Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.

Electronic Supplementary Information

Fe, Co, N-functionalized carbon nanotubes in situ grown on 3D porous N-doped carbon foams as noble metal-free catalyst for oxygen reduction

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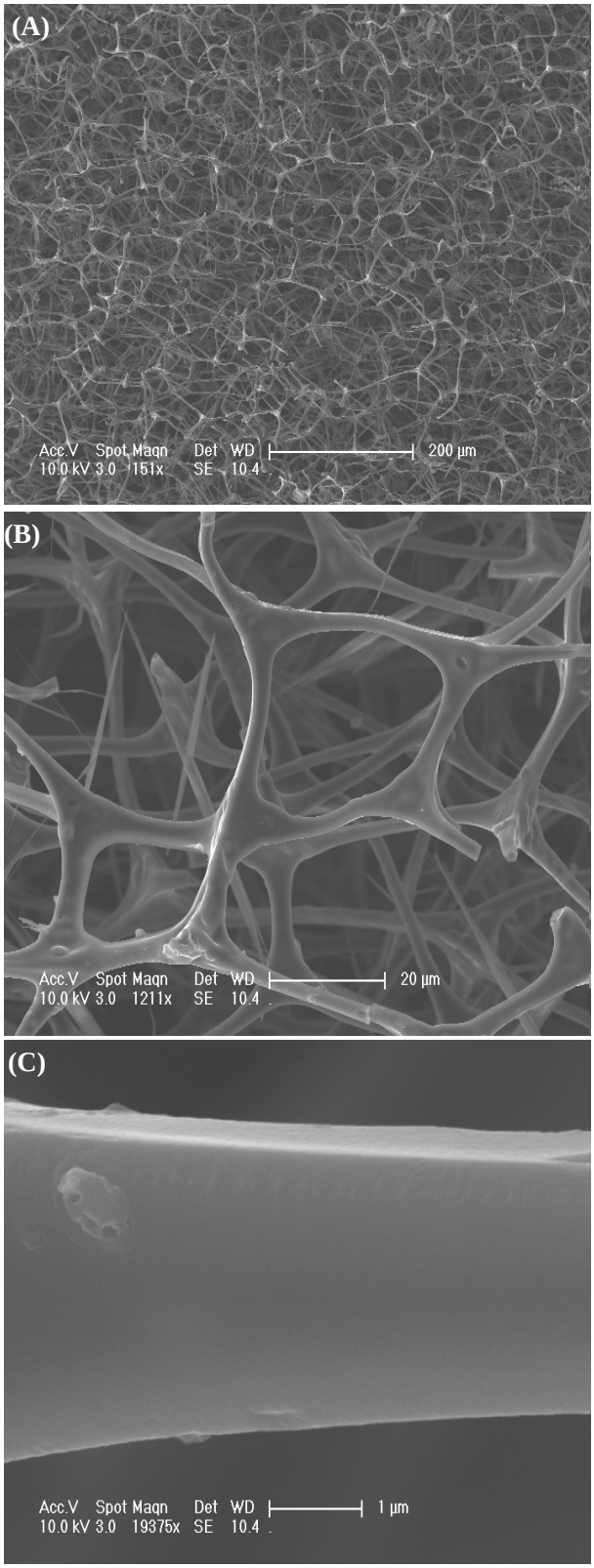

Fig. S1 SEM image at different magnifications of the nitrogen-doped carbon foam (3D NCFs) carbonized from melamine foam.

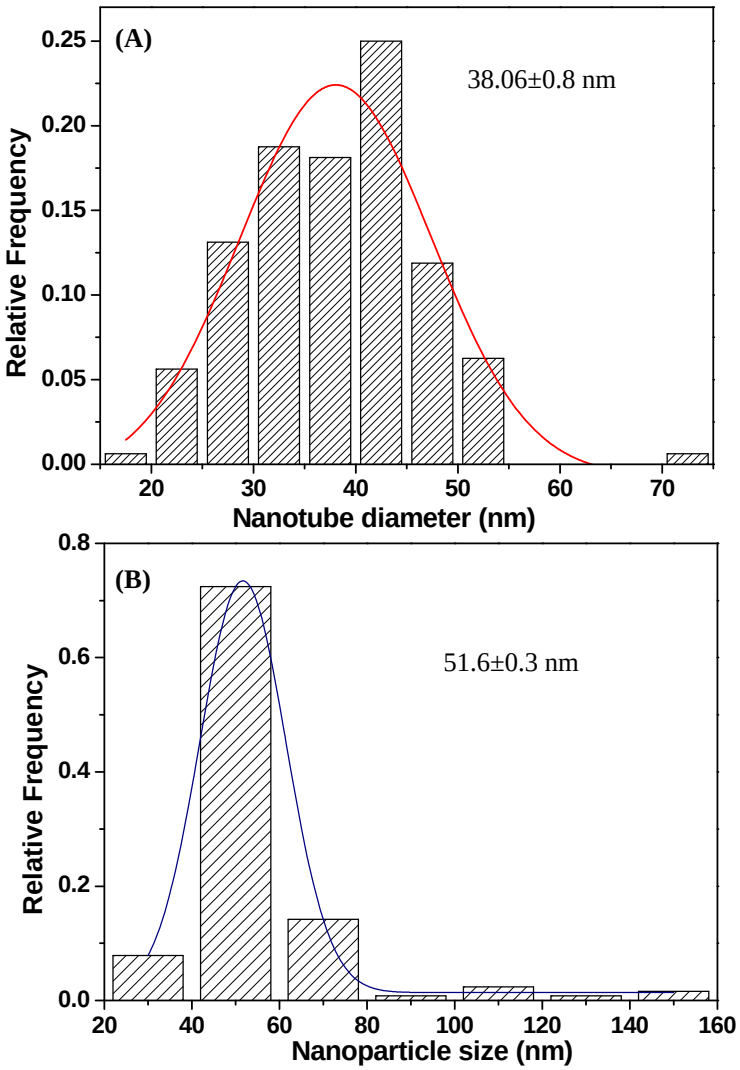

Fig. S2 (A) The diameter histogram of nitrogen-doped carbon nanotubes (NCNTs) grew on the nitrogen-doped carbon foams (NCFs) skeleton. (B) The diameter histogram of the FeCo nanocrystals dispersed on the NCNTs.

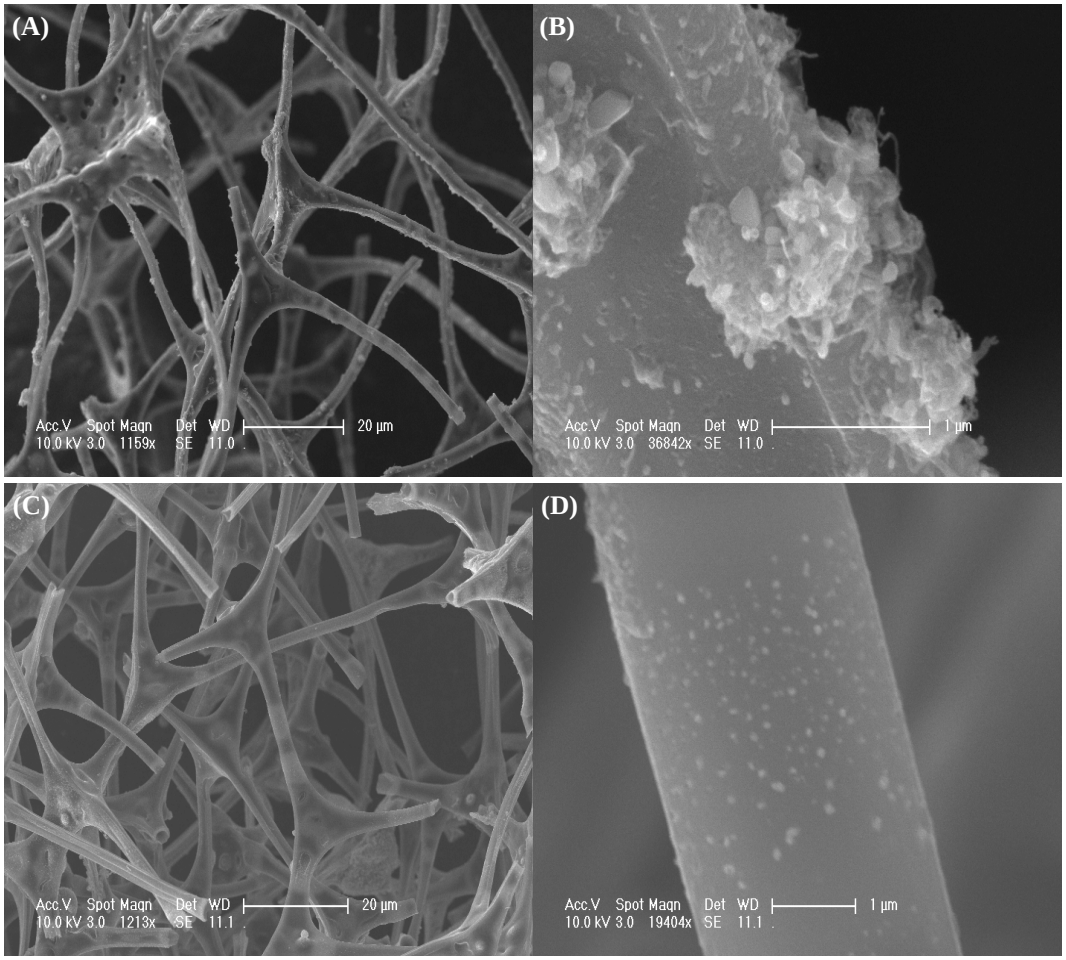

Fig. S3 SEM images with different magnification of the 3D Fe/NCFs (A, B) and 3D Co/NCFs (C, D) prepared by pyrolysis at 800 ^{o}C under Ar atmosphere.

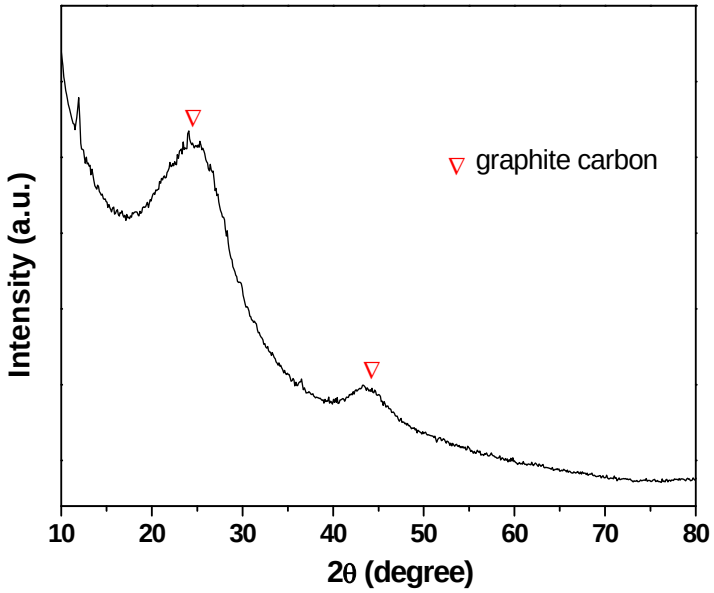

Fig. S4 XRD pattern of the as-prepared 3D NCFs nanostructure.

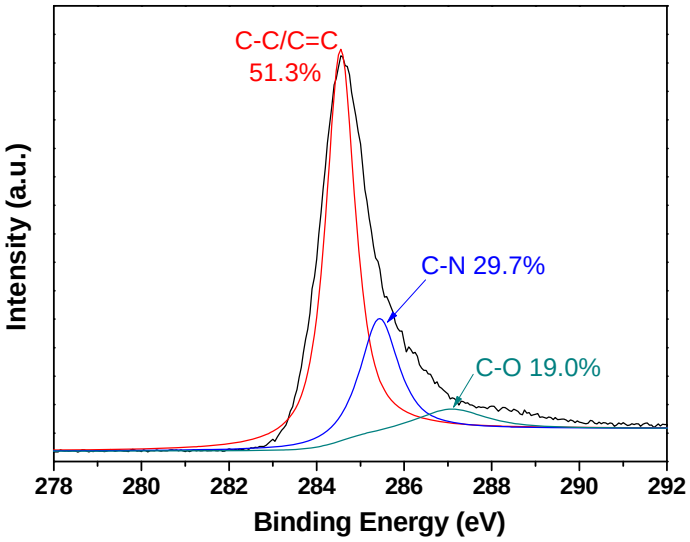

Fig. S5 High-resolution XPS spectrum of C1s of the 3D FeCoN-CNTs/NCFs hybrid nanostructure.

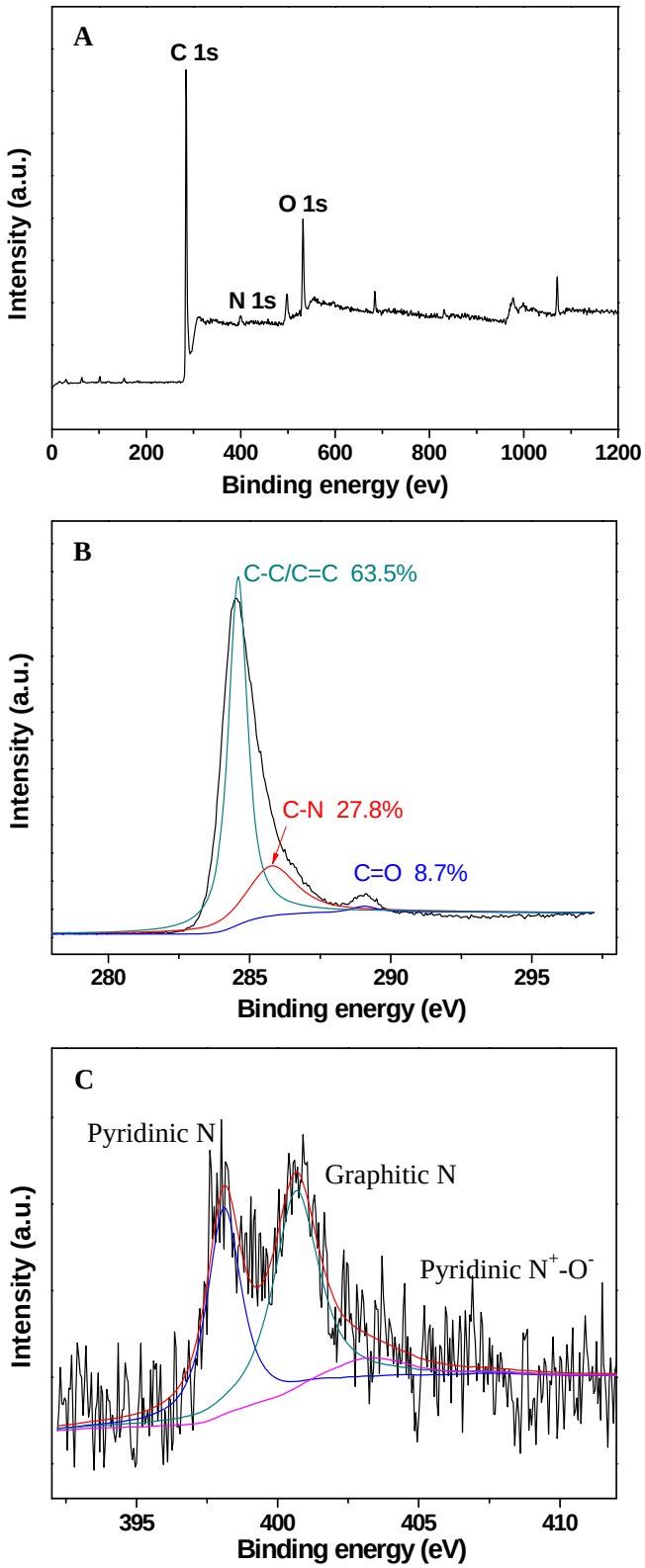

Fig. S6 XPS spectra of the 3D NCFs nanostructure. (A) Survey spectrum, and high resolution XPS spectra of C1s (B) and N1s (C).

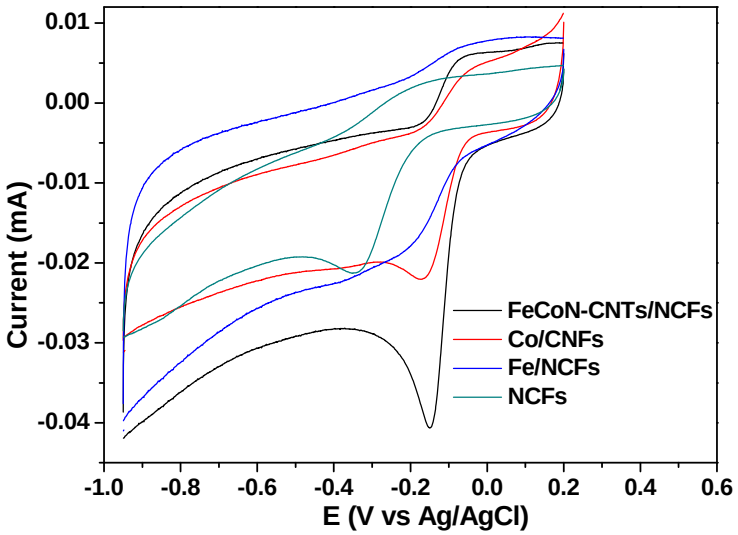

Fig. S7 Cyclic voltammograms of oxygen reduction on the 3D FeCoN-CNTs/NCFs hybrid, 3D Fe/NCFs, 3D Co/NCFs and 3D NCFs electrodes in O_2-saturated 0.1 M KOH at a scan rate of 10 mV/s.

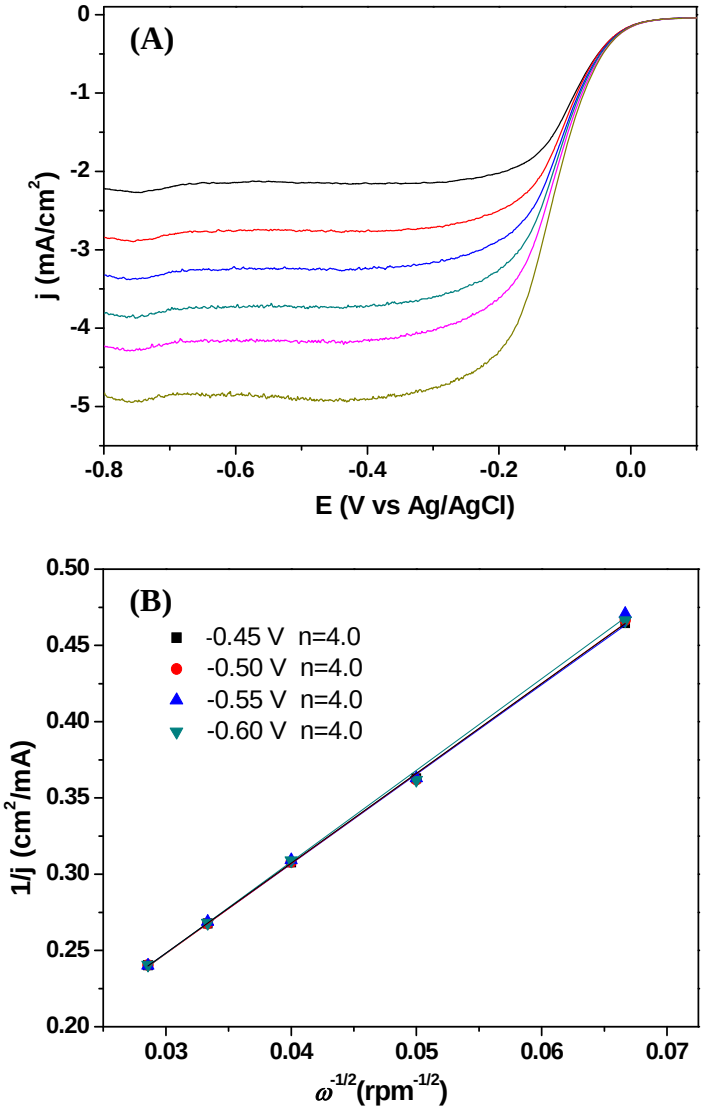

Fig. S8 (A) Rotating disk electrode (RDE) voltammograms obtained from the commercial Pt/C catalyst at various rotation rates. (B) Koutecky-Levich plots for ORR on the Pt/C at different potentials. The transferred electron number per oxygen molecule in the ORR is calculated and listed in the figure legend.

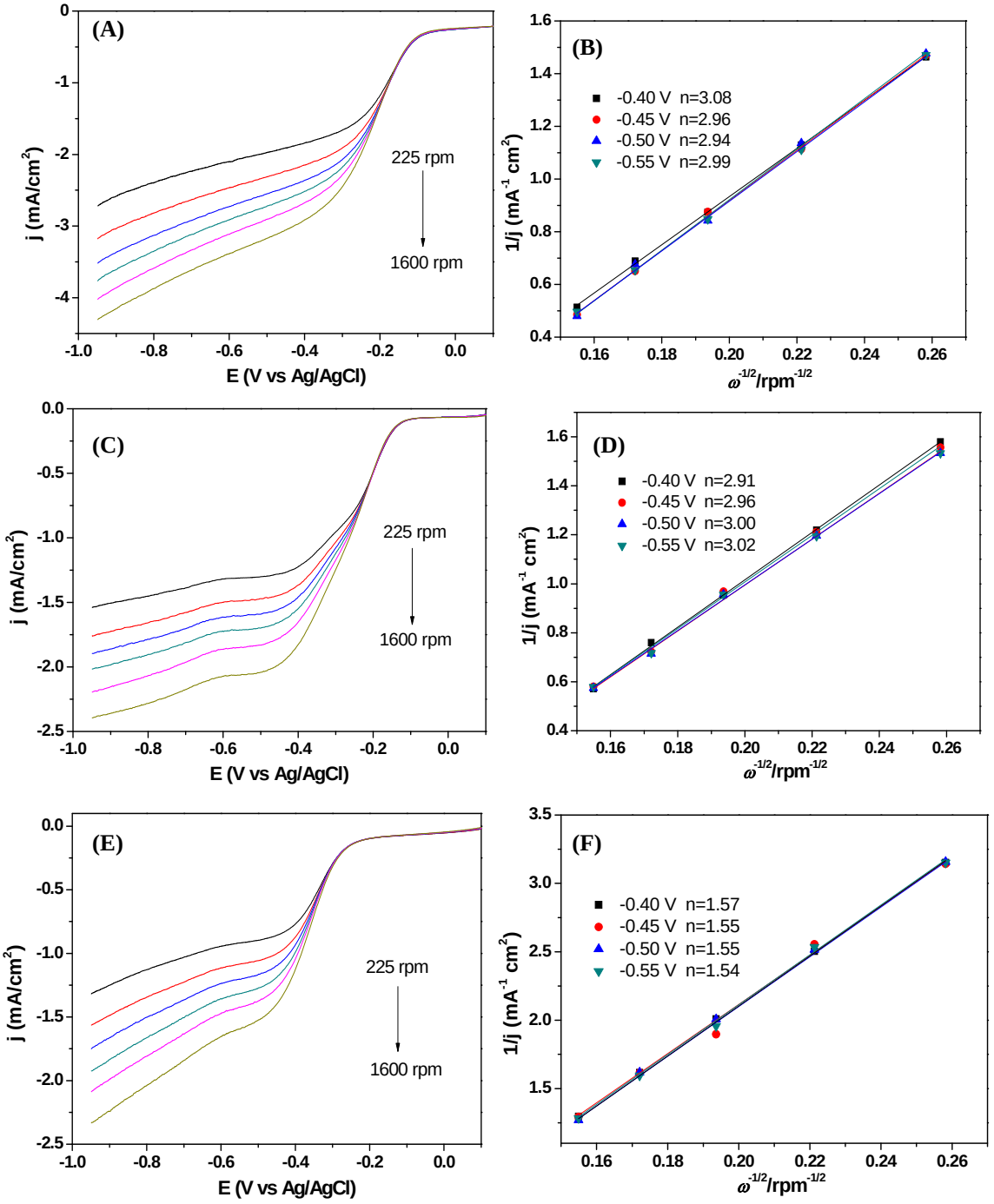

Fig. S9 Rotating disk electrode (RDE) measurements obtained for the 3D Fe/NCFs (A), 3D Co/NCFs (C) and 3D NCFs (E) at various rotation rates. Koutecky-Levich plots for ORR on the 3D Fe/NCFs (B), 3D Co/NCFs (D) and 3D NCFs (F) and the data were obtained from the RDE measurements in panels of A, C and E, respectively. The transferred electron numbers per oxygen molecule in the ORR were calculated and listed in the figure legends.

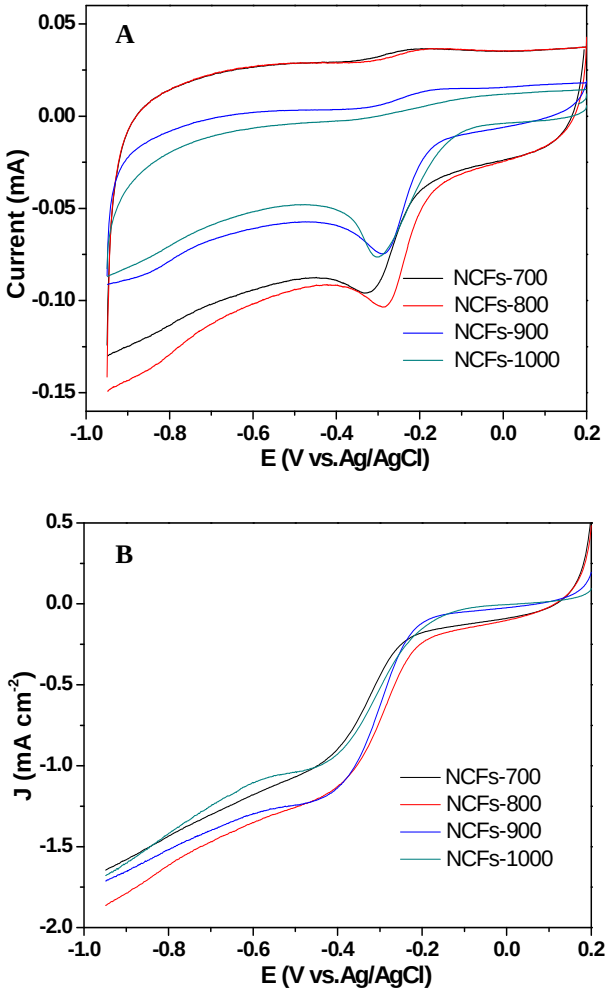

Fig. S10 Cyclic voltammetry curves (A) and linear sweep voltammogram (B, rotation rate 1600 rpm) on the 3D NCFs prepared at different pyrolysis temperatures (700 to 1000 ^{o}C) in O_2-saturated 0.1 M KOH with a scan rate of 10 mV/s, the catalyst loading is 0.2 mg/cm^2.