Electronic Supplementary Material (ESI) for Energy & Environmental Science

Supporting Information

N-doped graphene film-confined nickel nanoparticles as highly efficient three-dimensional oxygen evolution electrocatalyst

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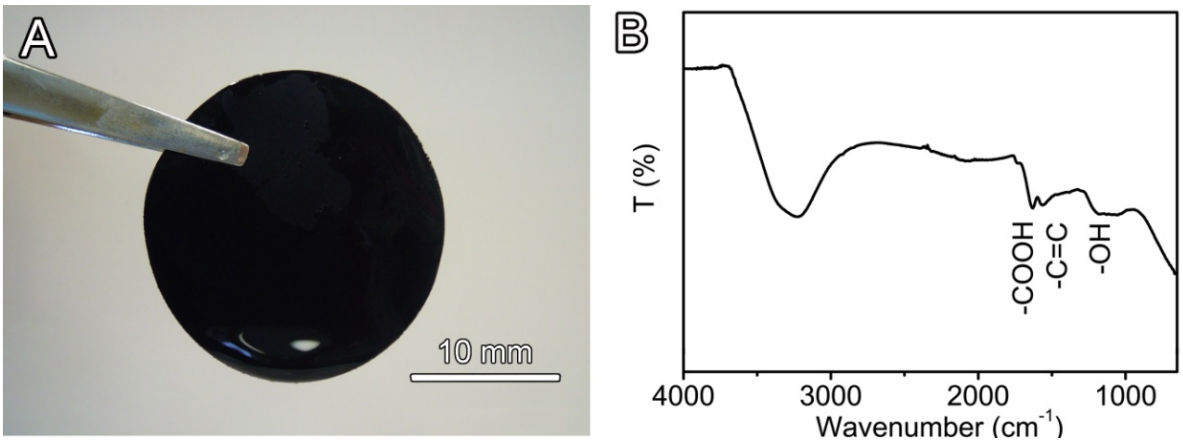

Fig. S1 (a) An optical image and (b) FTIR spectrum of graphene film prepared by controlled filtration.

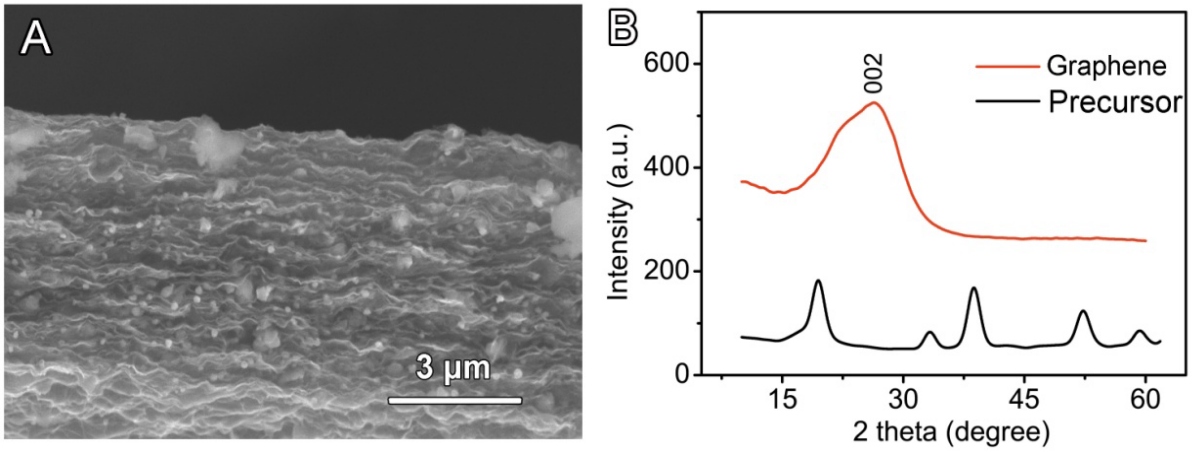

Fig. S2 (a) A SEM image of the precursor film obtained by a heterogeneous deposition process; (b) XRD profiles of graphene and the precursor film

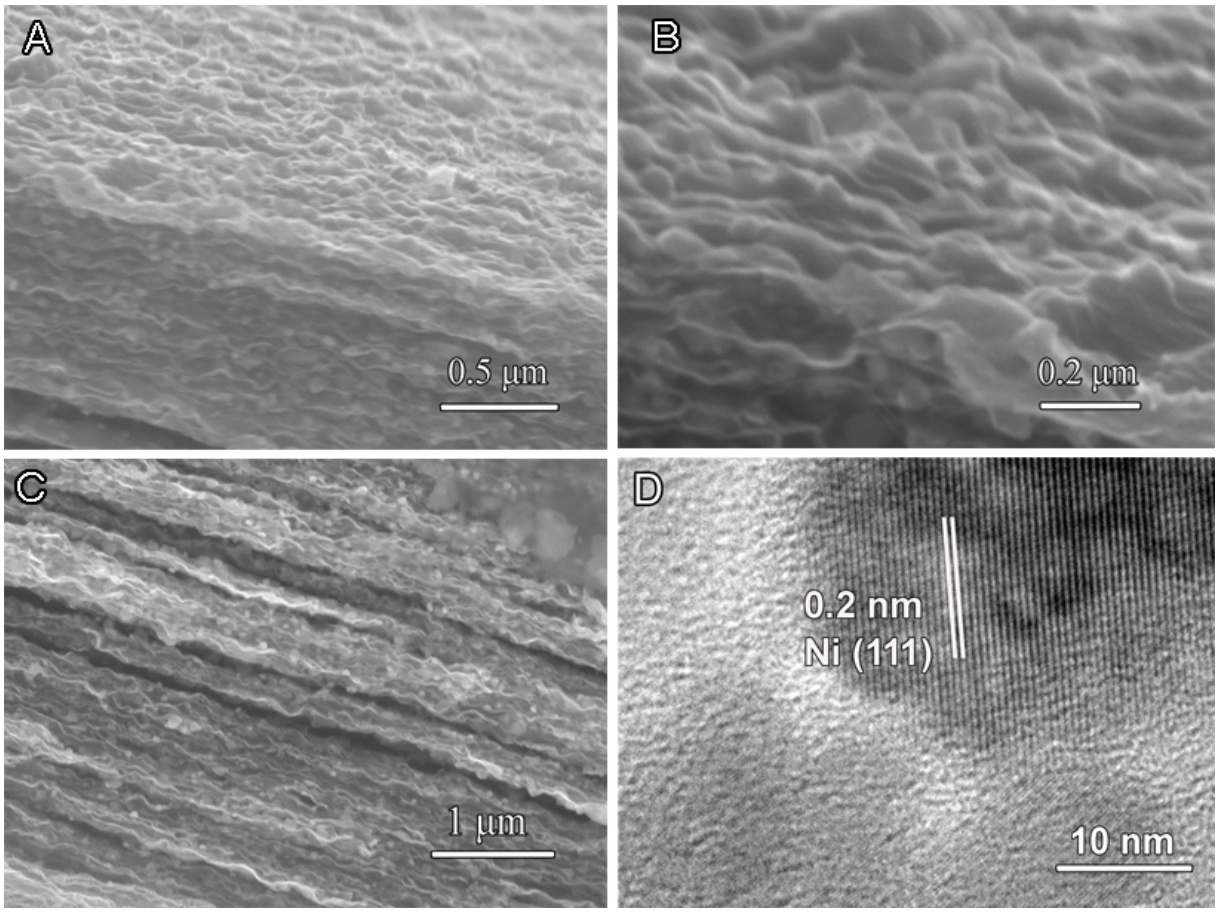

Fig. S3 (a-c) Additional SEM images of Ni-NG; (d) a HRTEM image of a nickel particle in Ni-NG.

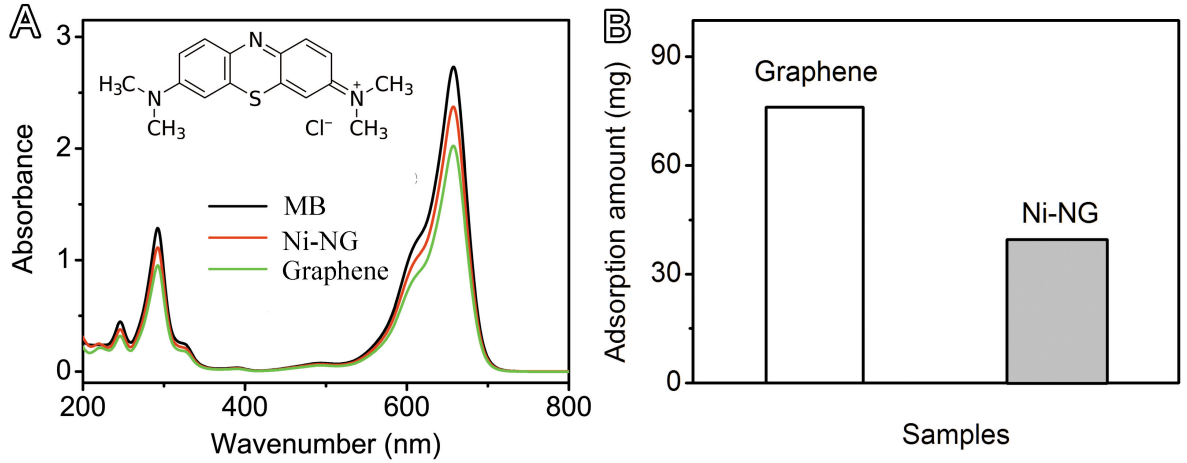

Fig. S4 (a) UV-vis spectra of graphene and Ni-NG in methylene blue (MB) adsorption experiments; (b) the MB adsorption amount of Ni-NG and graphene calculated from UV-vis spectra.

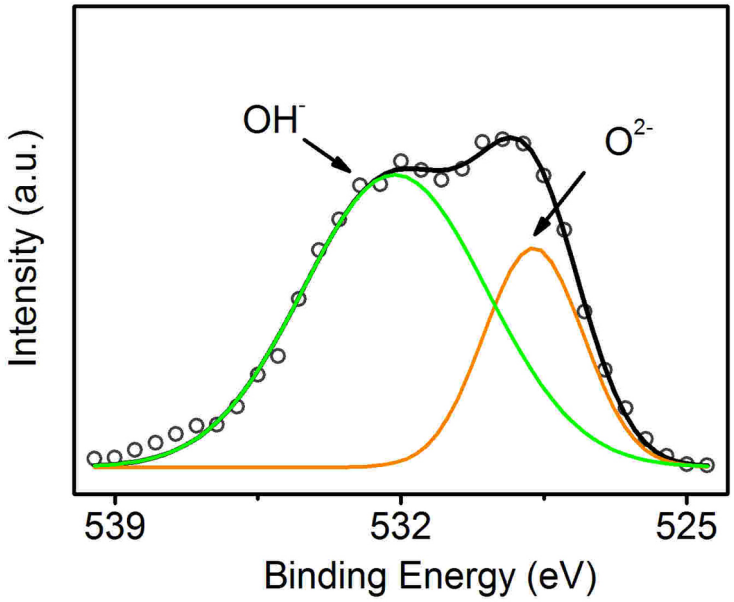

Fig. S5 XPS O1s analysis of Ni-NG

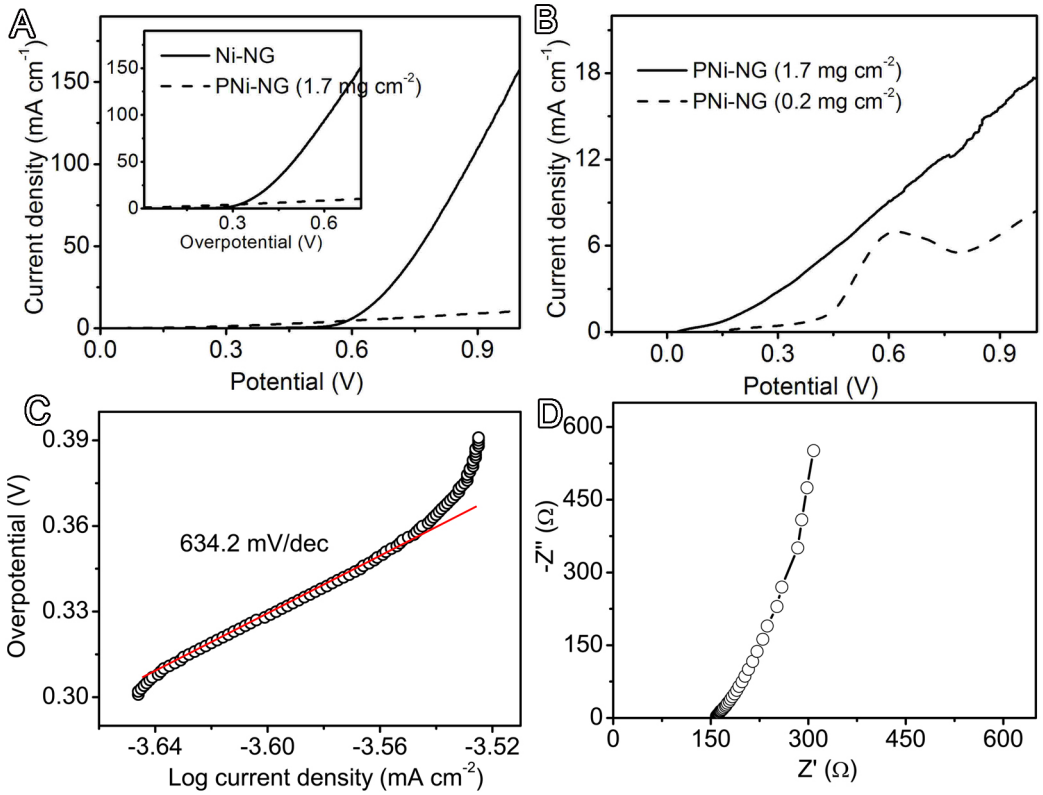

Fig. S6 (a) LSV plots of Ni-NG and PNi-NG; (b) LSV plots of PNi-NG with different catalyst loadings (0.2 and 1.7 mg cm^{-2}); the inset in (a) shows the corresponding data re-plotted as the current density *vs.* overpotential; Tafel plot (c) and EIS (d) of PNi-NG.

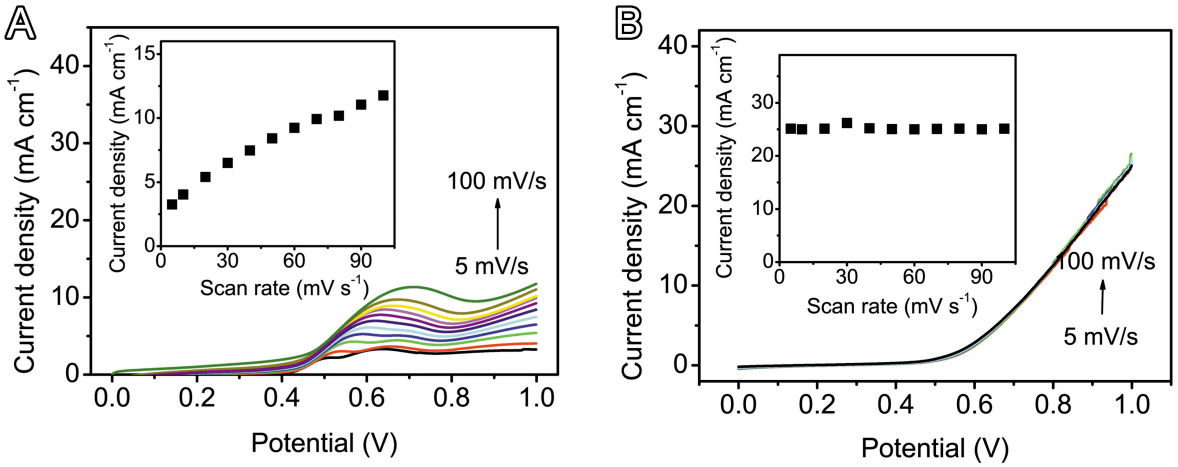

Fig. S7 LSV plots of PNi-NG (a) and NG (b) at different scan rates; the insets in (a) and (b) show the corresponding data re-plotted as the current density (at 1.0 V *vs.* Ag/AgCl) *vs.* scan rates, respectively.

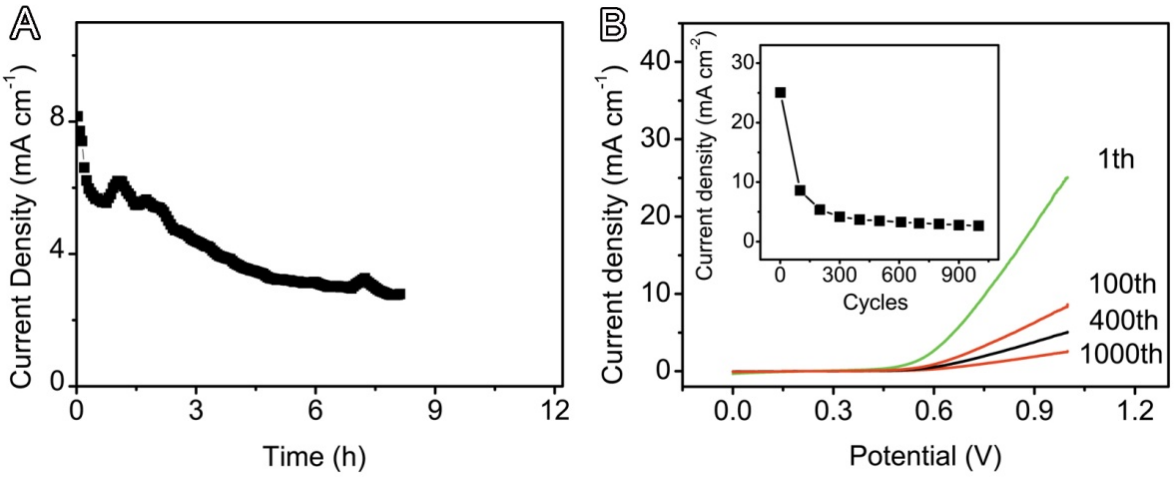

Fig. S8 (a) Chronometric response for NG (at 0.7 V *vs.* Ag/AgCl); (b) LSV plots of NG after different cycles; the inset in (b) shows the corresponding data re-plotted as the current density (at 1 V *vs.* Ag/AgCl) *vs.* cycle number.

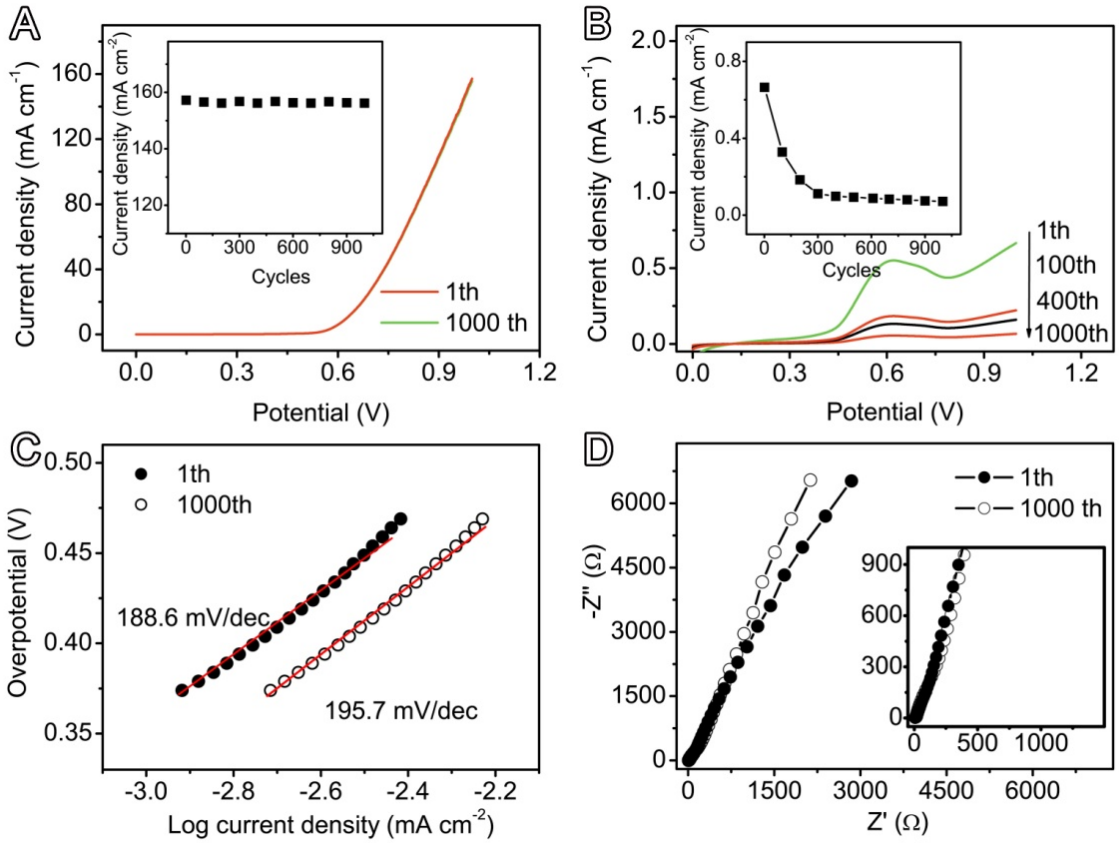

Fig. S9 LSV plots of Ni-NG (a) and PNi-NG (b) after 1000 cycles; the insets in (a) and (b) show the corresponding data re-plotted as the current density (at 1 V *vs.* Ag/AgCl) *vs.* cycle number; EIS spectra (c) and Tafel plots (d) of Ni-NG after 1000 cycles.

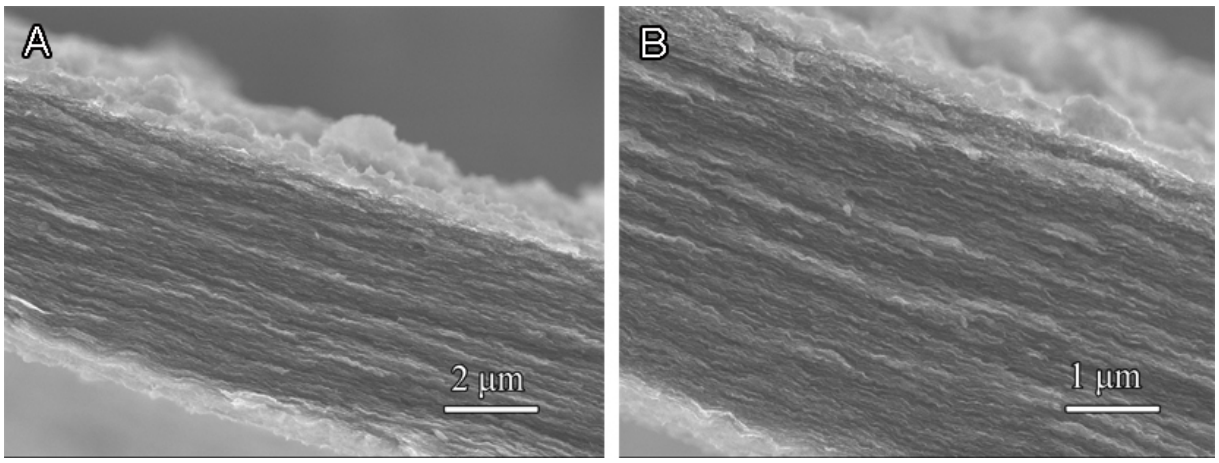

Fig. S10 SEM images of the samples obtained by using dry graphene film with small amount of residual functional groups on the sheets.

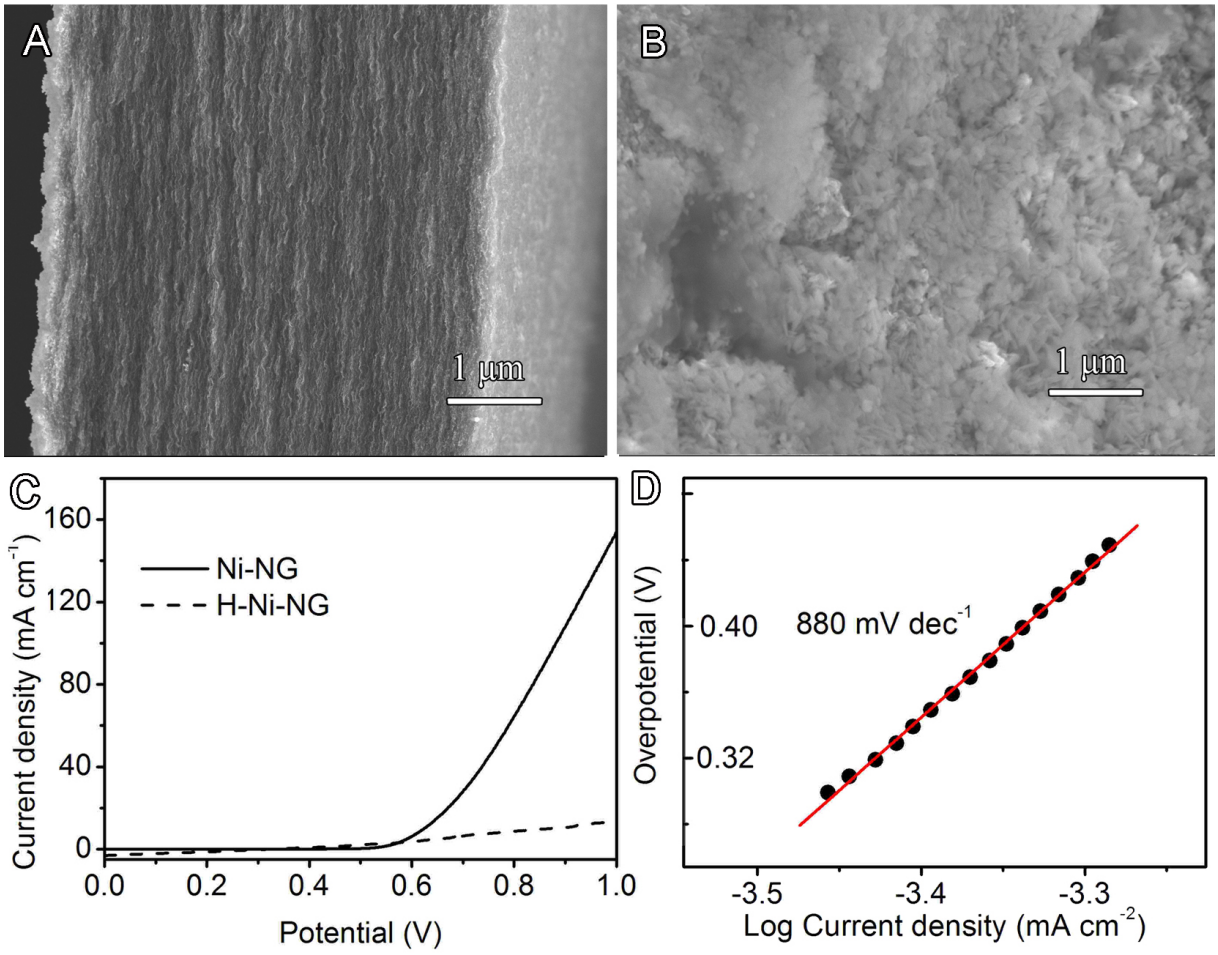

Fig. S11 (a,b) SEM images of the samples (H-Ni-NG) prepared in a homogeneous reaction system; LSV plot (c) and Tafel plot (d) of H-Ni-NG.

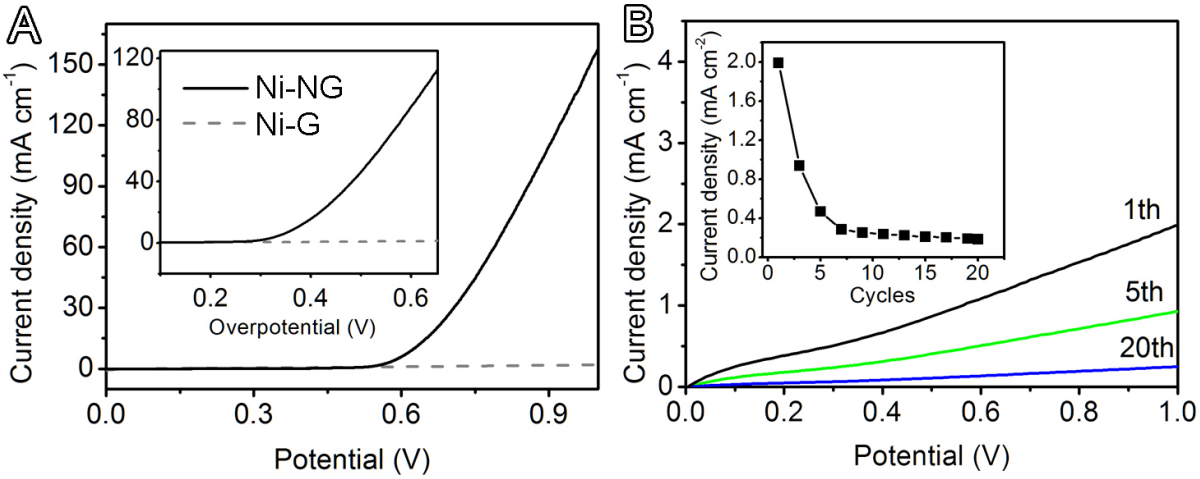

Fig. S12 (a) LSV plots of Ni-NG and Ni-G; (b) LSV plots of Ni-G after different cycles; the inset in (b) shows the corresponding data re-plotted as the current density (at 1 V *vs.* Ag/AgCl) *vs.* cycle number.

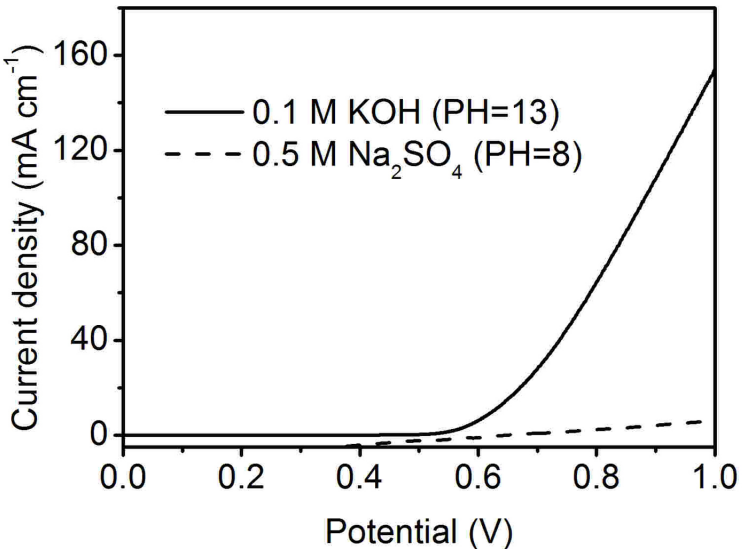

Fig. S13 LSV plots of Ni-NG performance at 0.1 M KOH and 0.5 M Na_2SO_4 electrolytes

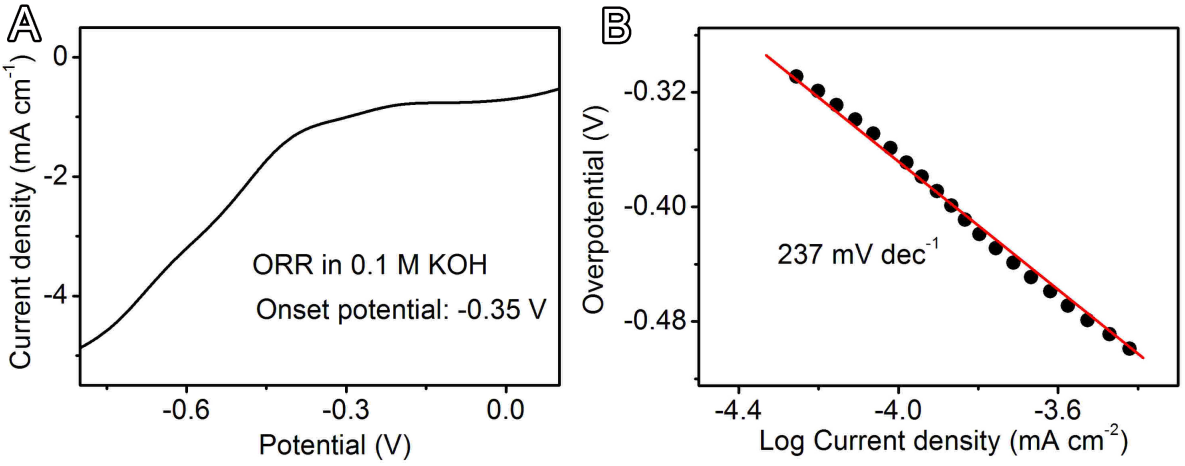

Fig. S14 Electrochemical studies of Ni-NG in 0.1 M KOH for electrocatalytic oxygen reduction reaction: (a) LSV plot; (b) Tafel plot.