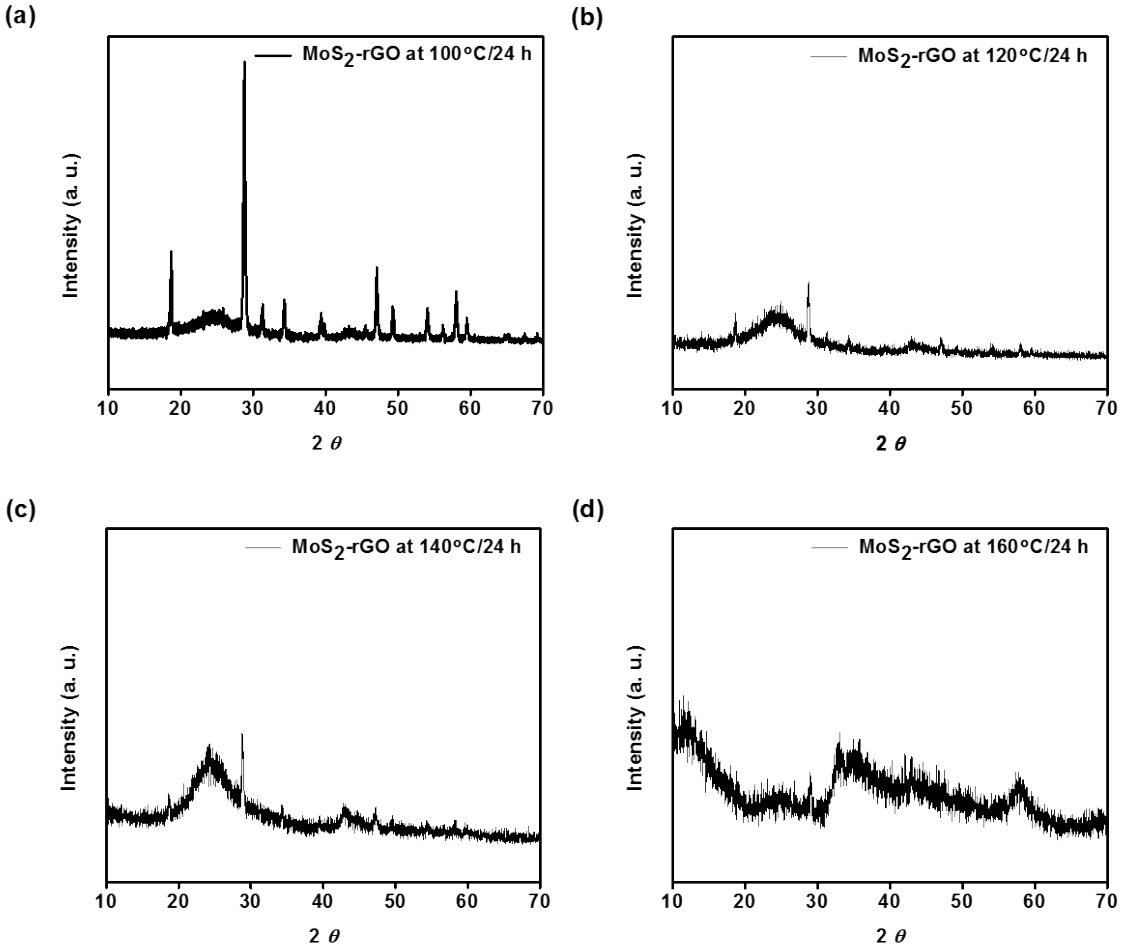


Fig. S3 XRD spectra of MoS_2-rGO at different reaction temperatures by keeping the reaction time constant.

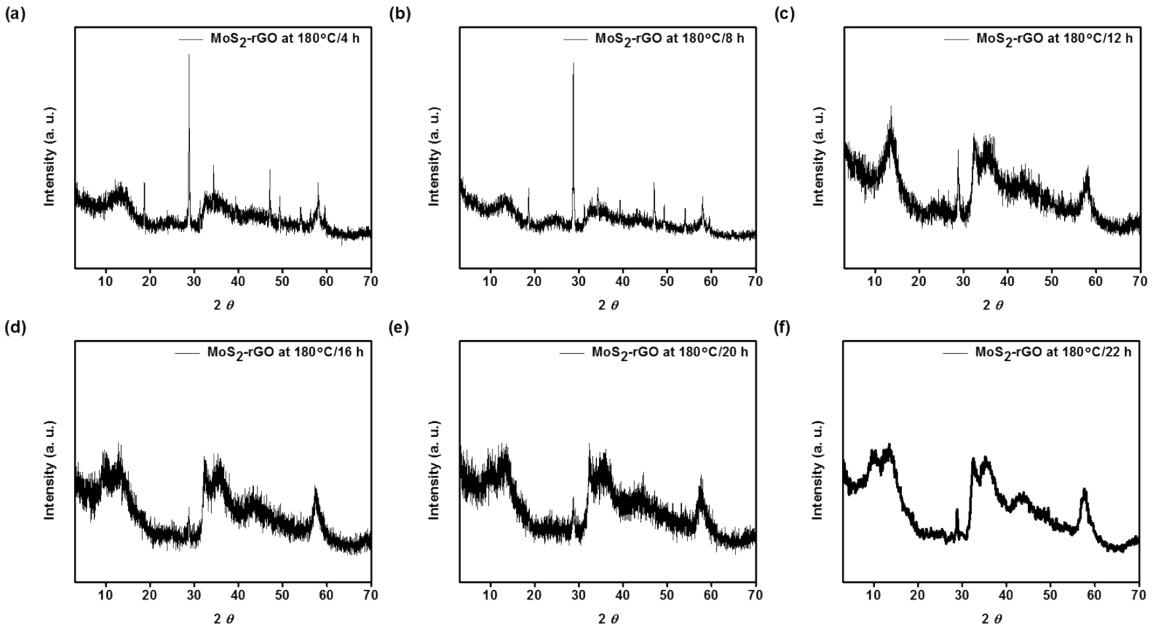


Fig. S4 XRD spectra of MoS_2-rGO at different reaction time by keeping the reaction temperature constant.

Fig. S1-S4 clearly shows that the MoS_2-rGO composites with optimal flower shaped morphology and phase were not obtained until the temperature and reaction time were set to be 180°C/24 h. **Fig. S1** shows the SEM images of MoS_2-rGO composites at different temperatures (100-160°C) by maintaining the reaction time constant. **Fig. S3** demonstrates the corresponding XRD spectra. **Fig. S2** presents the SEM images of MoS_2-rGO composites at different reaction time (4-22 h) by maintaining the temperature constant. **Fig. S4** exhibits the corresponding XRD spectra.

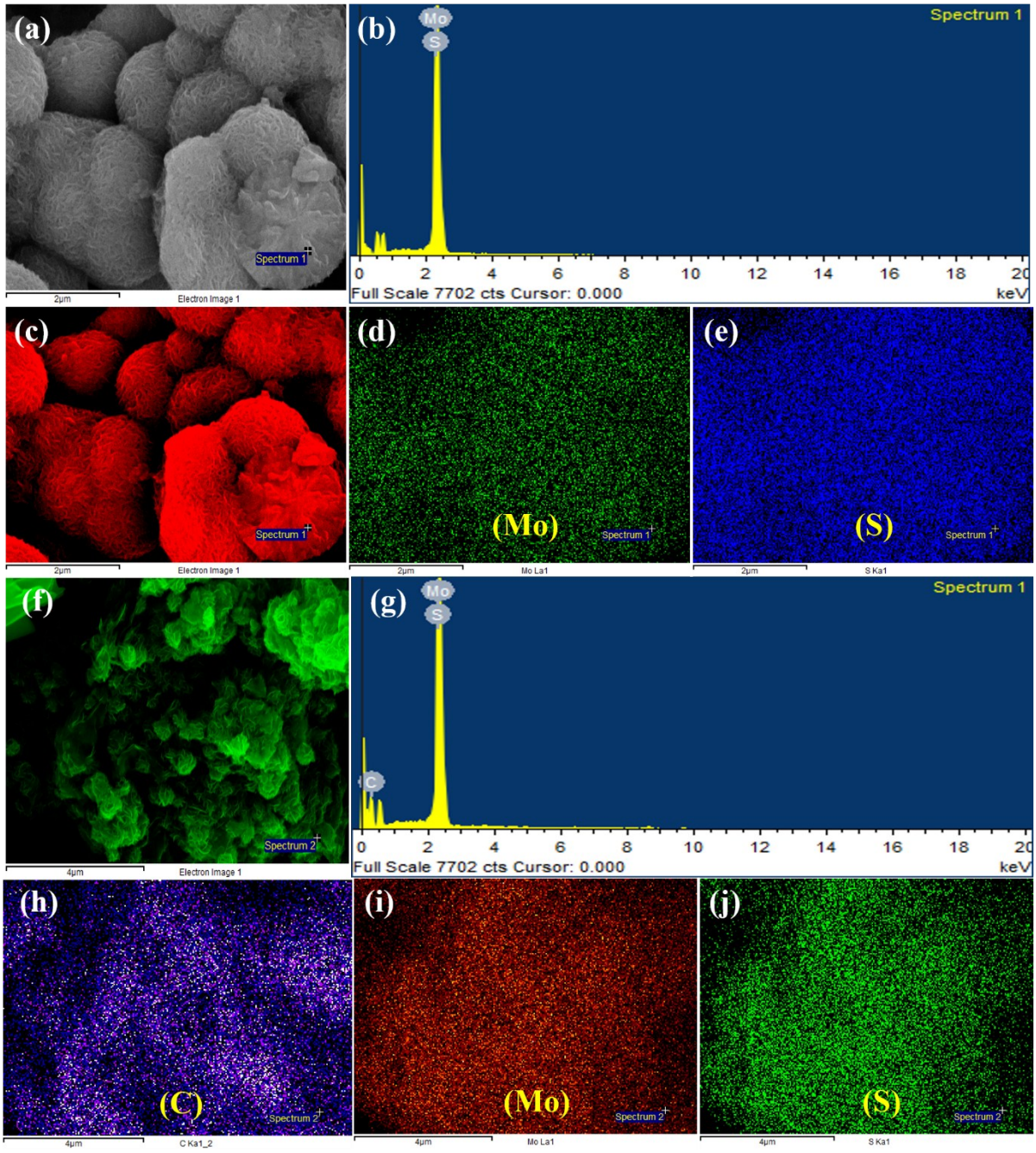


Fig. S5 (a) SEM image of MoS_2, (b) EDX spectrum of MoS_2, (c) color mapping image of MoS_2, and (d-e) elemental color mapping of molybdenum (Mo) and sulfur (S), respectively, (f) color mapping image of MoS_2-rGO, (g) EDX spectrum of MoS_2-rGO, and (h-j) elemental color mapping of carbon (C), molybdenum (Mo) and sulfur (S), respectively.

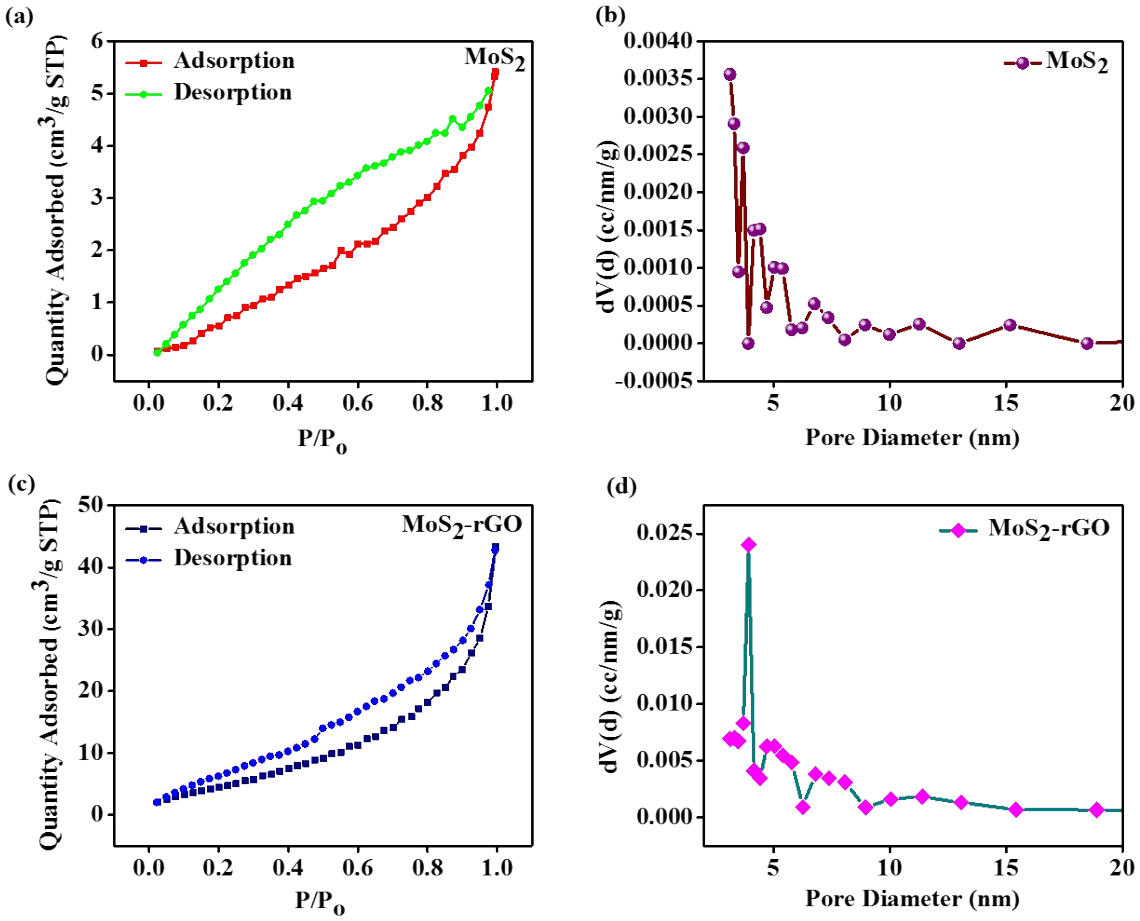


Fig. S6 N_2 isotherm and corresponding BJH plot for (a-b) MoS_2 and (c-d) MoS_2-rGO composite.

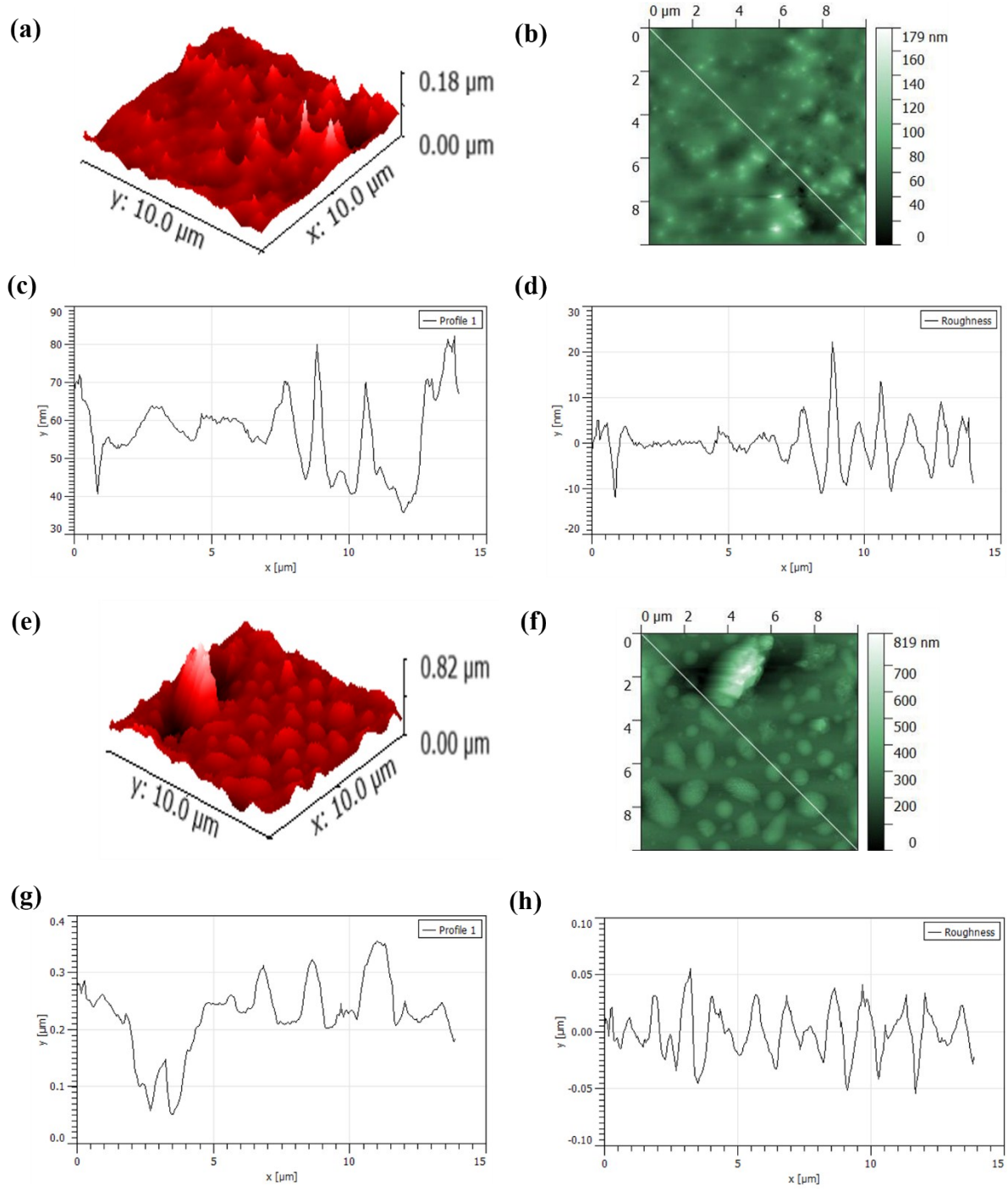
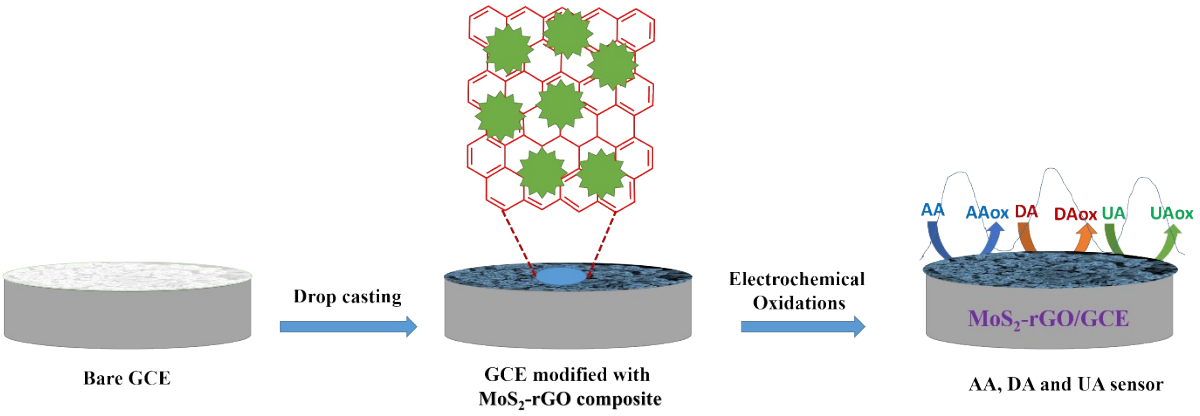


Fig. S7 AFM 3D view, surface topography, profile plot and roughness measurement of (a-d) MoS_2, and (e-h) MoS_2-rGO.

Table S1. Roughness parameters and surface area measurement.

Sample	Image area (μm^2)	Root-mean square Roughness (R_q) (nm)	Average Roughness (R_a) (nm)	R_q/R_a	Effective Surface area (μm^2)	Surface Roughness Parameter (R_s)
MoS_2	100	12.5576	8.828	1.4224	100.211	1.002
MoS_2-rGO	100	78.088	49.5861	1.5748	105.762	1.058



Scheme S1. **S**chematic of AA, DA and UA sensor based on MoS_2-rGO composite.

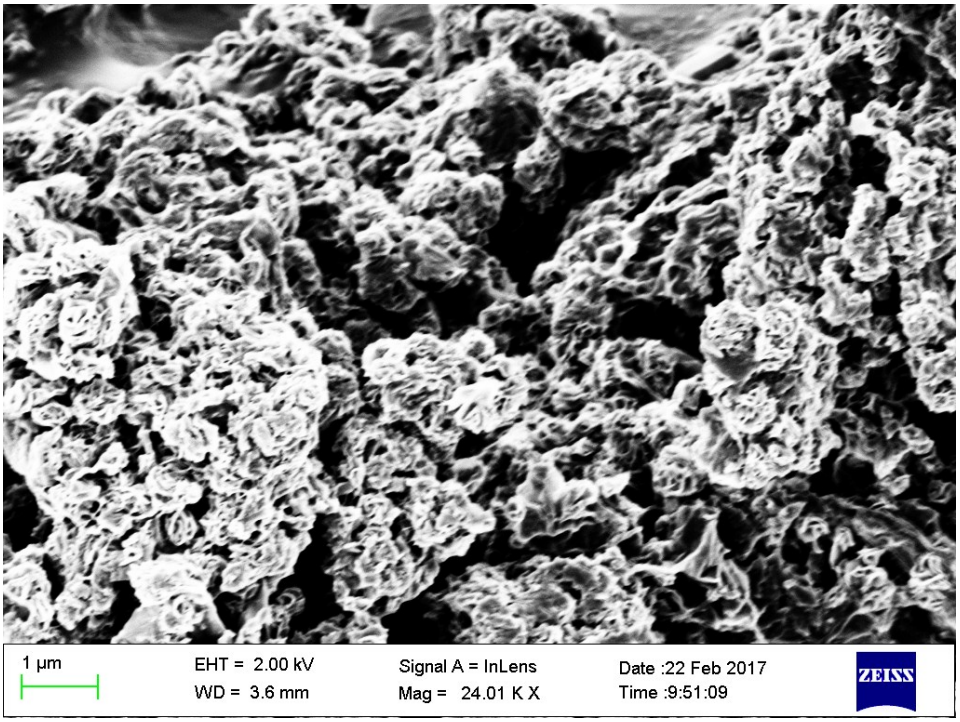


Fig. S8 SEM image of ***MoS_2-rGO/GCE***.

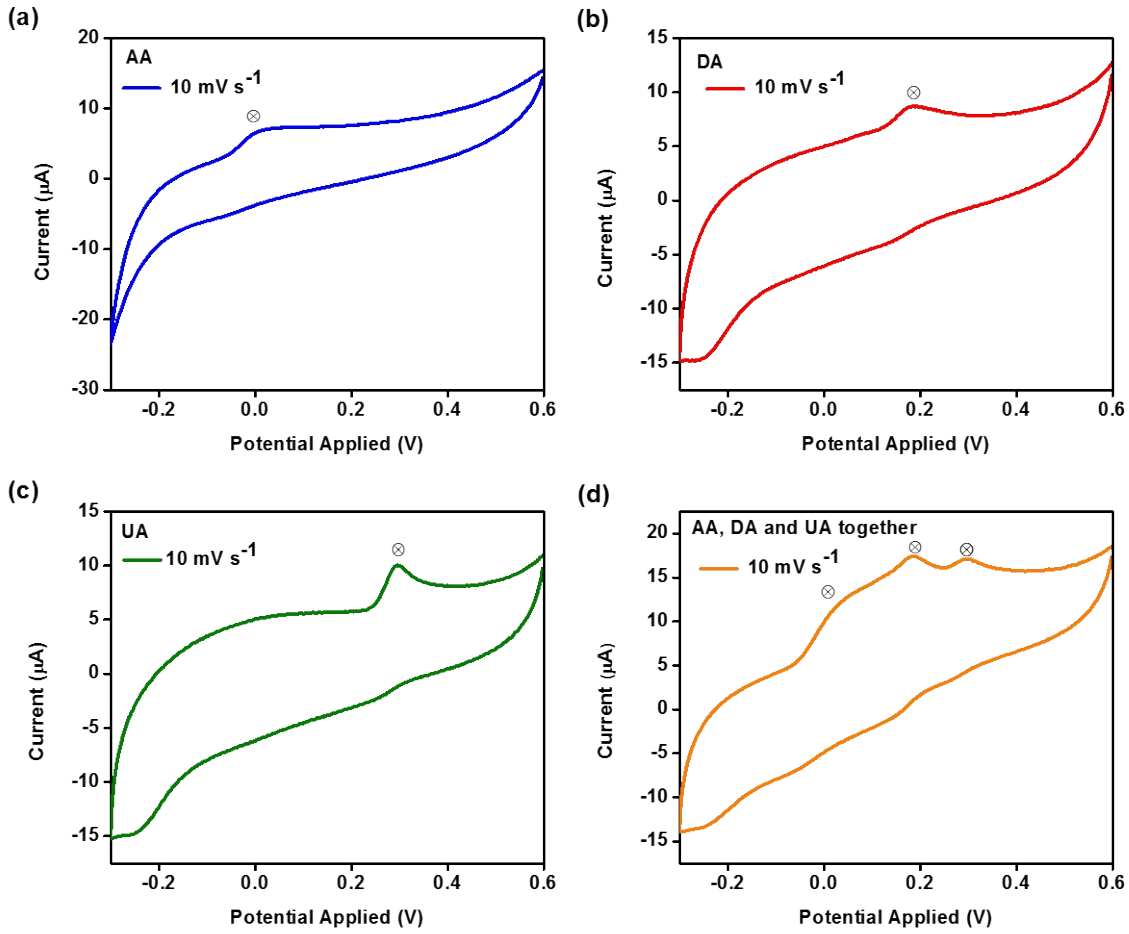


Fig. S9 CV profiles of ***MoS_2-rGO/GCE*** in the presence of (a) 300 μM AA, (b) 100 μM DA, and (c) 200 μM UA and (d) the mixture of 300 μM AA, 100 μM DA and 200 μM UA, respectively at a scan rate of 10 mV s^{-1}.

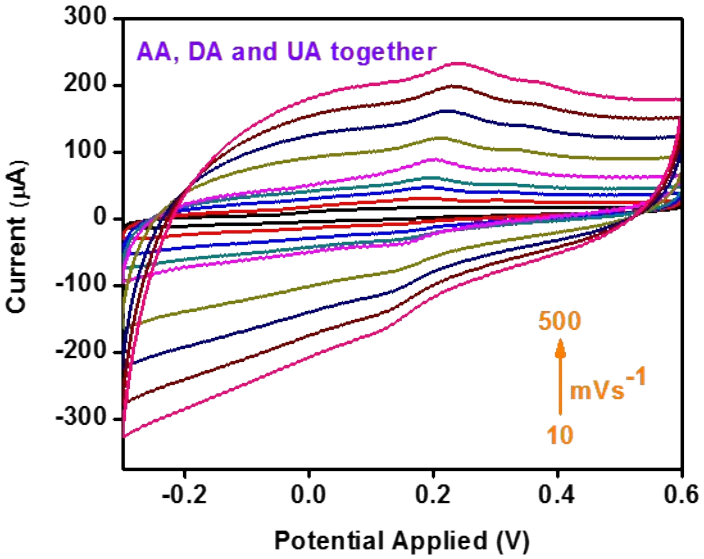


Fig. S10 CV profiles of ***MoS_2-rGO/GCE*** in a mixture of 300 μM AA, 100 μM DA and 200 μM UA at different scan rates (10-500 mV s^{-1}).

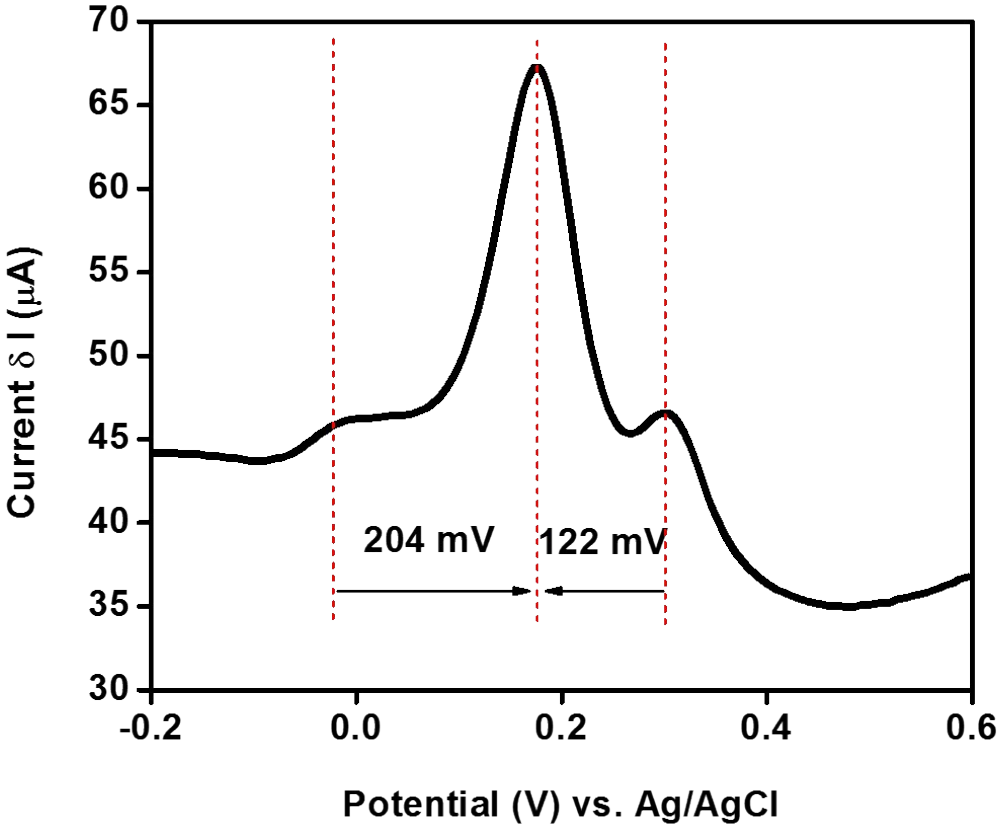


Fig. S11 DPV of ***MoS_2-rGO/GCE*** in a mixture of 300 μM AA, 100 μM DA and 200 μM UA.

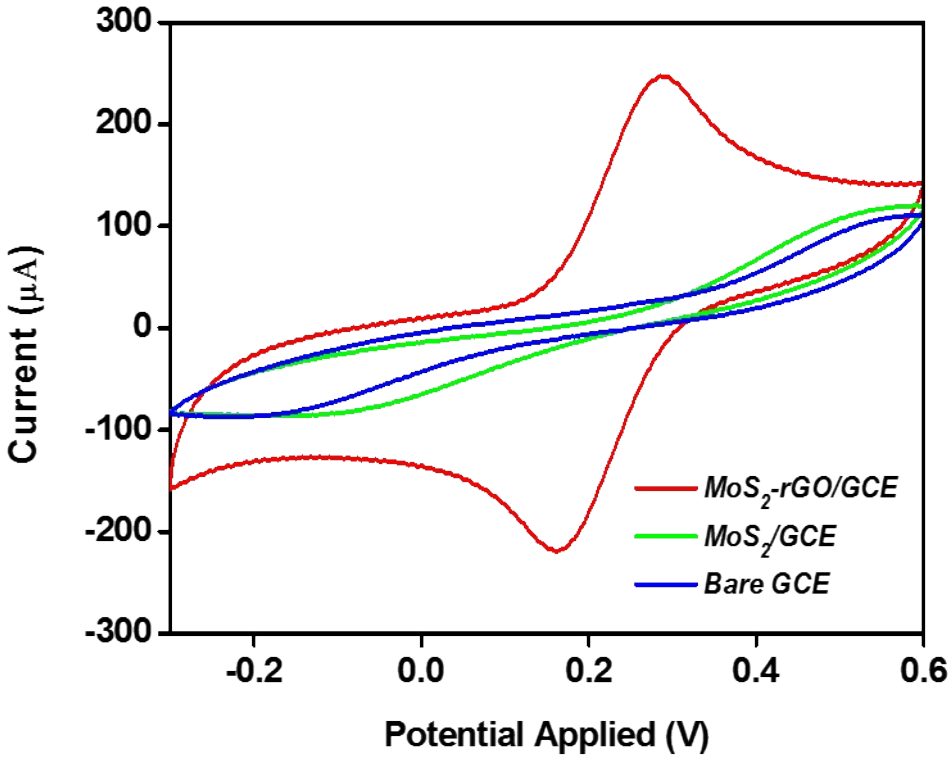


Fig. S12 CVs of bare GCE, ***MoS_2/GCE*** and ***MoS_2-rGO/GCE*** in 5 mM $[Fe(CN)_6]^{3-/4-}$ aqueous solution containing 0.1 M KCl.

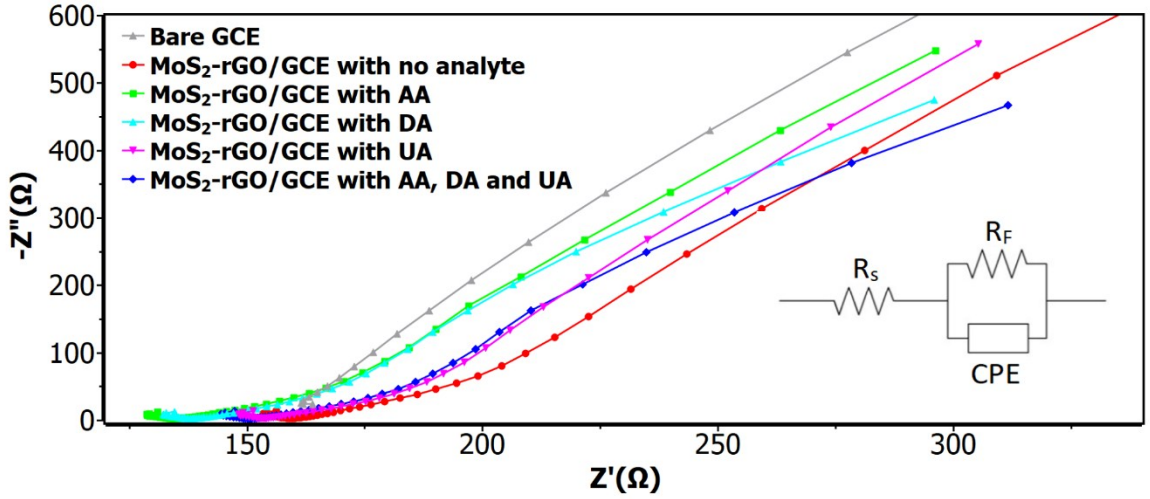


Fig. S13 EIS data of bare GCE and ***MoS_2-rGO/GCE*** in the absence and presence of analytes (AA, DA and UA), inset shows the equivalent circuit used to fit the EIS data.

Table S2. Circuit parameters generated after the fitting to the given equivalent circuit.

Parameter	bare GCE	*MoS_2-rGO/GCE* (No Analyte)	*MoS_2-rGO/GCE* (Only AA)	*MoS_2-rGO/GCE* (Only DA)	*MoS_2-rGO/GCE* (Only UA)	*MoS_2-rGO/GCE* (AA, DA and UA)
R_s (Ω)	5.7×10^{-12}	6.0259×10^{-12}	7.1128×10^{-12}	6.967×10^{-12}	4.2768×10^{-7}	6.3906×10^{-12}
CPE (F)	4.21874×10^{-3}	9.647×10^{-2}	9.577×10^{-2}	9.96503×10^{-2}	6.683×10^{-5}	9.77553×10^{-2}
α	0.7	0.7	0.7	0.7	0.7	0.7
R_F (Ω)	1.01675×10^{5}	2.098×10^{3}	1.38685×10^{3}	1.17566×10^{3}	2.16213×10^{3}	1.14538×10^{3}

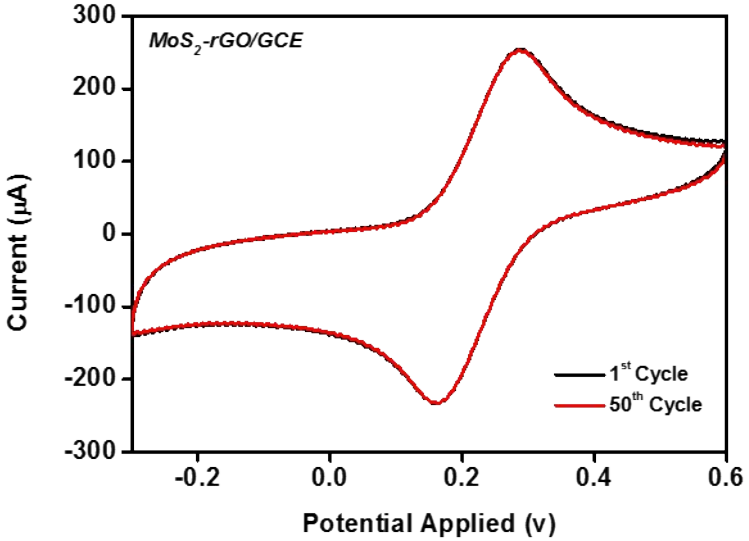


Fig. S14 CVs (1st and 50th cycle) of ***MoS_2-rGO/GCE*** with 50 continuous scan in 5 mM $[Fe(CN)_6]^{3-/4-}$ aqueous solution containing 0.1 M KCl.

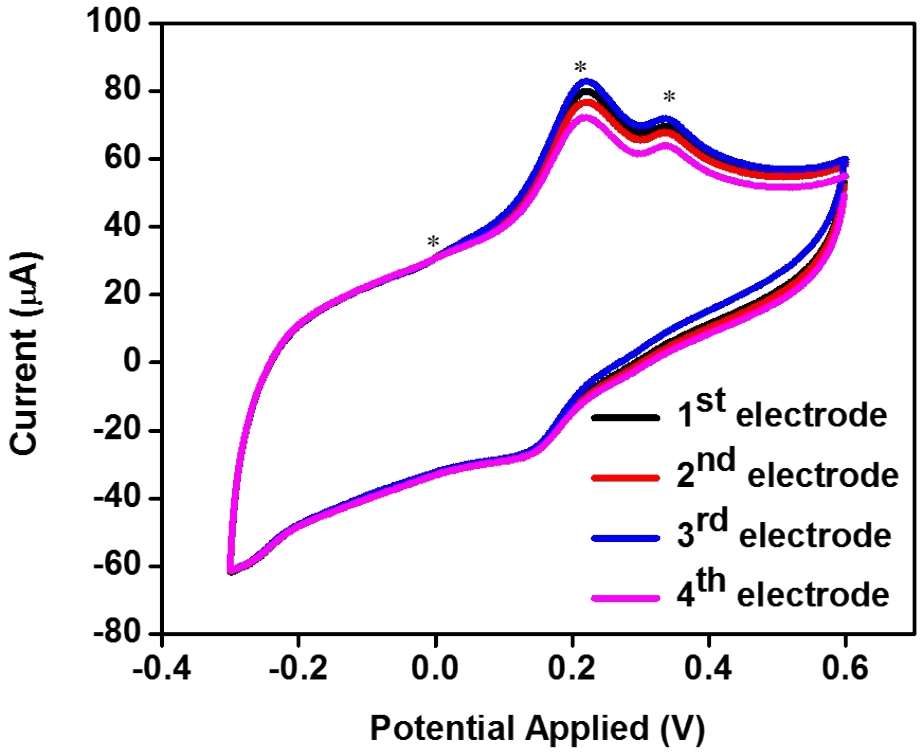


Fig. S15 Reproducibility test**:** CV curves of 4 different ***MoS_2-rGO/GCE*** in the presence of 300 μM AA, 100 μM DA and 200 μM UA at a scan rate of 100 mV s^{-1}.