Electronic Supplementary Material (ESI) for RSC Advances.

Electronic Supplementary Information

MnO-Nitrogen Doped Graphene as Durable Non-Precious Hybrid Catalyst for Oxygen Reduction Reaction in Anion Exchange Membrane Fuel Cells

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Table S1 Comparative ORR performance of previously reported various electrocatalysts.

Catalysts	Loading (μg cm^{-2})	On-set potential (V)	$E_{1/2}$ (V)	j @ -0.6 V (mA cm^{-2})	Tafel slope (mV dec^{-1})	Ref.
N-rGO/ Mn_3O_4	100	-0.075 vs. SCE	NA	2.0	NA	S1
MnO/ NRG	NA	-0.15 vs. Ag/AgCl	NA	1.4	NA	S2
Mn_3O_4/ NG	425	-0.12 vs. Ag/AgCl	-0.20	4.4	62	S3
Holey GS/ Mn_3O_4	310	-0.14 vs. Ag/AgCl	-0.33 vs. Ag/AgCl	4.2	73	S4
Mesoporous Hybrid Mn_3O_4 /NG	200	-0.09 vs. Ag/AgCl	NA	3.7	NA	S5
MnO_2/ rGO Nanosheets	150	-0.178 vs. SCE	-0.32 vs. SCE	3.0	NA	S6
CPS–Cu20 (Cu_xS_y)	1000	0.84 vs. RHE	0.75 vs. RHE	NA	NA	S7
$NiCo_2S_4$@N /S-rGO	283	-0.11 vs. Ag/AgCl	-0.18 Ag/AgCl	4.2	NA	S8
Fe_3O_4/N-GA	150	-0.19 vs. Ag/AgCl	-0.35 vs. Ag/AgCl	NA	NA	S9
CoTe/C-900	NA	-0.18 vs. Ag/AgCl	-0.35 vs. Ag/AgCl	2.9	62	S10
MnO/N-G-900 (10%)	600	0.89 vs. RHE	0.77 vs. RHE	3.4	81	Present work

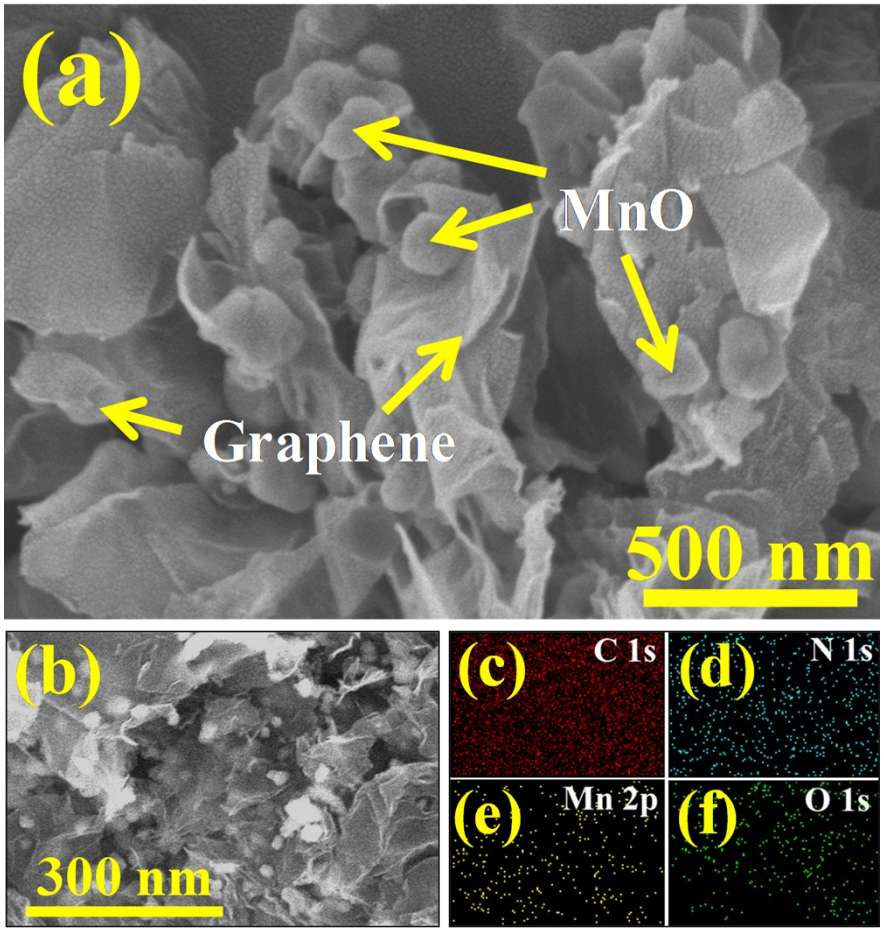

Fig. S1. (a) HR-SEM images, (b) selected area HR-SEM image considered for mapping, (c), (d), (e) and (f) corresponding EDS elemental mappings of C, N, Mn and O, respectively of MnO/NG-900 (10%) electrocatalyst.

RHE calibration

Saturated calomel electrode (SCE) was used as the reference electrode in all measurements. It was calibrated with respect to reversible hydrogen electrode (RHE). The calibration was accomplished in high purity hydrogen saturated 0.1 M aqueous KOH electrolyte with a Pt wire as the working electrode. CVs were performed between -1.2 to -0.9 V (vs. SCE) at a scan rate of 1 mV s^{-1}. The average of the two potentials which crosses zero was considered to be the thermodynamic potential for the hydrogen electrode reactions.

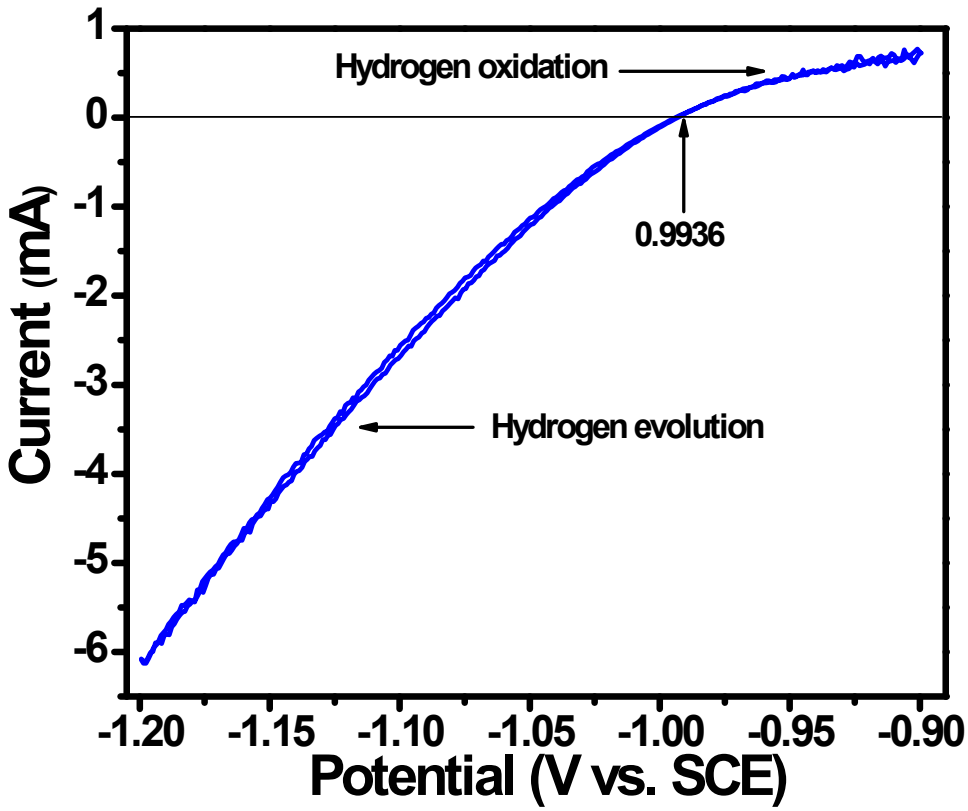

Fig. S2. CV for RHE calibration of SCE reference electrode recorded between -1.2 to -0.9 V (vs. SCE) in high purity H2 saturated 0.1 M aqueous KOH electrolyte at a scan rate of 1 mV s^{-1}. Therefore, in 0.1 M KOH electrolyte, E (RHE) = E (SCE) + 0.9936 V.

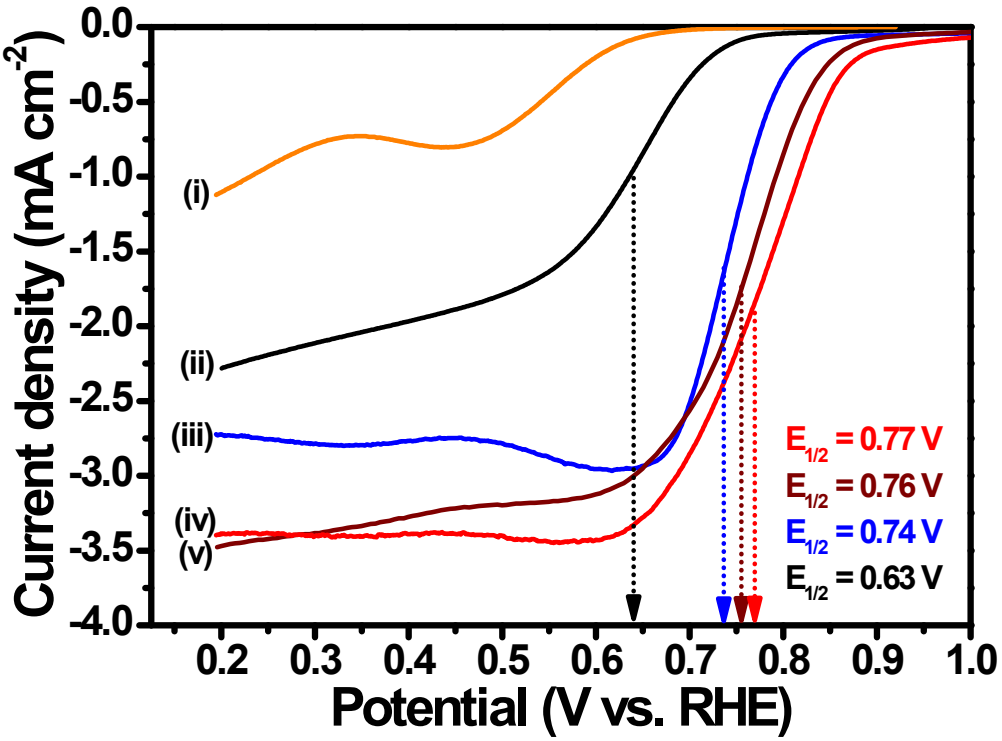

Fig. S3. LSVs of (i) MnO, (ii) N-doped graphene, (iii) Mn_3O_4/G-700, (iv) MnO/G-900 and (v) MnO/NG-900 (10%) recorded in O_2 saturated 0.1 M aqueous KOH electrolyte at a scan rate of 5 mV s^{-1} with the rotational rate of 1600 rpm.

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