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

Supporting Information

Nanoporous Carbons Derived from MOFs as Metal-Free Catalysts for Selective Aerobic Oxidations

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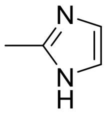
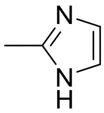
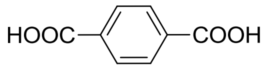
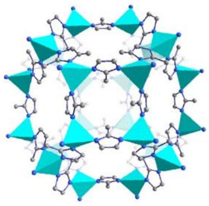
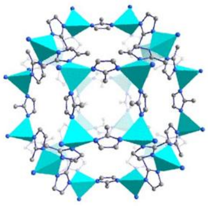
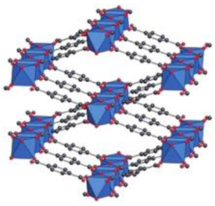
Table S1. Crystallographic date for ZIF-67, ZIF-8, and Co-MOF-71.

Item	ZIF-67	ZIF-8	Co-MOF-71
Identification code	Co(MeIM)$_2$	Zn(MeIM)$_2$	Co(BDC)
Empirical formula	$C_8H_{10}CoN_4$	$C_8H_{10}ZnN_4$	$C_8H_4CoO_4$
Formula weight	221.13	229.59	223.05
Metal precursor	$Co(NO_3)_2 \cdot 6H_2O$	$Zn(NO_3)_2 \cdot 6H_2O$	$Co(NO_3)_2 \cdot 6H_2O$
Organic linker	 MeIM	 MeIM	 1,4-BDC
Crystal system	cubic	cubic	orthorhombic
SBU[a]			

[a] SBU refers to secondary building units. SBU of Co-MOF-71 is reproduced from ref. S1.

Table S2. Characterization results of the materials.

Sample	C content (wt%)[a]	N content (wt%)[a]	H content (wt%)[a]	Co content (wt%)[b]
67-CN-600	78.7	16.5	1.3	-
67-CN-700	84.8	10.9	1.2	-
67-CN-800	92.2	4.8	0.7	-
67-CN-900	95.8	2.1	0.6	-
8-CN-600	79.6	15.6	2.0	-
71-C-600	95.6	0.1	1.2	-

[a] Measured by elemental analysis.

[b] Measured by AAS.

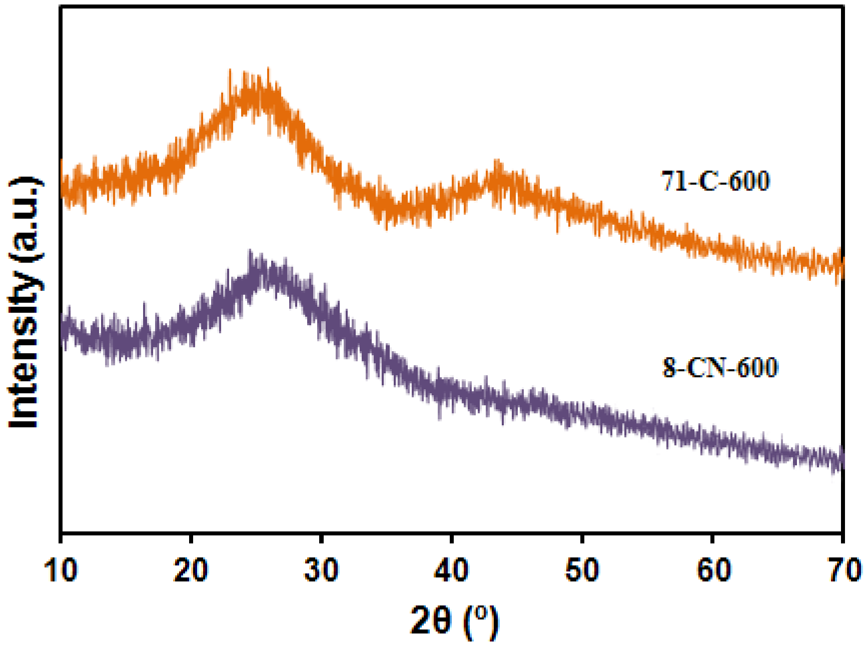


Figure S1. Powder XRD patterns of the porous N-doped carbons derived from Co-MOF-71 (up) and ZIF-8 (down).

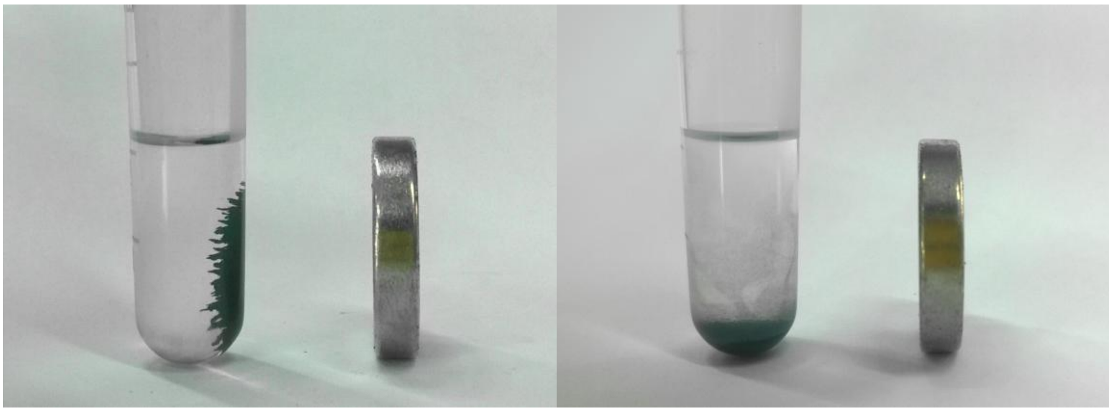


Figure S2. Photos of Co/CN-600 (left) and 67-CN-600 (right) in solution close to a magnet.

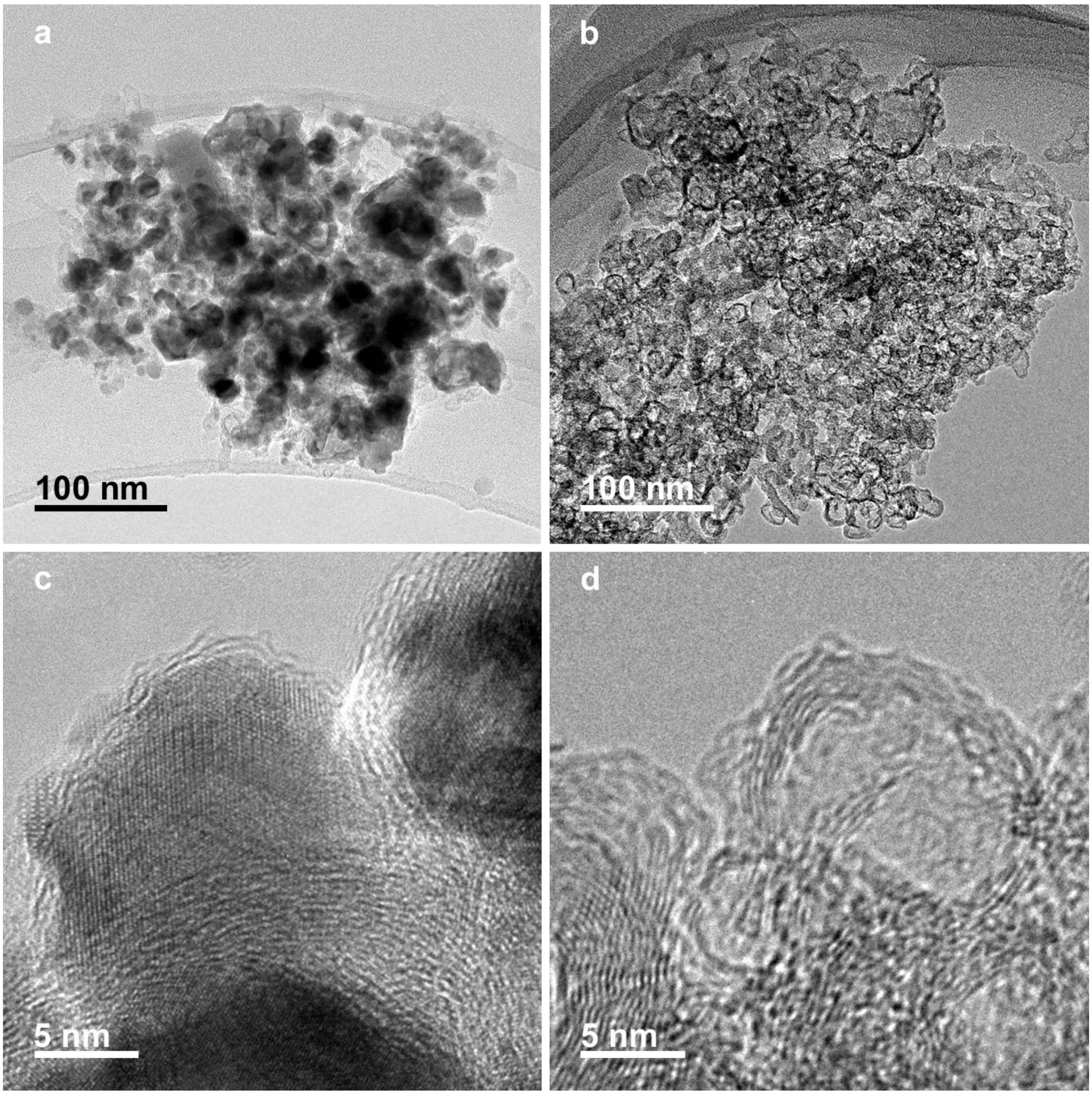


Figure S3. TEM images of Co/C-600 (a, c) and the obtained 71-C-600 (b, d) after chemical etching.

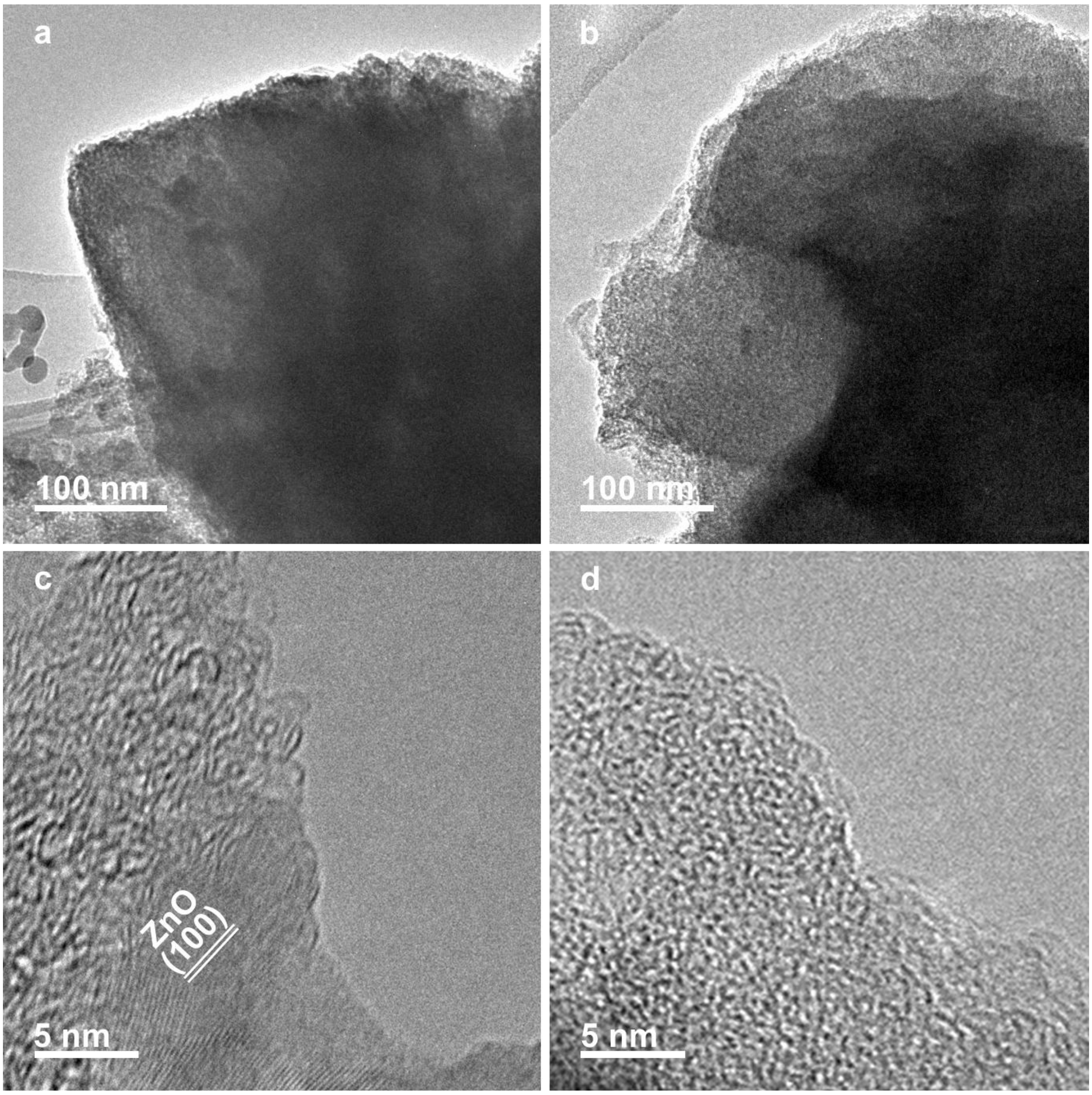


Figure S4. TEM images of ZnO/CN-600 (a, c) and the obtained 8-CN-600 (b, d) after chemical etching.

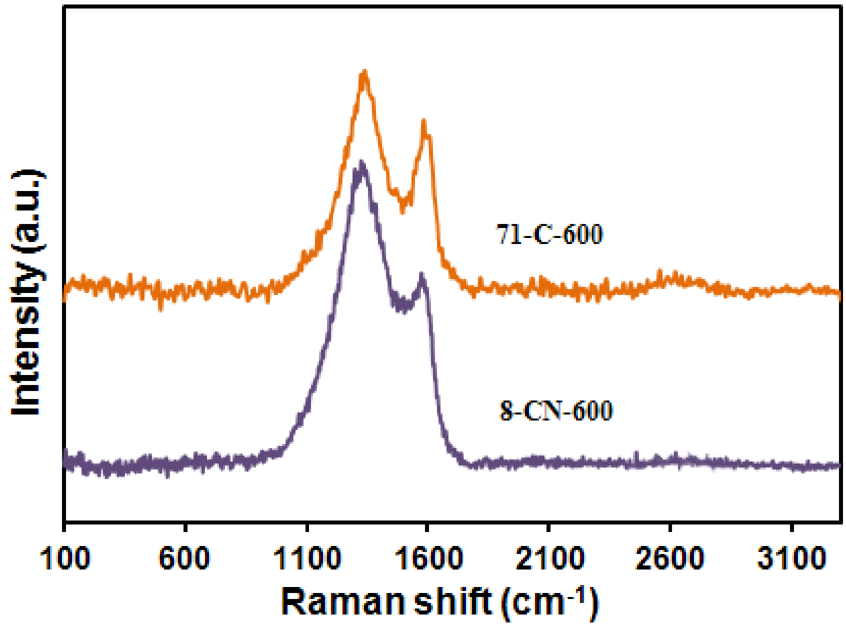


Figure S5. Raman spectra of the resultant porous N-doped carbons derived from Co-MOF-71 (up) and ZIF-8 (down).

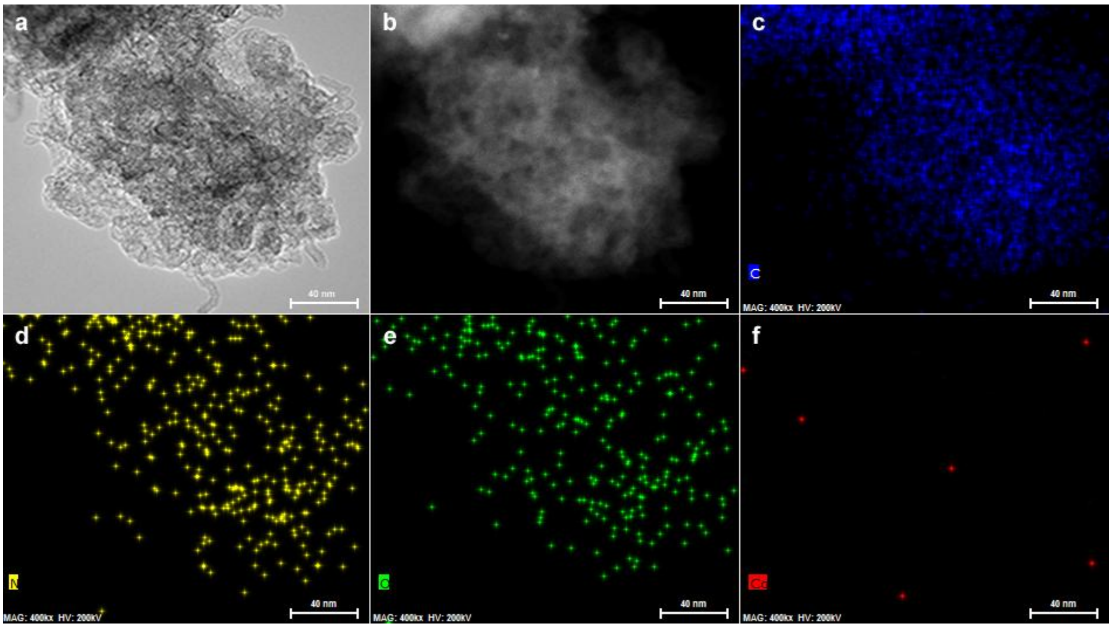


Figure S6. TEM image (a), HAADF-STEM image (b) of an individual 67-CN-600 particle and the corresponding elemental mappings of C (c), N (d), O (e) and Co (f), respectively.

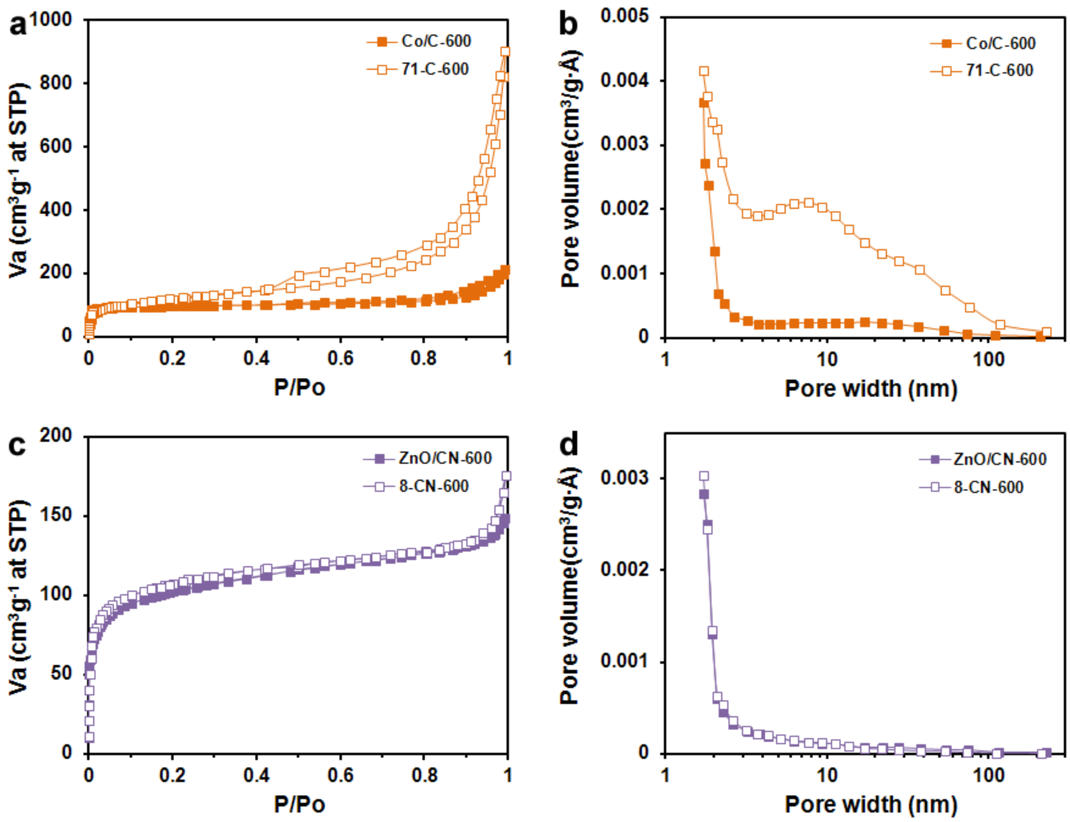


Figure S7. (a) N_2 adsorption/desorption isotherm at 77 K of Co/C-600 and 71-C-600. (b) Pore-size distribution of Co/C-600 and 71-C-600. (c) N_2 adsorption/desorption isotherm at 77 K of ZnO/CN-600 and 8-CN-600. (d) Pore-size distribution of ZnO/CN-600 and 8-CN-600.

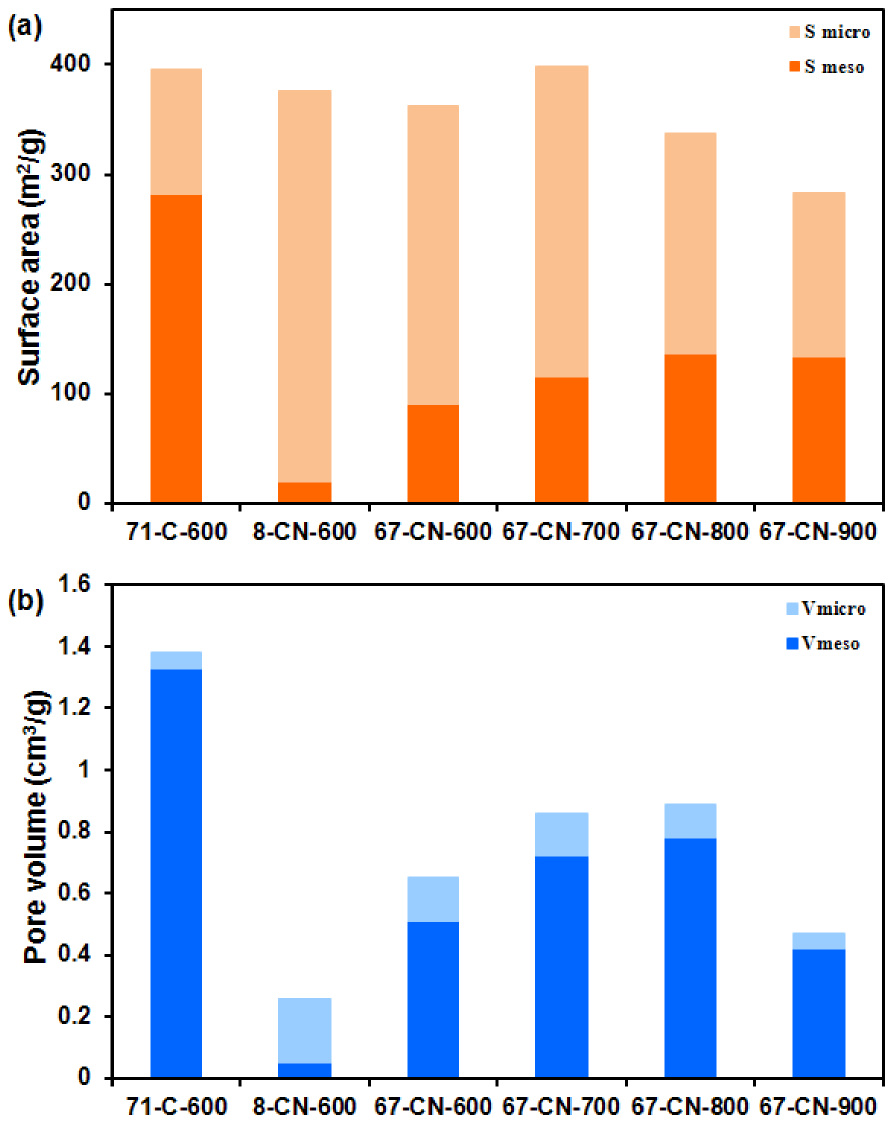


Figure S8. Surface areas (a) and pore volumes (b) of the carbon samples.

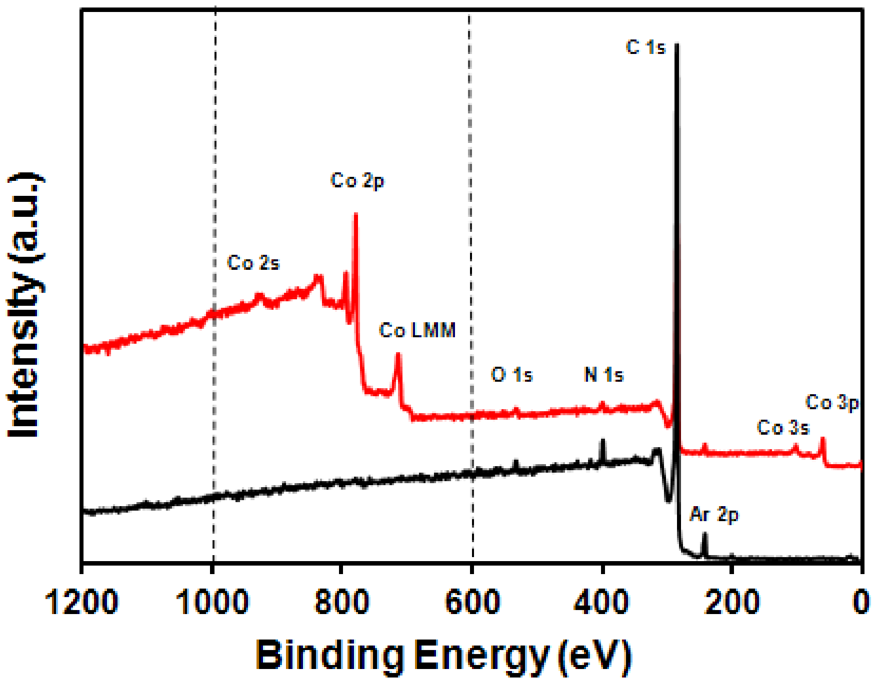


Figure S9. XPS survey spectra of Co/CN-600 (red) and 67-CN-600 (black).

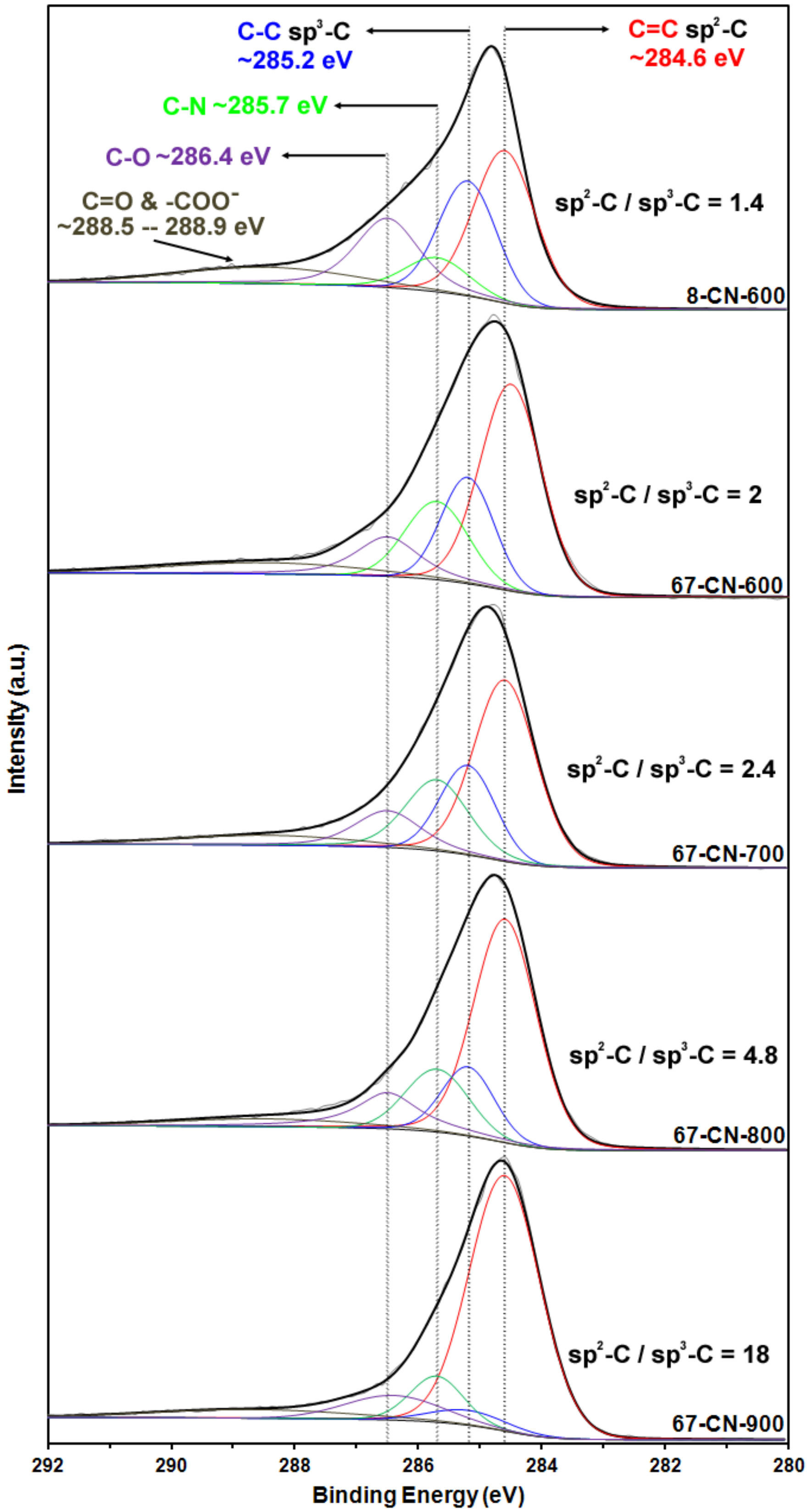


Figure S10. High-resolution C 1s XPS spectra of the 8-CN-600 and 67-CN-X samples.

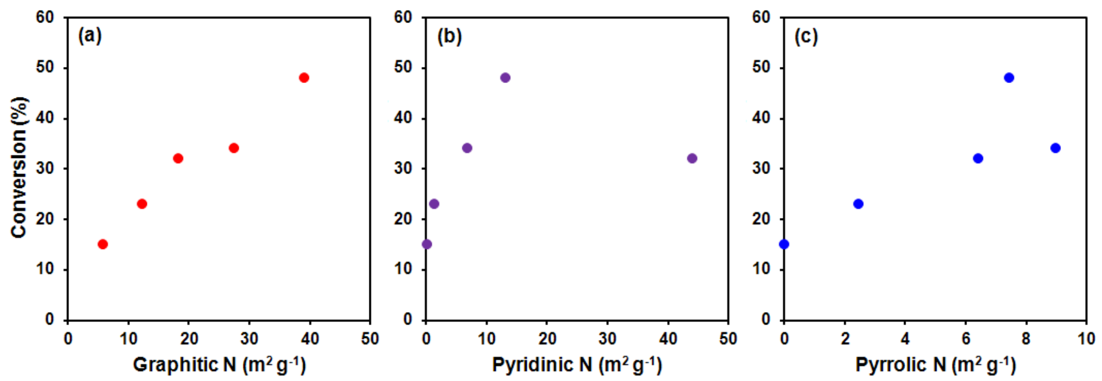


Figure S11. Plots of conversion in oxidation of cyclohexane against the amount of graphitic (a), pyridinic (b), and pyrrolic (c) nitrogen species on the nitrogen-doped carbon catalysts listed in Table 2 (entries 4-8).

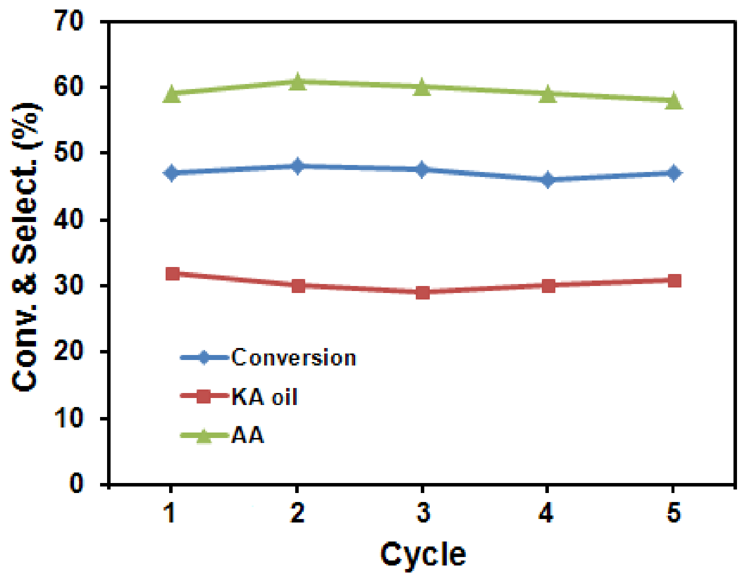


Figure S12. The reusability of 67-CN-600 in the cyclohexane oxidation.

Reference

S1. N. L. Rosi, J. Kim, M. Eddaoudi, B. Chen, M. O'Keeffe and O. M. Yaghi, *J. Am. Chem. Soc.*, 2005, **127**, 1504-1518.