# Supplementary Information

# Improved oxygen reduction reaction activity of three-dimensional porous N-doped graphene from soft-template synthesis strategy in microbial fuel cells

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**Table of Contents:**



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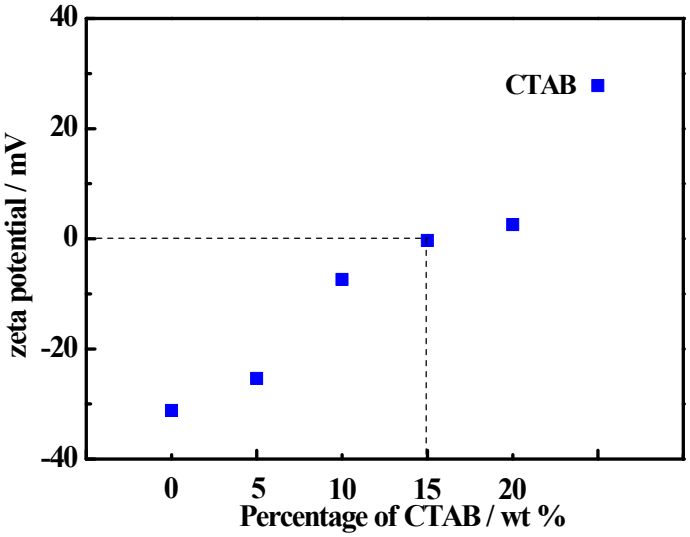
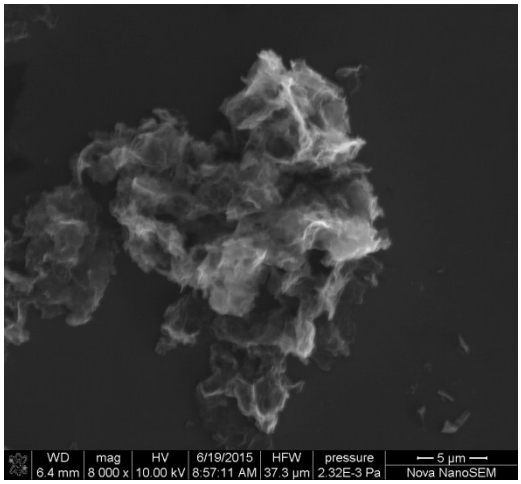
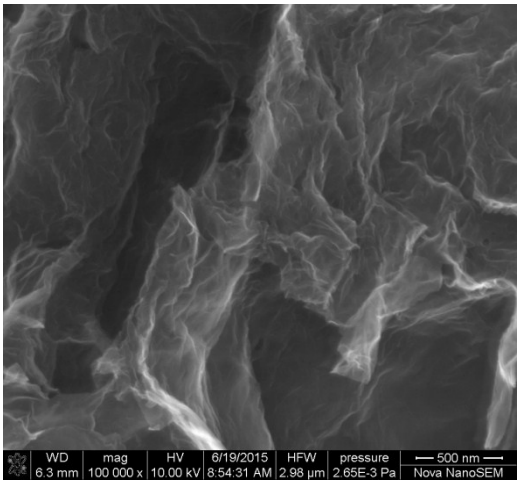

40
20
0
-20
-40
zeta potential / mV
CTAB
0
5
10
15
20
Percentage of CTAB / wt %

**Fig. S1.**

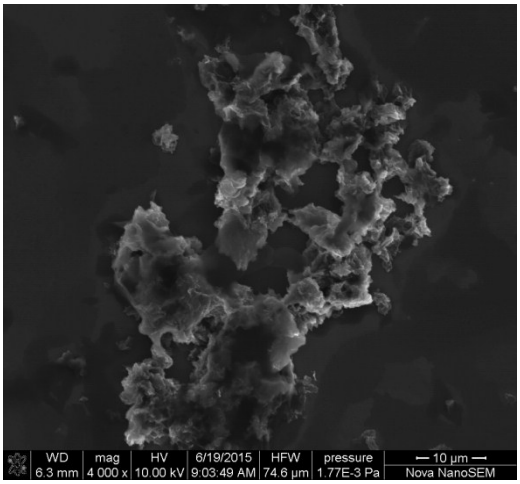
(a)


WD 6.4 mm | mag 8 000 x | HV 10.00 kV | 6/19/2015 8:57:11 AM | HFW 37.3 µm | pressure 2.32E-3 Pa | 5 µm | Nova NanoSEM

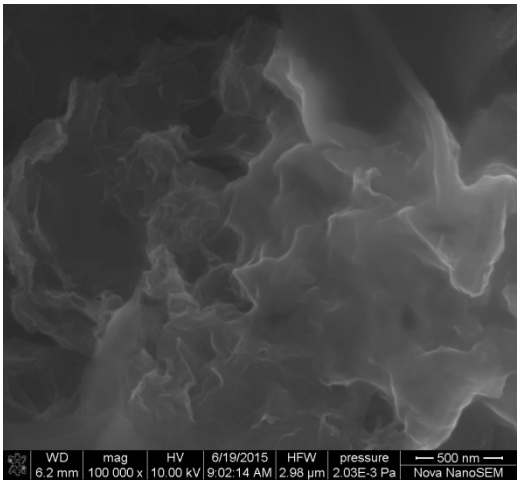
(b)


WD 6.3 mm | mag 100 000 x | HV 10.00 kV | 6/19/2015 8:54:31 AM | HFW 2.98 µm | pressure 2.65E-3 Pa | 500 nm | Nova NanoSEM

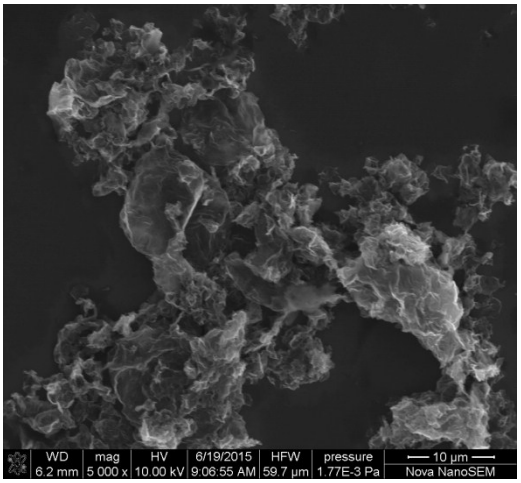
(c)


WD 6.3 mm | mag 4 000 x | HV 10.00 kV | 6/19/2015 9:03:49 AM | HFW 74.6 µm | pressure 1.77E-3 Pa | 10 µm | Nova NanoSEM

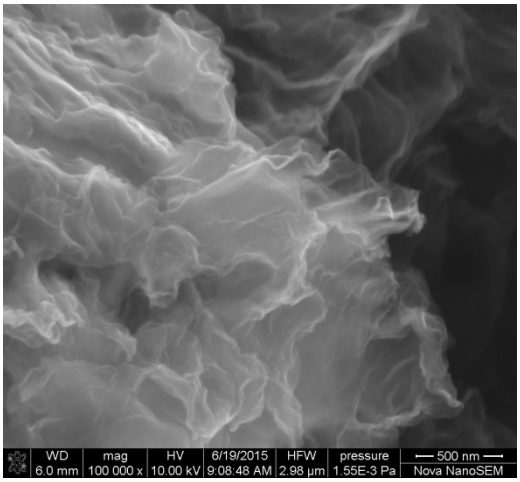
(d)

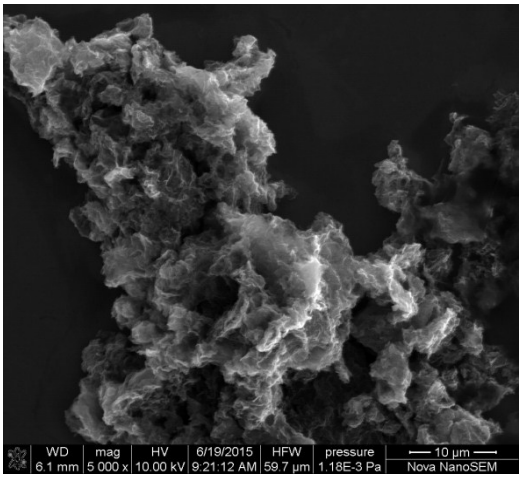

WD 6.2 mm | mag 100 000 x | HV 10.00 kV | 6/19/2015 9:02:14 AM | HFW 2.98 µm | pressure 2.03E-3 Pa | 500 nm | Nova NanoSEM

(e)


WD 6.2 mm | mag 5 000 x | HV 10.00 kV | 6/19/2015 9:06:55 AM | HFW 59.7 µm | pressure 1.77E-3 Pa | 10 µm | Nova NanoSEM

(f)


WD 6.0 mm | mag 100 000 x | HV 10.00 kV | 6/19/2015 9:08:48 AM | HFW 2.98 µm | pressure 1.55E-3 Pa | 500 nm | Nova NanoSEM

(g) 
WD
6.1 mm
mag
5 000 x
HV
10.00 kV
6/19/2015
9:21:12 AM
HFW
59.7 µm
pressure
1.18E-3 Pa
10 µm
Nova NanoSEM

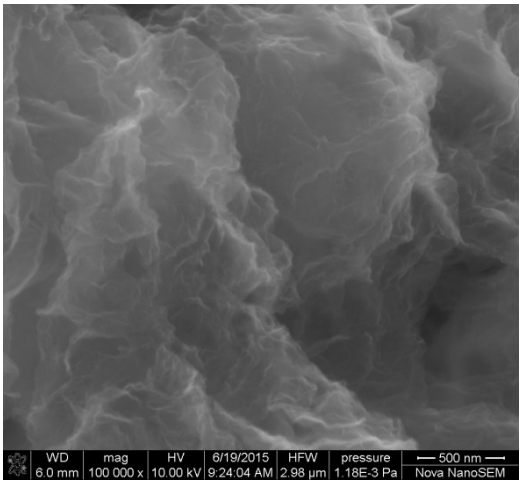
(h) 
WD
6.0 mm
mag
100 000 x
HV
10.00 kV
6/19/2015
9:24:04 AM
HFW
2.98 µm
pressure
1.18E-3 Pa
500 nm
Nova NanoSEM

**Fig. S2.**

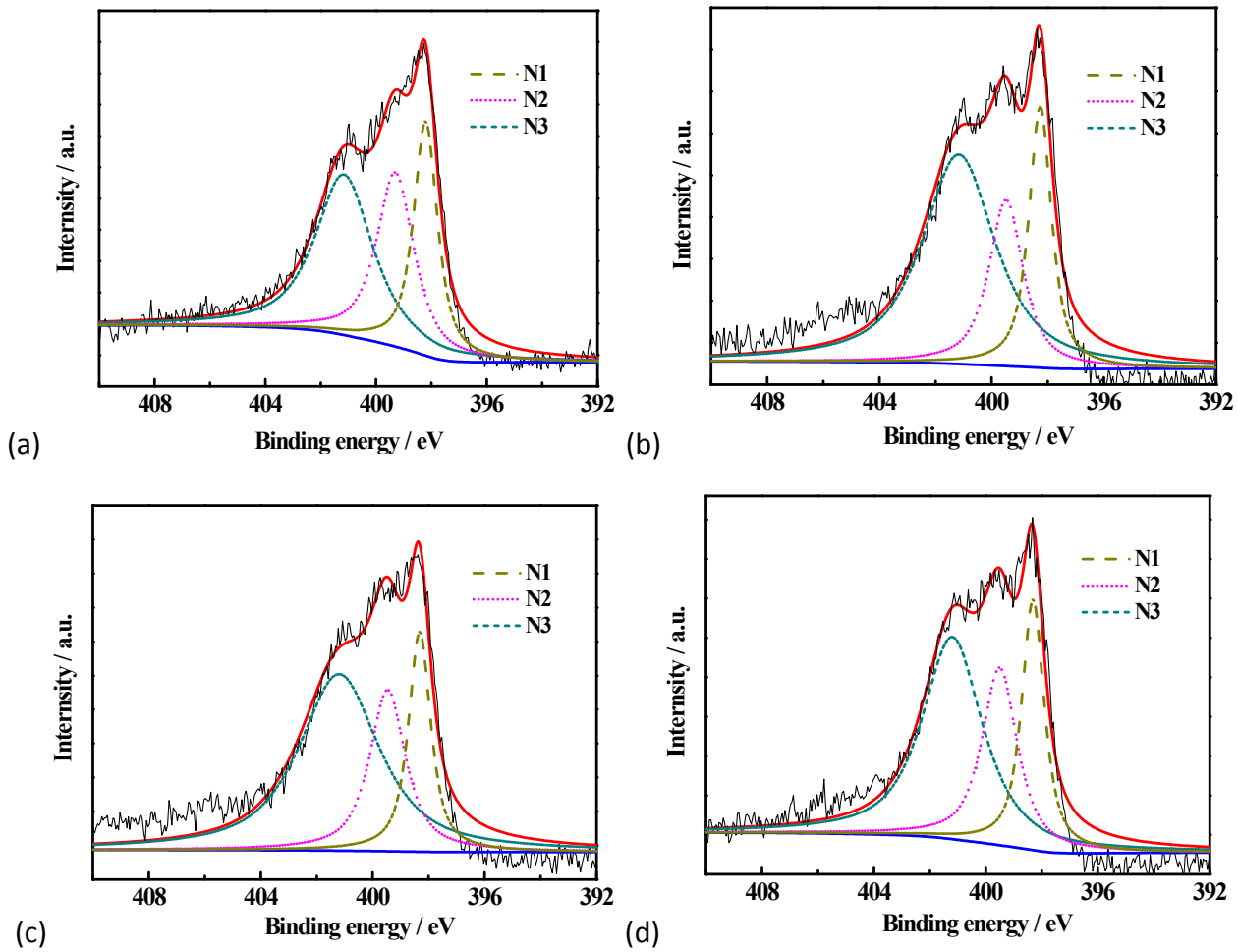

Internsity / a.u.
Binding energy / eV
N1
N2
N3
408
404
400
396
392
(a)
(b)
(c)
(d)

**Fig. S3.**

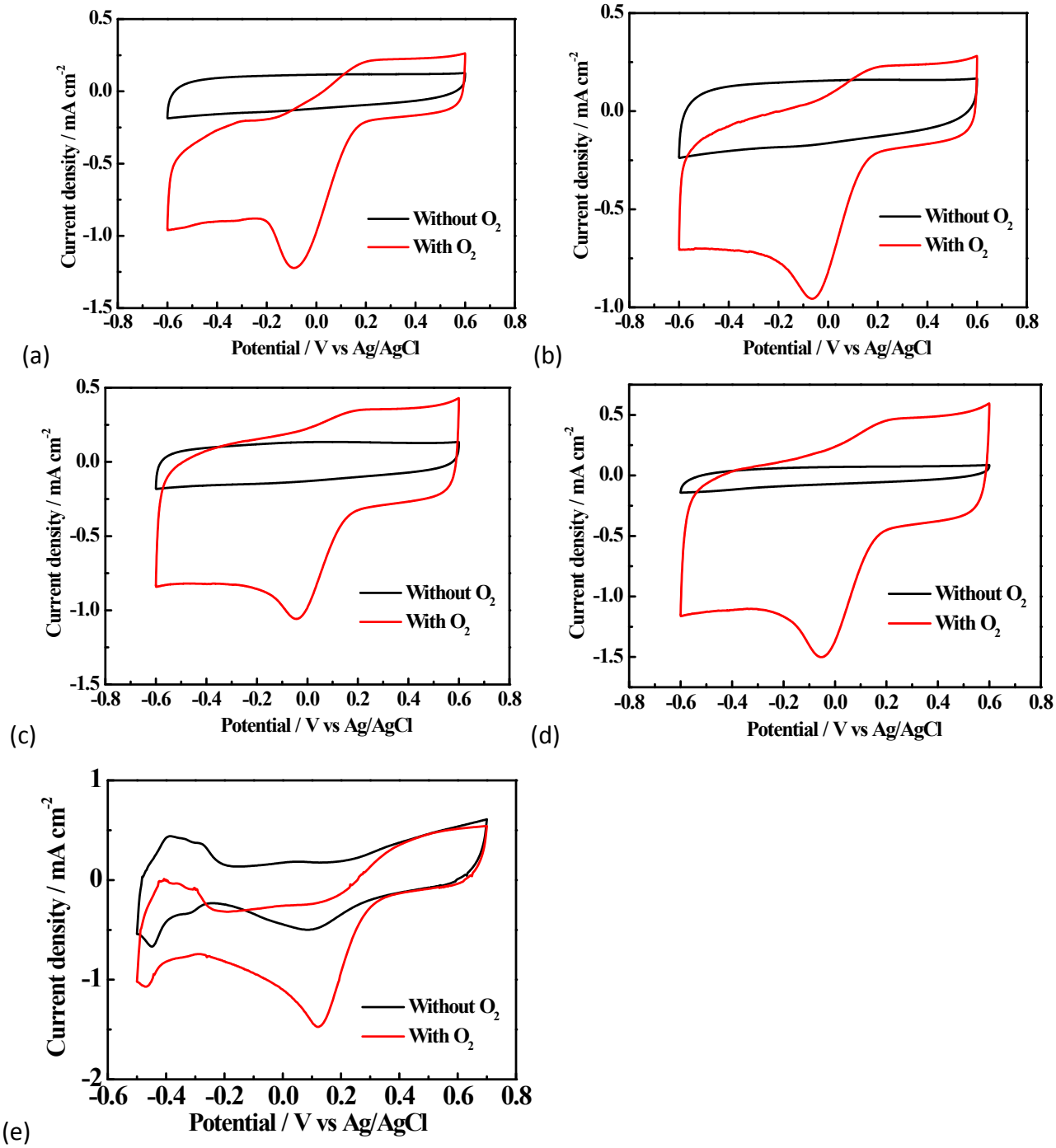

(a)
Current density / mA cm$^{-2}$
Potential / V vs Ag/AgCl
Without $O_2$
With $O_2$
(b)
Current density / mA cm$^{-2}$
Potential / V vs Ag/AgCl
Without $O_2$
With $O_2$
(c)
Current density / mA cm$^{-2}$
Potential / V vs Ag/AgCl
Without $O_2$
With $O_2$
(d)
Current density / mA cm$^{-2}$
Potential / V vs Ag/AgCl
Without $O_2$
With $O_2$
(e)
Current density / mA cm$^{-2}$
Potential / V vs Ag/AgCl
Without $O_2$
With $O_2$

**Fig. S4.**

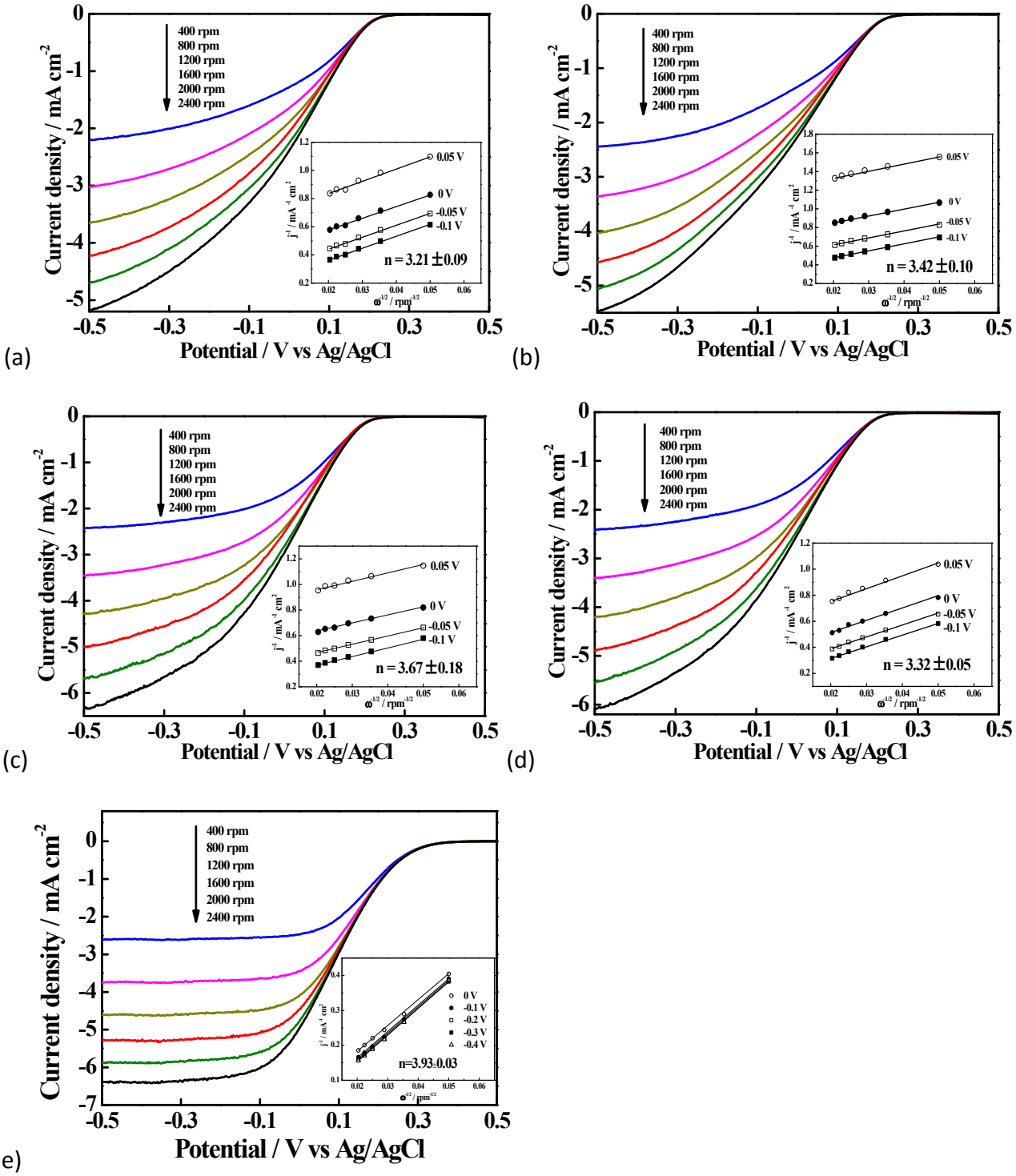
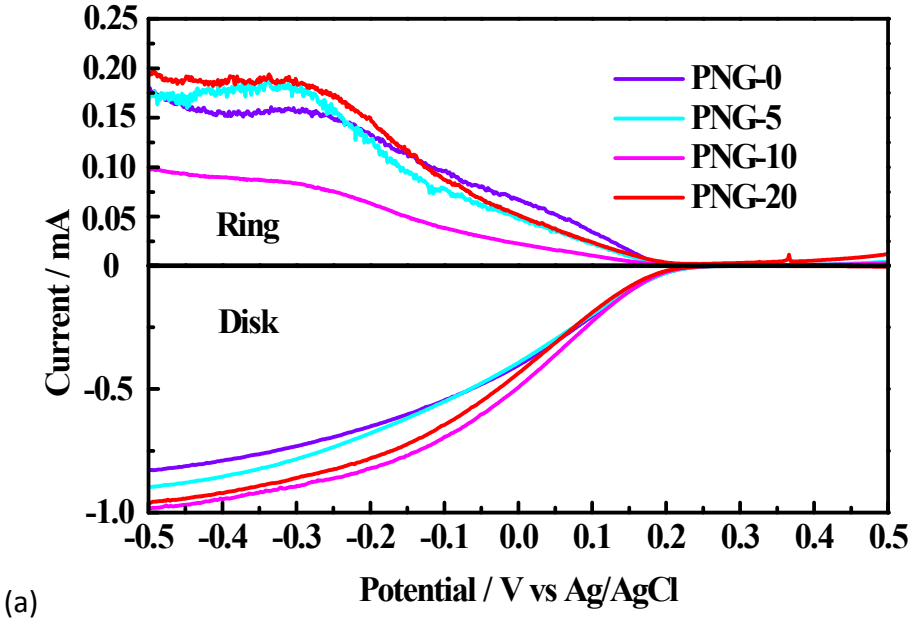
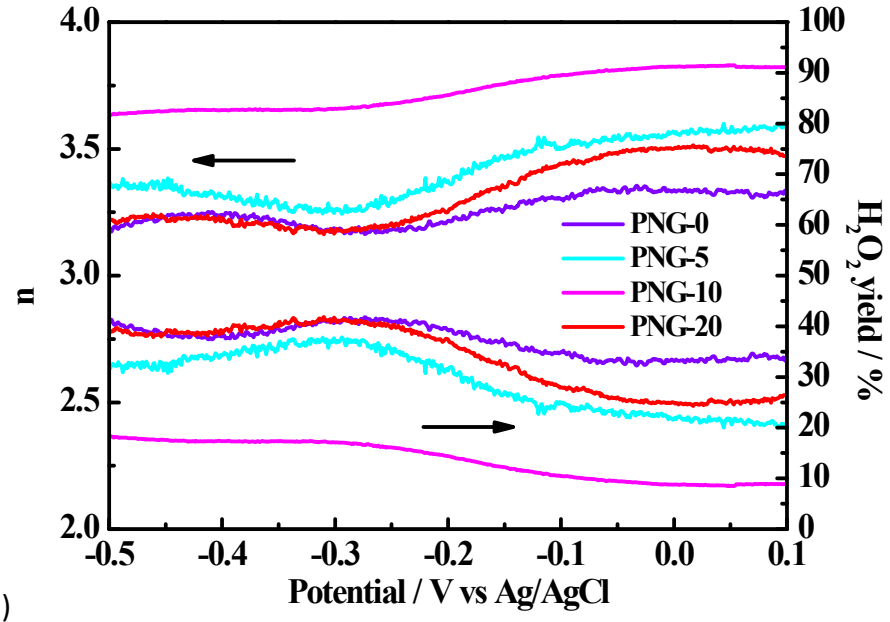

400 rpm
800 rpm
1200 rpm
1600 rpm
2000 rpm
2400 rpm
Current density / mA cm-2
Potential / V vs Ag/AgCl
0.05 V
0 V
-0.05 V
-0.1 V
n = 3.21 ±0.09
(a)
n = 3.42 ±0.10
(b)
n = 3.67 ±0.18
(c)
n = 3.32 ±0.05
(d)
-0.2 V
-0.3 V
-0.4 V
n=3.93±0.03
(e)

**Fig. S5.**


0.25
0.20
0.15
0.10
0.05
0
-0.5
-1.0
Current / mA
Ring
Disk
PNG-0
PNG-5
PNG-10
PNG-20
-0.5 -0.4 -0.3 -0.2 -0.1 0.0 0.1 0.2 0.3 0.4 0.5
Potential / V vs Ag/AgCl

(a)


4.0
3.5
3.0
2.5
2.0
n
100
90
80
70
60
50
40
30
20
10
0
H2O2 yield / %
PNG-0
PNG-5
PNG-10
PNG-20
-0.5 -0.4 -0.3 -0.2 -0.1 0.0 0.1
Potential / V vs Ag/AgCl

(b)

**Fig. S6.**

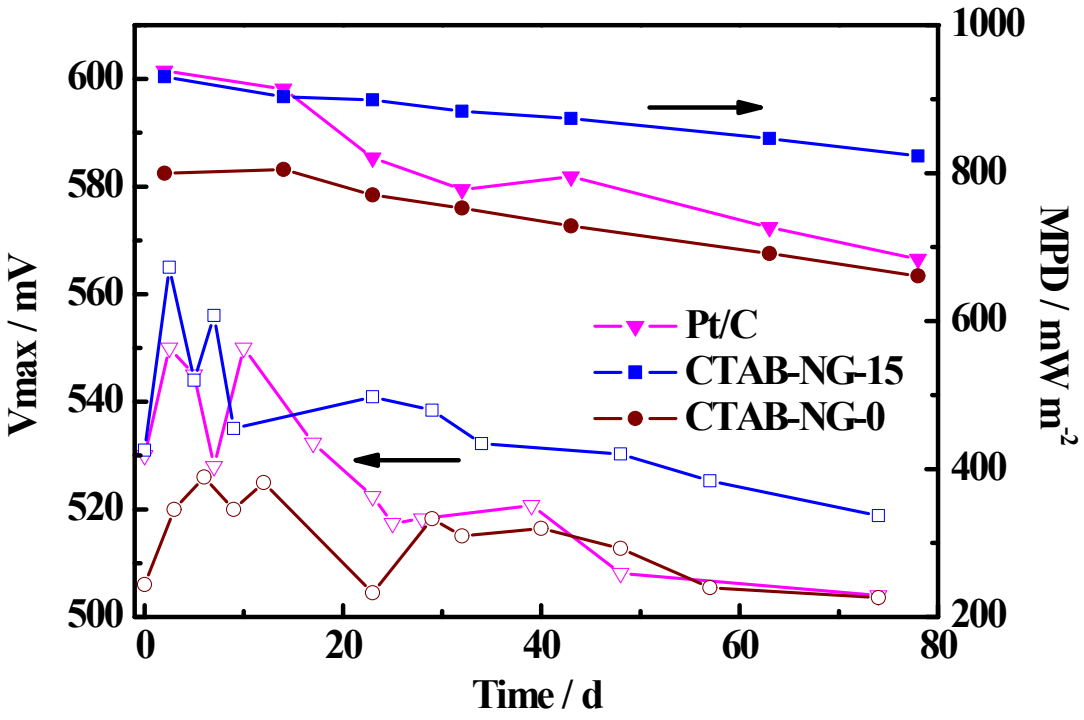

Vmax / mV
MPD / mW m-2
Time / d
Pt/C
CTAB-NG-15
CTAB-NG-0
600
580
560
540
520
500
1000
800
600
400
200
0
20
40
60
80

Fig. S7.

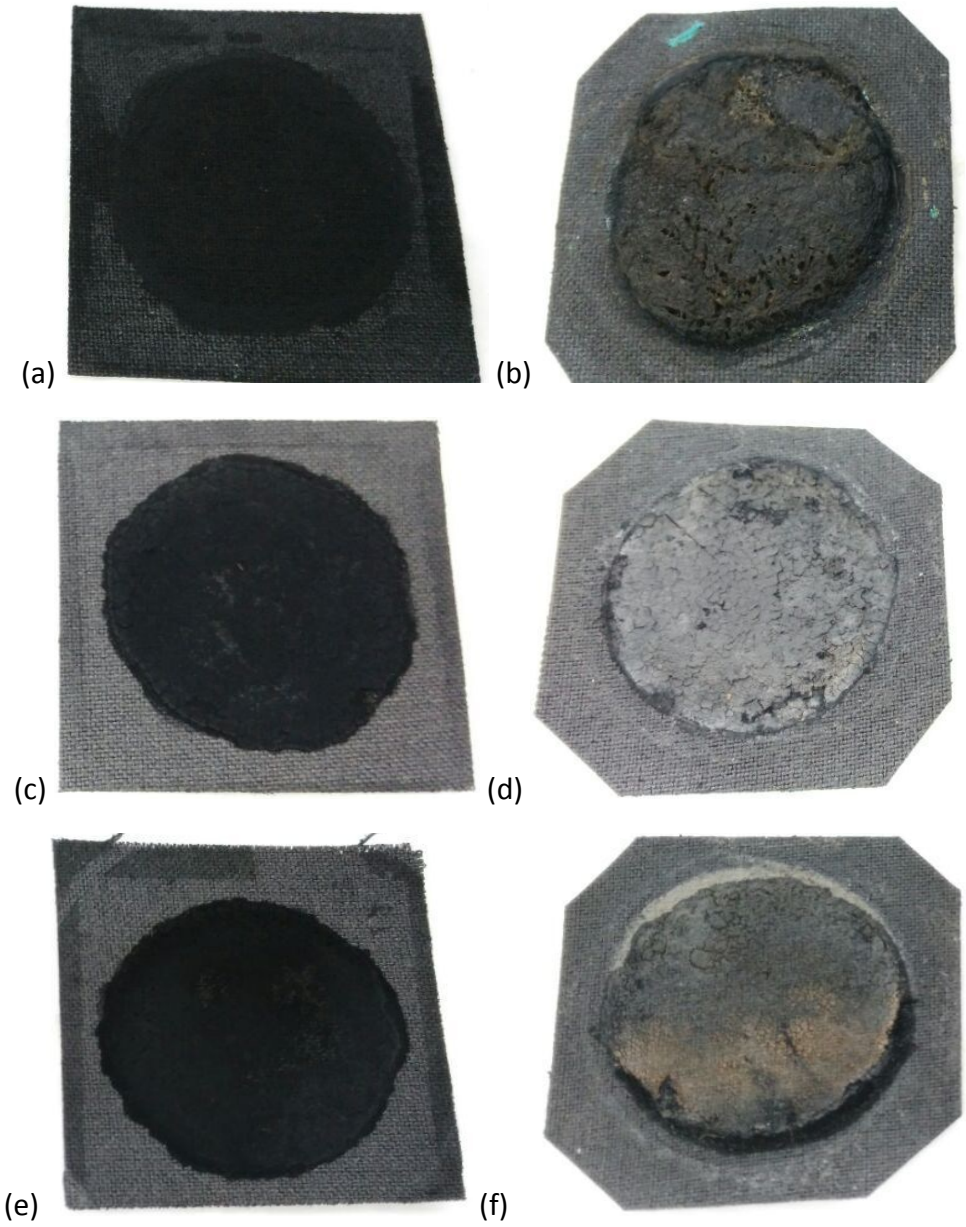



**Fig. S8.**