Electronic Supplementary Material (ESI) for RSC Advances.

Supplementary Information

Table S1: Atomic percentage of AN and PZ from the EDS mapping

Sample	C (at. %)	N (at. %)	O (at. %)	W (at. %)
AN	85.43	3.14	11.17	0.26
PZ	83.24	6.94	9.35	0.47

Table S2: Surface composition of AN and PZ from the XPS spectra

Sample	C (at. %)	N (at. %)	O (at. %)	W (at. %)
AN	77.1	2.6	19.9	0.4
PZ	79.8	7.5	12.0	0.7

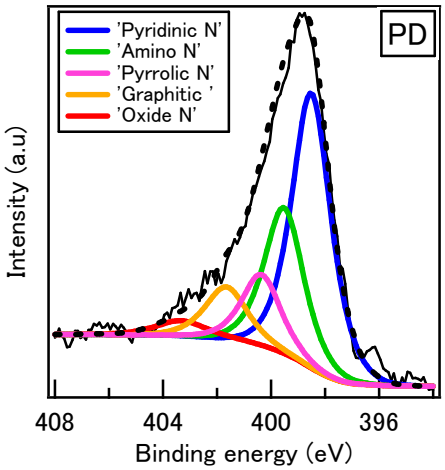

Fig. S1. High resolution N 1s spectra with peak deconvolution of Pyridine (PD)

Table S3: Bonding states of carbon in pyridine (PD) from detailed deconvolution of XPS N1s spectra.
(The results were compared to AN and PZ from Table 3 as reference.)

Bonding	Peak Position (eV)	Relative percentage (%)		
		Pyridine (PD)	AN	PZ
Pyridinic	398.4 – 398.6	47.9	37.9	56.0
Amino	399.5	22.6	34.9	19.9
Pyrrolic	400.1 - 400.3	12.4	8.5	13.5
Quaternary (center)	401.1 – 401.5	8.4	12.8	8.1
Quaternary (valley)	402.	3.6	5.74	2.0
Oxide	403.8 – 404.1	5.0	--	1.39

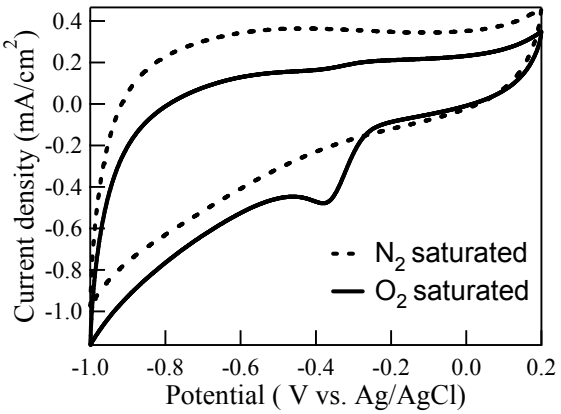

Fig. S2. CV curves of carbon samples synthesized by pyridine (PD) under N2 (dotted) and O2 (solid) saturated 0.1M KOH solution at a scan rate of 50 mV s^{-1}.

Table S4. Summarized data for the relative percentage of pyridinic-N, amino-N, quaternary-N, normalized current and ORR onset potential for Fig. 7a and b.

	Amino (%)	Pyridinic (%)	Quaternary center (%)	Quaternary valley (%)	Normalized Current (mA/cm^2)	ORR onset potential (V vs Ag/AgCl)
AN	34	33.3	12.8	5.74	0.4	-0.23
PZ	65.6	18.4	8.1	2	0.73	-0.27
PD	47.9	22.6	8.4	3.6	0.53	-0.24

*The current density has been normalized based on total surface area.