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Supporting Information

Waste wool derived nitrogen-doped hierarchical porous carbon for selective CO_2 capture

Yao Li,[ac] Ran Xu,[a] Xin Wang,[b] Binbin Wang,*[b] Jianliang Cao,[d] Juan Yang*[ac] and Jianping Wei*[ac]

[a] School of Safety Science and Engineering, Henan Polytechnic University, Jiaozuo, Henan 454000, China.

[b] School of Materials Science and Engineering, Henan Polytechnic University, Jiaozuo, Henan 454000, China.

[c] State Key Laboratory Cultivation Base for Gas Geology and Gas Control, Henan Polytechnic University, Jiaozuo 454000, China.

[d] School of Chemistry and Chemical Engineering, Henan Polytechnic University, Jiaozuo 454000, China.

* Corresponding authors.

[a] *E-mail address: wangbb580@aliyun.com (B. Wang), yangjuanhpu@163.com (J. Yang), hpuwjp@163.com (J. Wei).*

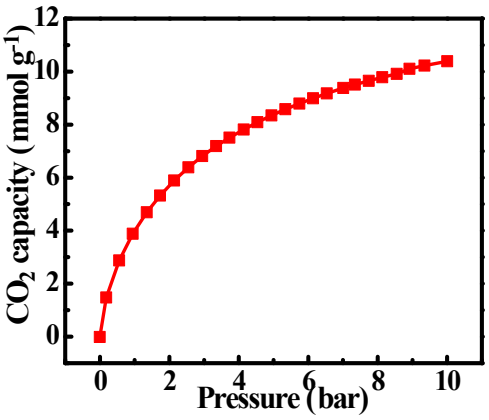

Fig. S1 The CO_2 adsorption isotherm of the WNPC-3 measured under high pressure at 0 °C.

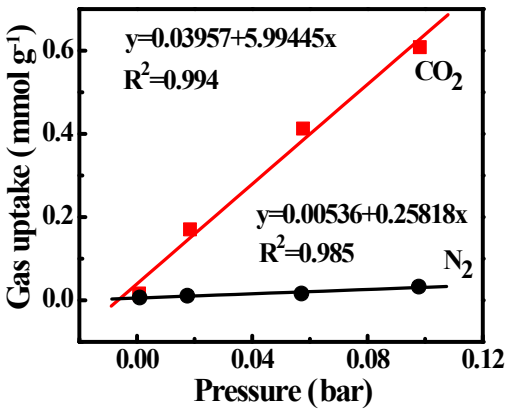

Fig. S2 The initial slopes are calculated from CO_2 and N_2 adsorption isotherms at 25 ºC for WPC-3. The CO_2/N_2 selectivity ratio is 23.

The ideal adsorption solution theory (IAST) calculation

The pure adsorption isotherms of CO_2 and N_2 on the WNPC-3 at 25 ºC and 1 bar are given in Fig. 6c.

The CO_2 and N_2 experimental adsorption isotherms were fitted to the dual-site Langmuir model (DL) and single site Lagmuir modle (L), respectively, as following:[S1-S3]

Dual site Langmuir model = $q_A + q_B$; Single site Lagmuir model = q_A

$$q = q_A + q_B = \frac{q_{sat,A}\, b_A\, p}{1 + b_A\, p} + \frac{q_{sat,B}\, b_B\, p}{1 + b_B\, p}$$

Where A and B are two distinct adsorption sites, q is the amount of gas adsorbed (mmol/g), p is the pressure (bar), $q_{sat,i}$ is the saturation capacity (mmol/g), b_i is the dual-site Langmuir parameter (bar^{-1}).

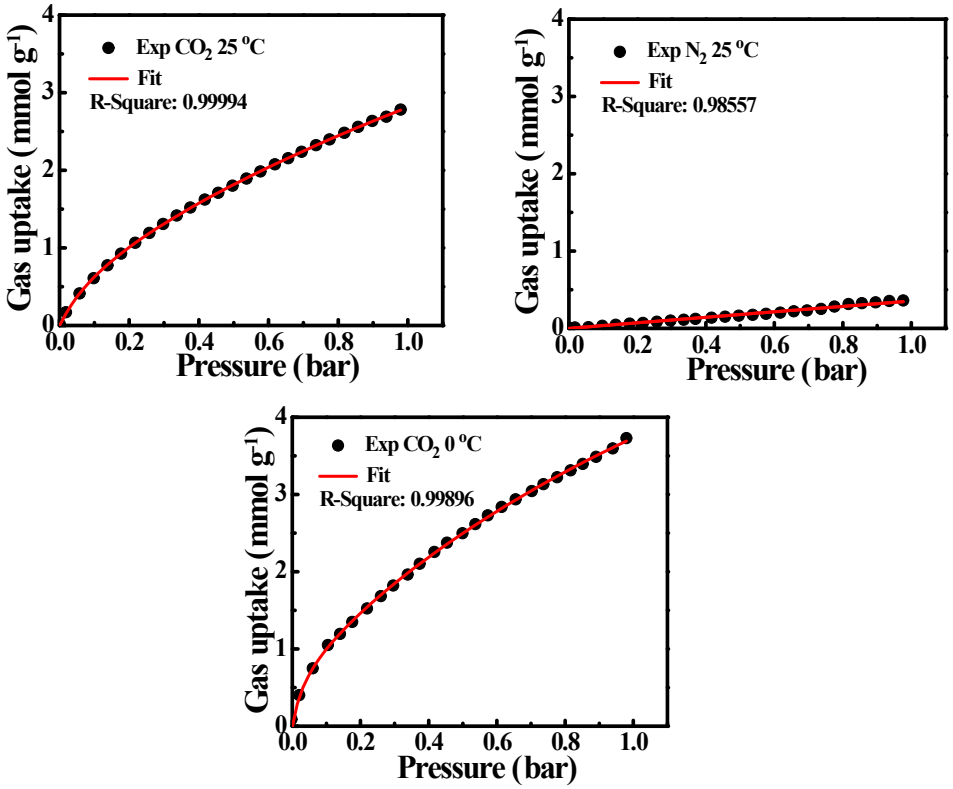

Fig. S3 CO_2 and N_2 gas adsorption isotherms for WPC-3 (black dot). The red lines correspond to DL and L equation fits.

The ideal adsorption solution theory (IAST) of developed by Myers and Prausnitz has been reported to predict binary gas mixture adsorption on porous materials.[S4-S6] Adsorption selectivity (S_{ads}) for binary mixtures is defined as following:

$$S_{ads} = [q_1/q_2] / [p_1/p_2]$$

Where S_{ads} is the selectivity factor, q_i is the amount adsorbed at partial pressure p_i of the gas i in the binary mixture. Generally, to estimate the CO_2/N_2selectivity, partial pressures of CO_2 and N_2 are taken as 0.15 and 0.85, respectively, which is a typical composition of flue gas.

The isosteric heat of adsorption (Qst) calculation

Isosteric heat of adsorption (Qst) is the standard enthalpy of adsorption at a fixed surface coverage. The Qst of CO_2 adsorption on the WNPC-3 was calculated at two different temperatures (0 ºC and 25 ºC) considering the same adsorbed amount obtained at two different pressures using a modified version of the Clausius-Clapeyron equation:[S6-S8]

$$\ln (P_1/P_2) = \Delta H_{ads} \left(\frac{T_2-T_1}{R\cdot T_1\cdot T_2}\right)$$

Where P_1 and P_2 are the pressures, for the same of CO_2 adsorbed amount, at different temperatures of T_1 and T_2, respectively. ΔH_{ads} gives the isosteric heat of adsorption.

Table S1 The comparison of CO_2 uptake and CO_2/N_2 selectivity for **WNPC-3 in this work** with several other reported porous carbons.

Sample	CO_2 uptake (mmol·g^{-1})		CO_2/N_2 selectivity (25 ºC)		Reference
	0 ºC	25 ºC	Initial slope[a]	IAST[b]	
aC-AO1	4.237	2.489	22.4	-----	[S7]
NPCs-2-500	4.0	2.5	-----	21.5	[S9]
H-NMC-2.5	-----	2.8	37	-----	[S10]
STC-2.5	2.3	1.3	17	-----	[S11]
4 AN	3.37	2.4	14	-----	[S12]
N-TC-EMC	-----	4.0	14	-----	[S13]
NC-800	2.65	1.95	-----	-----	[S14]
700[c]	-----	3.51	-----	79	[S15]
SU-MAC-600	-----	4.18	32	-----	[S16]
500-2	4.8	3.5	-----	41.6	[S17]
AC-PAIN-F	-----	2.69	-----	18.97	[S18]
WNPC-3	**3.72**	**2.78**	**23**	**16**	**This work**

[a] Selectivity was calculated from initial slope calculations at 25 ºC;

[c] Selectivity was calculated from IAST for 15/85 gas mixtures for CO_2/N_2 at 25 ºC.

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