Supplementary Information for

Electrocatalytic reduction of oxygen at platinum nanoparticles dispersed on electrochemically reduced graphene oxide/ PEDOT:PSS composites

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Determination of collection efficiency(N)

The value of N for an ideal RRDE is independent of the reaction and rotational rate (ω) but dependent only by its geometry parameters. However, when a thick catalyst layer is loaded on the disk, the geometry of the RRDE changes; therefore, it is necessary to calibrate the N value of the RRDE with the catalyst. The calibration of N is carried out using a simple one-electron transfer redox pair reaction [1].

$$Fe(CN)_6^{3-} + e^- \overset{disk}{\underset{ring}{\rightleftharpoons}} Fe(CN)_6^{4-}$$

The ring and the disk currents in the negative sweep direction (10 mV s^{-1}) at a constant ring potential of 1.3 V for the determination of collection efficiency on rGO (1:0) are shown in S1. The N values of the RRDE loaded with catalysts (S2) are lower than the bare RRDE (0.37) as supplied by the manufacturer. The N values of 2:1 (0.35), 1:1 (0.36) and 1:2 (0.36) are close to 0.37 but even lower values for 1:0 (0.31), 1:3 (0.30), and 1:5 (0.32) were recorded.

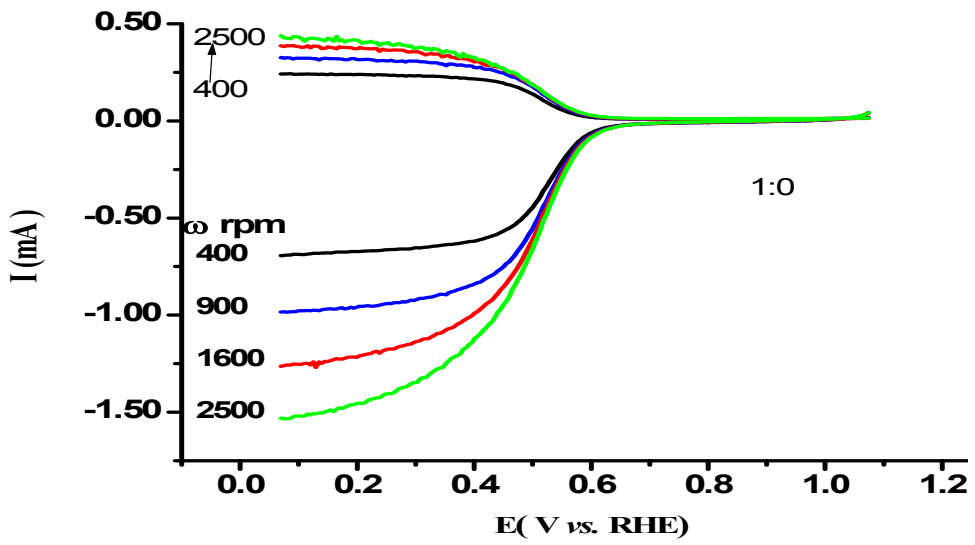

Fig. S1 Ring ($Fe^{2+} \rightarrow Fe^{3+} + e^-$) and disk ($Fe^{3+} + e^- \rightarrow Fe^{2+}$) currents for the determination of the collection efficiency on 1:0 in 1 M KNO_3 supporting electrolyte with 10 mM $K_3Fe(CN)_6$. Negative sweeps at 10 mV s^{-1}; E_{Ring} =1.3 V.

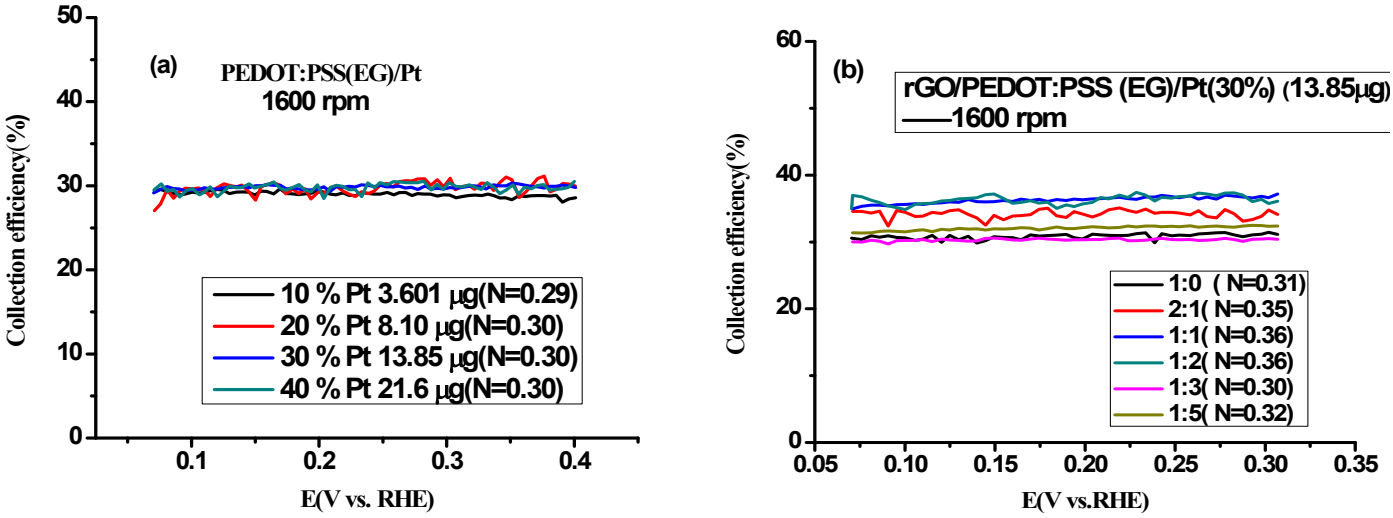

Fig. S2 Variation of the collection efficiency with potential and catalyst loading for the different catalysts (a) PEDOT:PSS(EG)/Pt, and (C)rGO/PEDOT:PSS(EG)/Pt(30%)

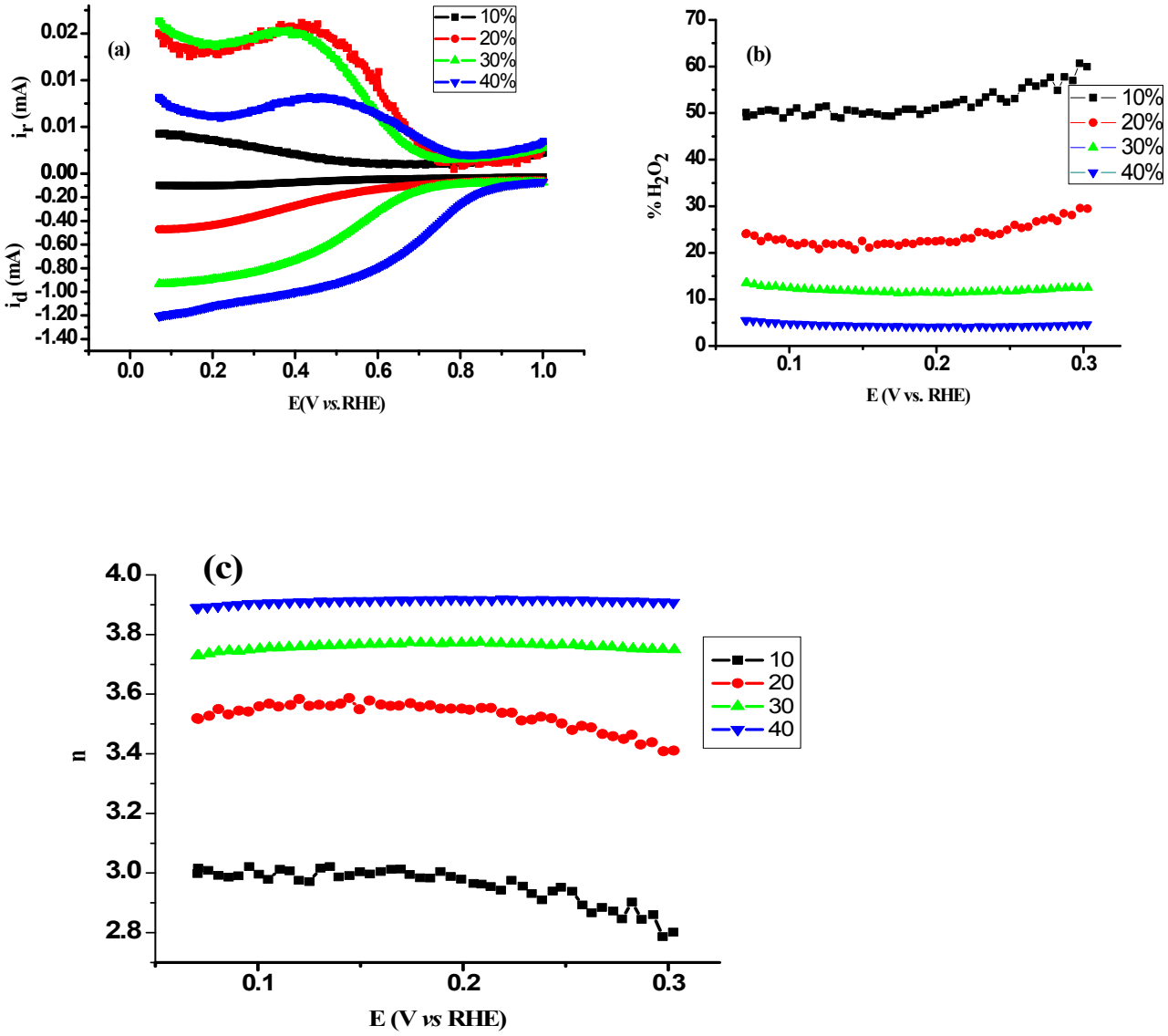

Fig S3:(a) RRDE volatmmograms, (b) % H_2O_2 formation and (c) electron transfer number (n)as a function of the disk potential for various platinum loadings PEDOT:PSS(EG) at 1600 rpm in 0.1 M $HClO_4$ solution.

Table S1 Kinetic parameters for oxygen reduction on PEDOT:PSS/Pt, PEDOT:PSS/Pt(EG), and rGO/PEDOT:PSS(EG)/Pt(30%) in 0.1 M $HClO_4$ at 1600 rpm.

Electrocatalyst	Pt loading (mg cm^{-2})	A_r (cm^2)	ECAS (m^2 g^{-1})	SA (μA cm^{-2} Pt)		MA (mA $mgPt^{-1}$	
				0.81V	0.86V	0.81 V	0.86 V
PEDOT:PSS/Pt 30%	0.071	0.41	2.93	194.5	41.3	5.8	1.2
PEDOT:PSS/Pt 40%	0.12	0.526	2.32	284.9	33.4	6.6	0.7
PEDOT:PSS(EG)/Pt 30%	0.071	0.526	3.8	228.4	49.8	8.7	1.9
PEDOT:PSS(EG)/Pt 40%	0.12	0.61	2.68	287.3	83.7	7.71	2.24
rGO/PEDOT:PSS(EG) (1:0)/Pt 30%	0.071	0.49	3.57	212.4	96.5	7.8	3.4
rGO/PEDOT:PSS(EG) (2:1)/Pt 30%	0.071	0.47	3.36	514.7	158.6	17.3	5.3
rGO/PEDOT:PSS(EG) (1:1)/Pt 30%	0.071	0.69	4.96	419	134.8	20.8	6.7
rGO/PEDOT:PSS(EG) (1:2)/Pt 30%	0.071	0.65	4.72	472	162	22.3	7.6
rGO/PEDOT:PSS(EG) (1:3)/Pt 30%	0.071	0.78	5.63	284.8	102.3	16.02	5.8
rGO/PEDOT:PSS(EG) (1:5)/Pt 30%	0.071	0.77	5.58	347.5	129.7	19.4	7.2

1. R. Zhou, Y. Zheng, M. Jaroniec, S. Qiao, *ACS Catal*. 2016, 6, 4720-4728.