

-Supporting information-

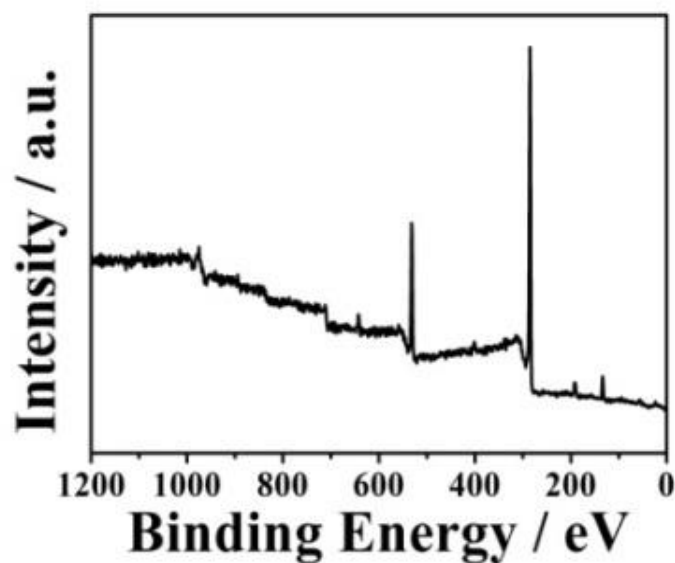


Figure S1 XPS survey spectrum of MnO₂/Fe₂O₃.

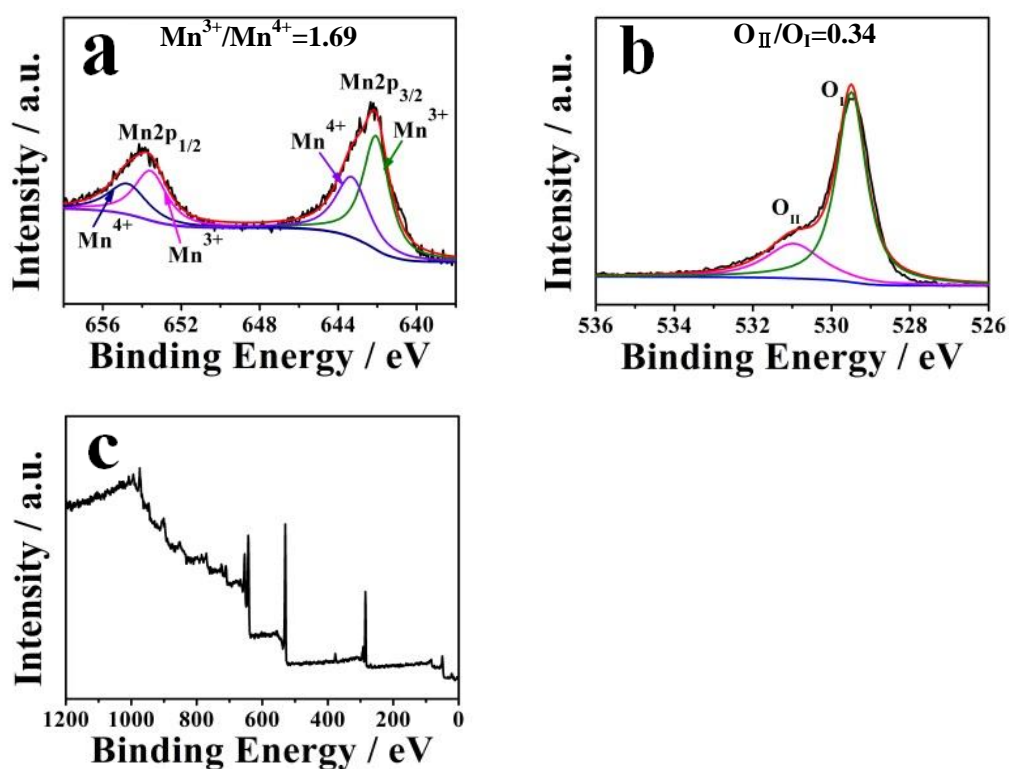


Figure S2 High-resolution Mn 2p (a) and O 1s (b) spectra and XPS survey spectrum (c) of pure MnO₂.

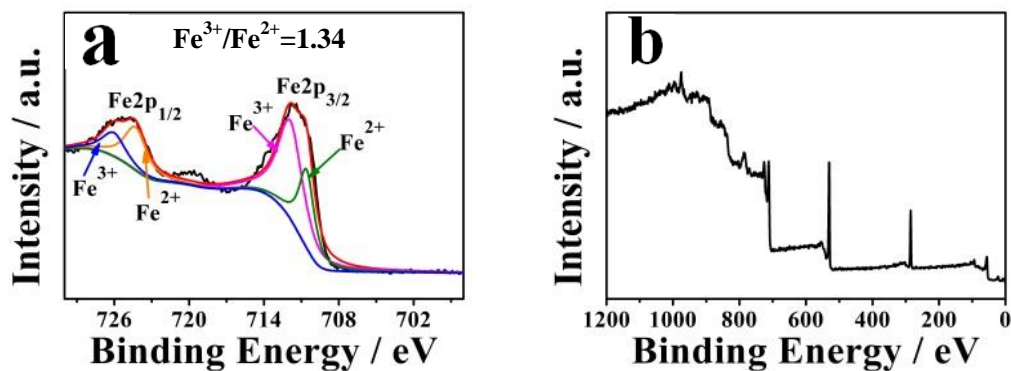


Figure S3 High-resolution Fe 2p (a) and XPS survey spectra (b) of pure Fe_2O_3 .

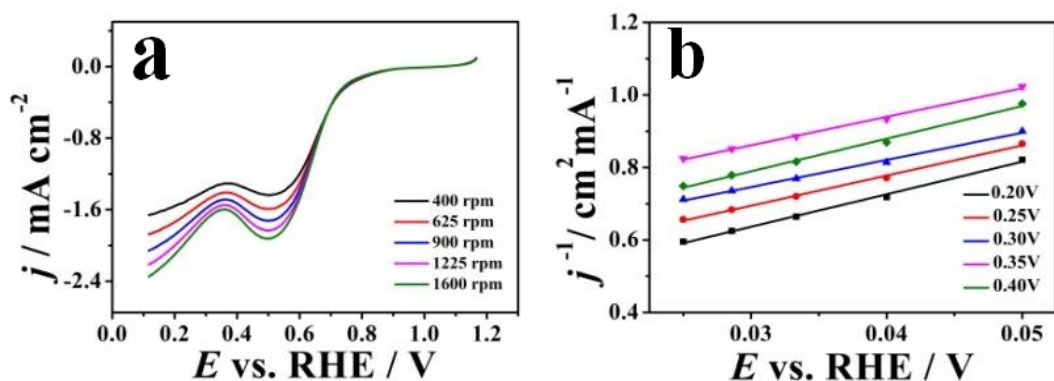


Figure S4 (a) LSV curves of pure MnO_2 measured at different rotating rates; (b) Corresponding K-L plots of pure MnO_2 in various potential range (vs. RHE, the inset gives the calculated electron transfer number at various potentials).

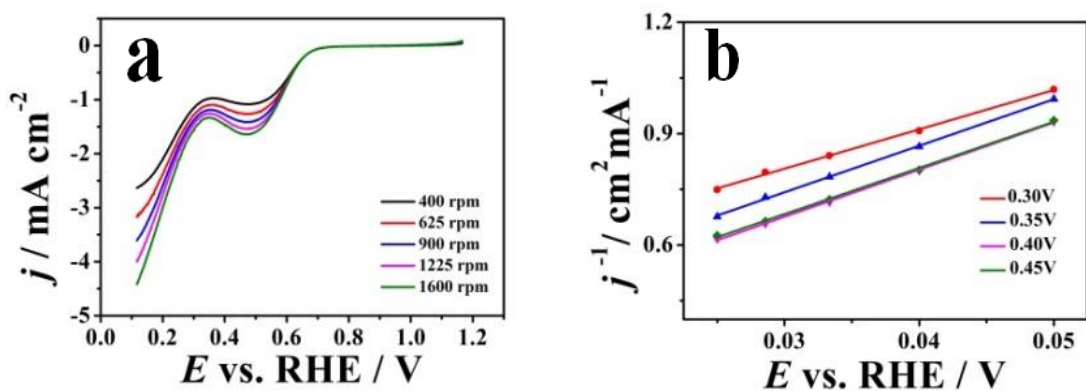


Figure S5 (a) LSV curves of pure Fe_2O_3 measured at different rotating rates; (b) Corresponding K-L plots of pure Fe_2O_3 in various potential range (vs. RHE, the inset gives the calculated electron transfer number at various potentials).

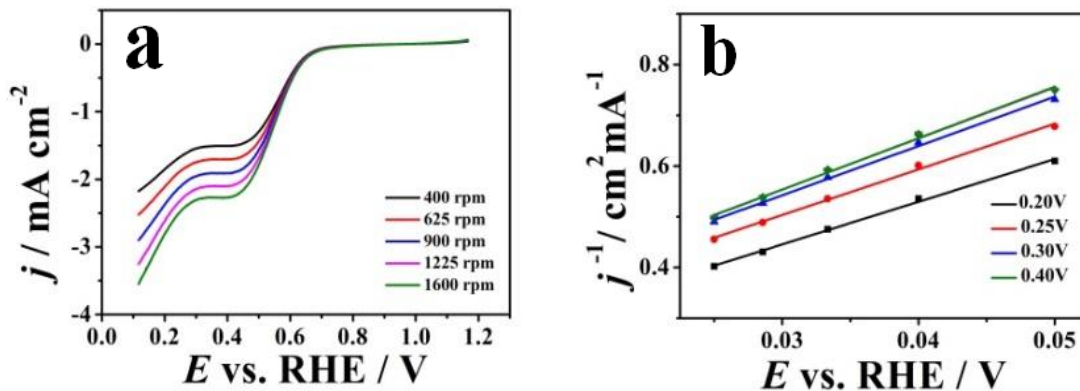


Figure S6 (a) LSV curves of MnO₂/Fe₂O₃-400 measured at different rotating rates; (b) Corresponding K-L plots of MnO₂/Fe₂O₃-400 in various potential range (vs. RHE, the inset gives the calculated electron transfer number at various potentials).

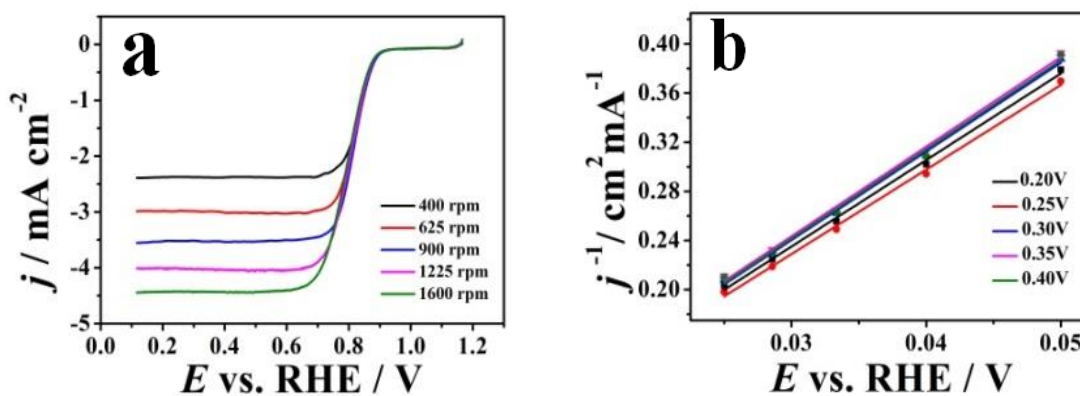


Figure S7 (a) LSV curves of MnO₂/Fe₂O₃-600 measured at different rotating rates; (b) Corresponding K-L plots of MnO₂/Fe₂O₃-600 in various potential range (vs. RHE, the inset gives the calculated electron transfer number at various potentials).

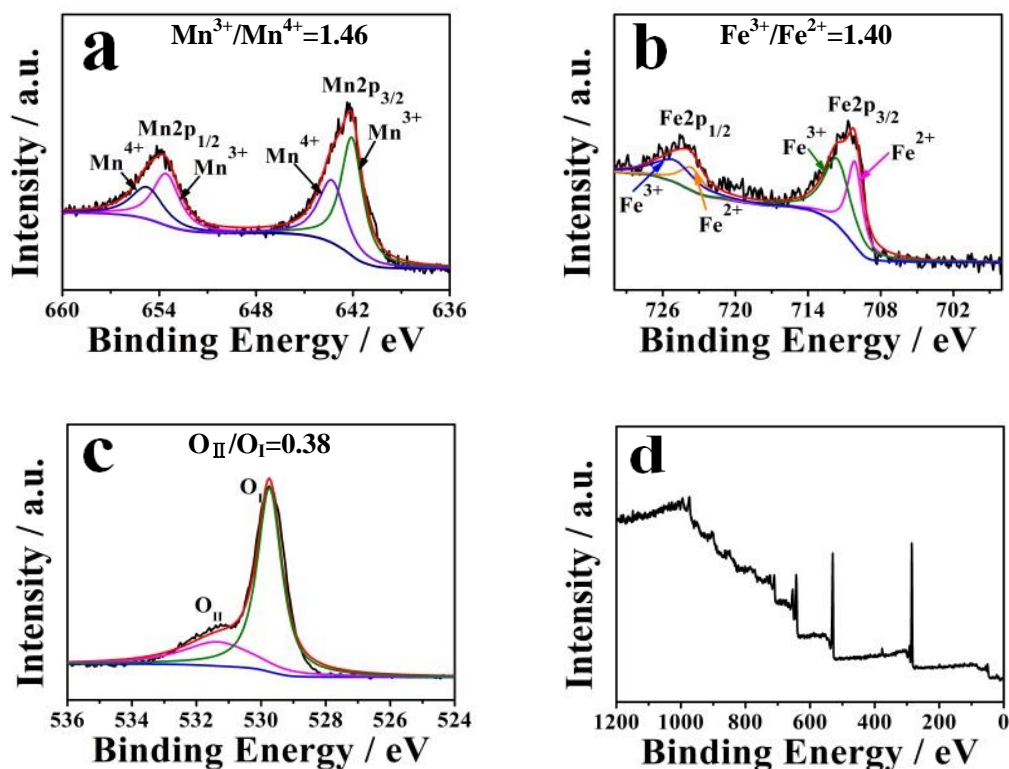


Figure S8 High-resolution Mn 2p (a) and Fe 2p (b) and O 1s spectra (c) and XPS survey spectrum (d) of $\text{MnO}_2/\text{Fe}_2\text{O}_3$ -400.

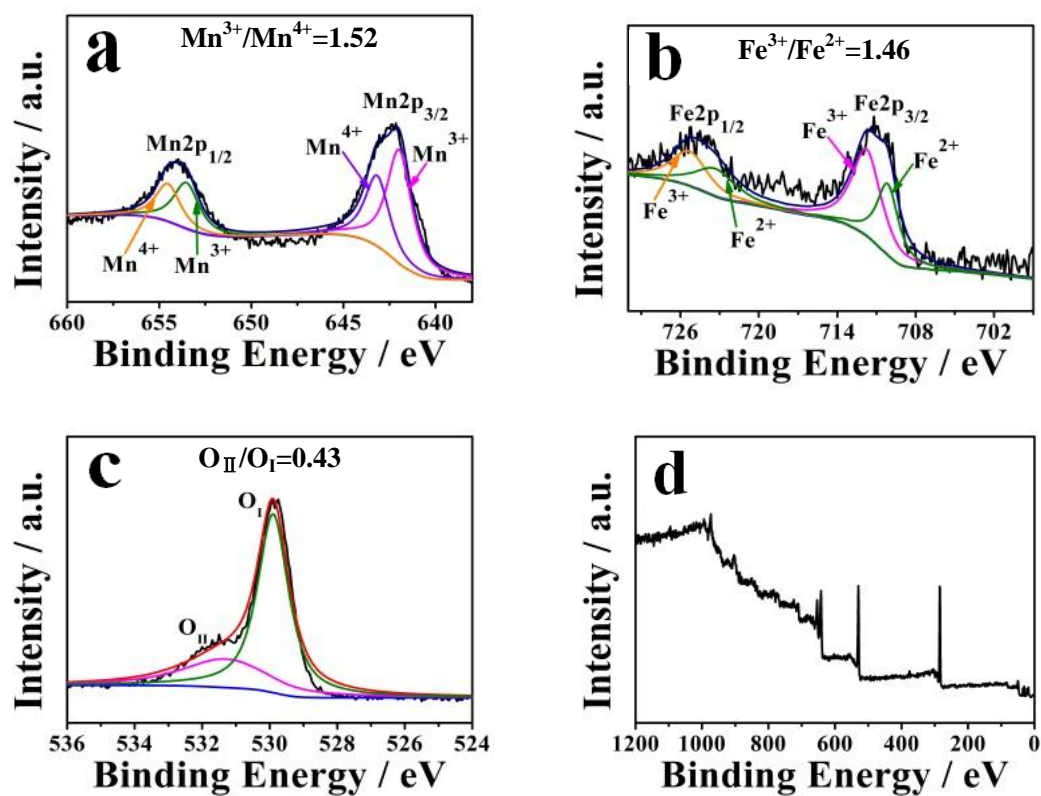


Figure S9 High-resolution Mn 2p (a) and Fe 2p (b) and O 1s spectra (c) and XPS survey spectrum (d) of $\text{MnO}_2/\text{Fe}_2\text{O}_3$ -600.

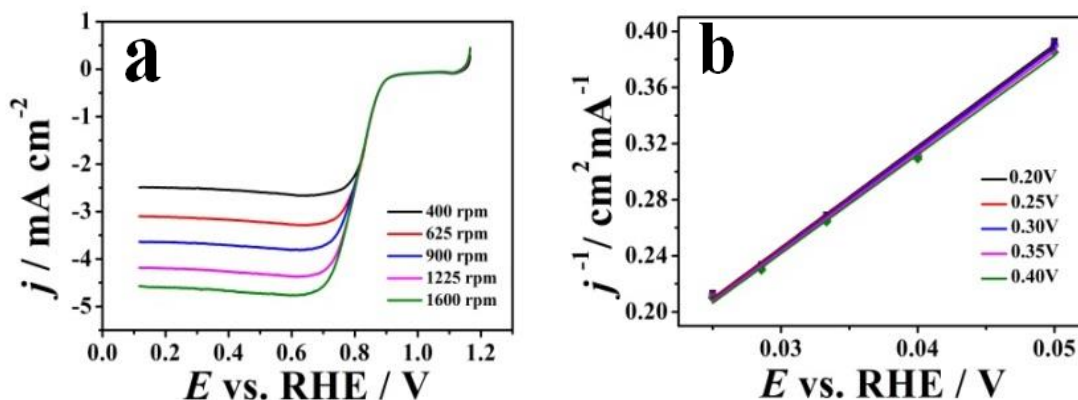


Figure S10 (a) LSV curves of $\text{MnO}_2/\text{Fe}_2\text{O}_3\text{-3.2}$ measured at different rotating rates; (b) Corresponding K-L plots of $\text{MnO}_2/\text{Fe}_2\text{O}_3\text{-3.2}$ in various potential range (vs. RHE, the inset gives the calculated electron transfer number at various potentials).

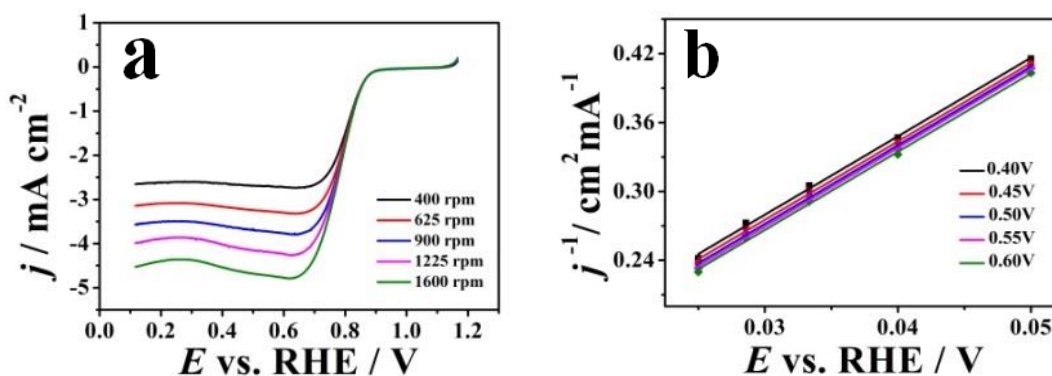


Figure S11 (a) LSV curves of $\text{MnO}_2/\text{Fe}_2\text{O}_3\text{-1.7}$ measured at different rotating rates; (b) Corresponding K-L plots of $\text{MnO}_2/\text{Fe}_2\text{O}_3\text{-1.7}$ in various potential range (vs. RHE, the inset gives the calculated electron transfer number at various potentials).

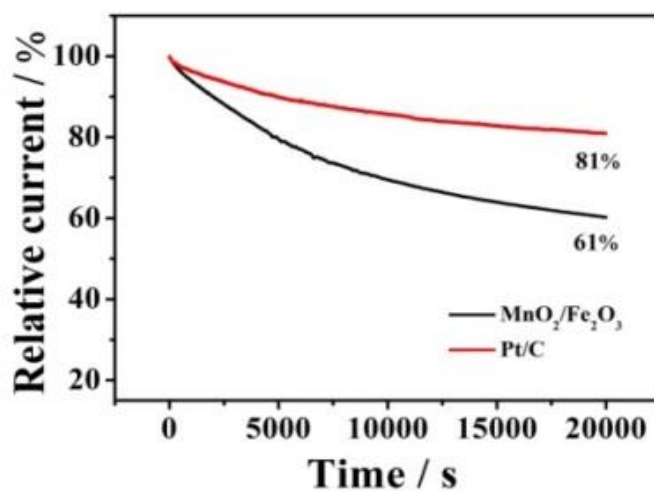


Figure S12 Current-time chronoamperometric responses of $\text{MnO}_2/\text{Fe}_2\text{O}_3/\text{N,P-C}$ and Pt/C.

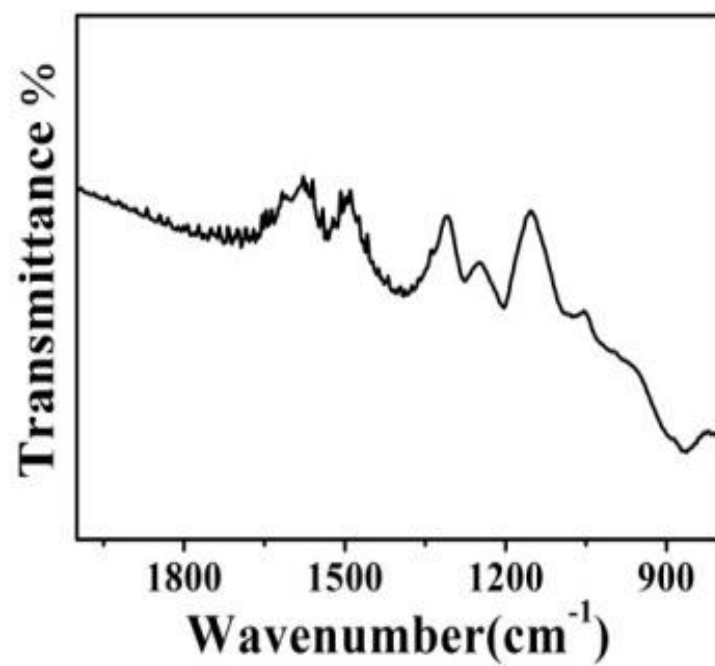


Figure S13 FTIR spectrum of MnO₂/Fe₂O₃/PANI.

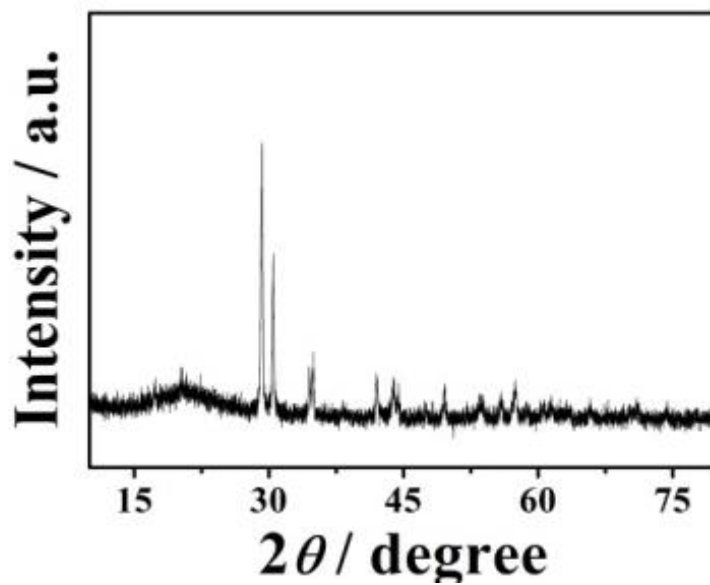


Figure S14 XRD pattern of MnO₂/Fe₂O₃/N,P-C.

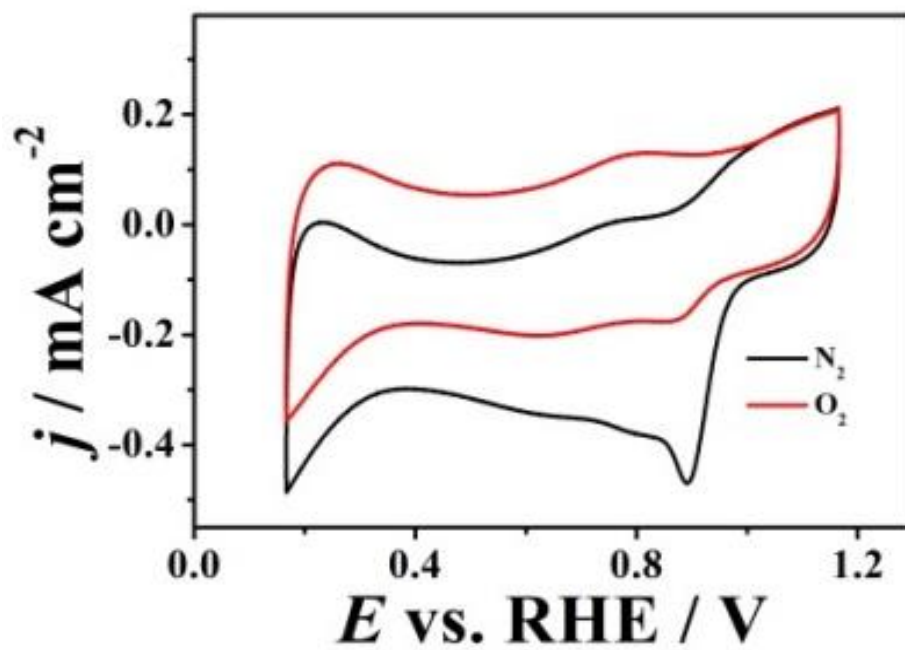


Figure S15 (a) CV curves of $\text{MnO}_2/\text{Fe}_2\text{O}_3/\text{N,P-C}$ in N_2 and O_2 saturated 0.1 M KOH.

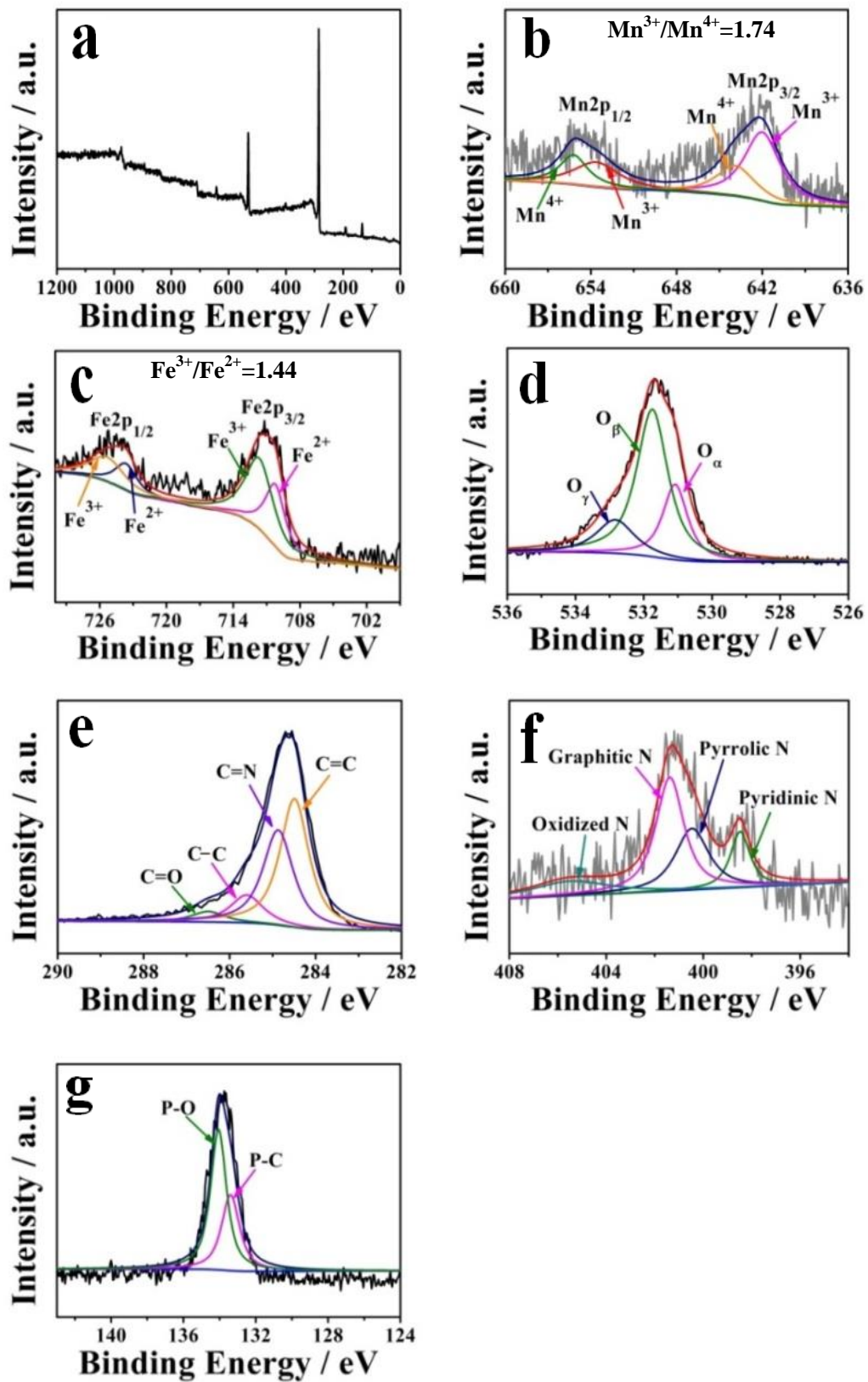


Figure S16 XPS survey spectrum (a) and high-resolution Mn 2p (b), Fe 2p (c), O 1s (d), C 1s (e), N 1s (f) and P 2p (g) spectra of MnO₂/Fe₂O₃/N,P-C.