

Electronic Supporting Information

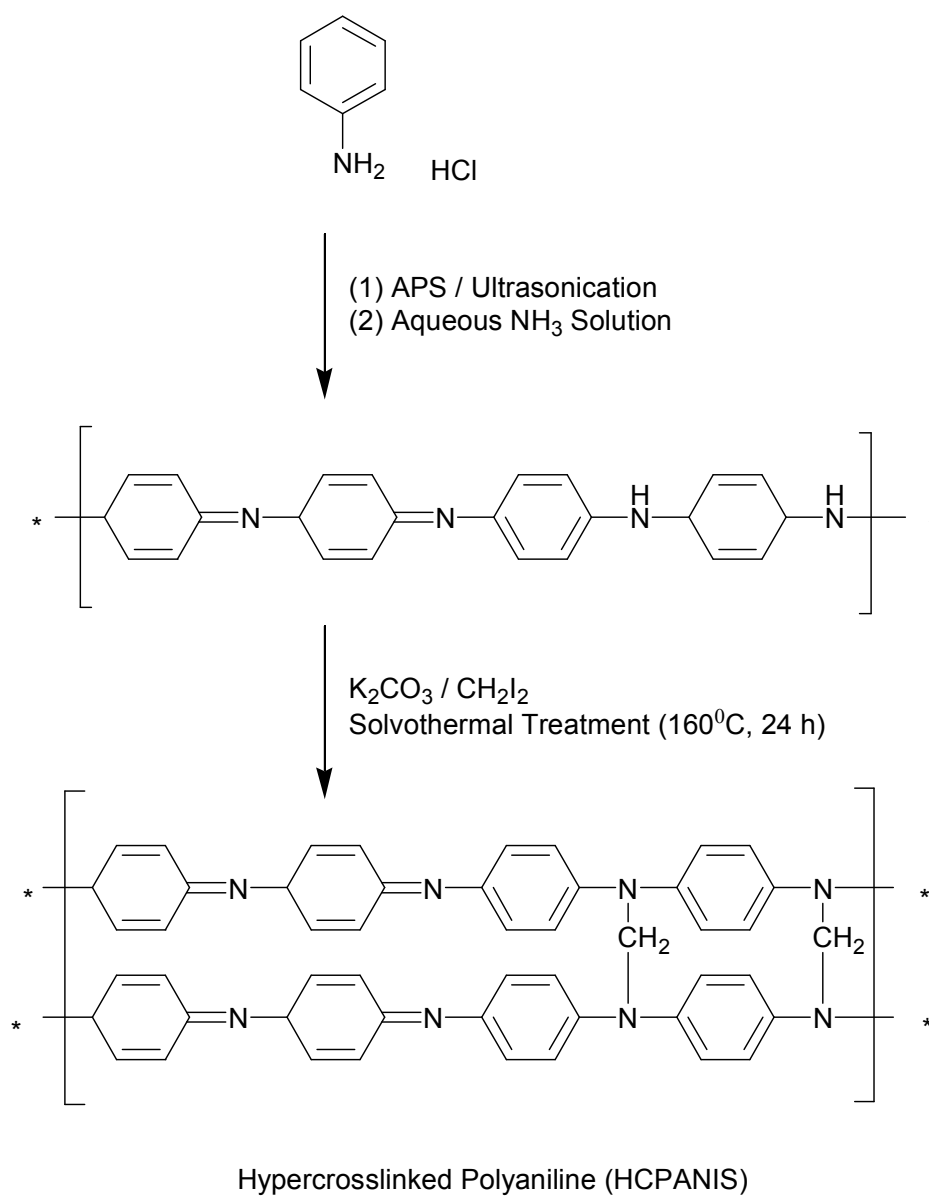
**Solvothermally Synthesized Nanoporous Hypercrosslinked Polyaniline:
Studies of the Gas Sorption and Charge Storage Behavior**

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Scheme S1. Reaction scheme for the synthesis of HCPANIS.

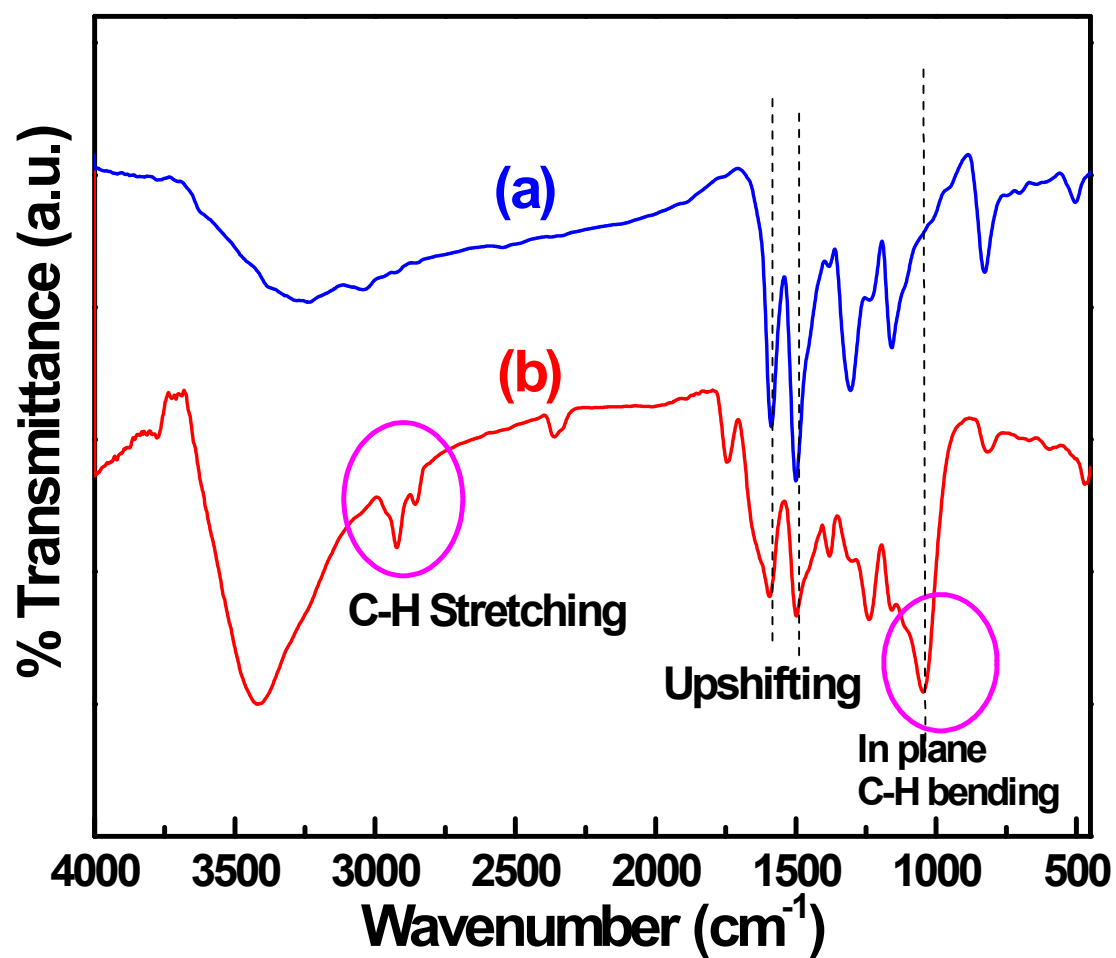


Fig. S1 FTIR spectra of (a) EBPANI and (b) HCPANIS-1 mL-160°C.

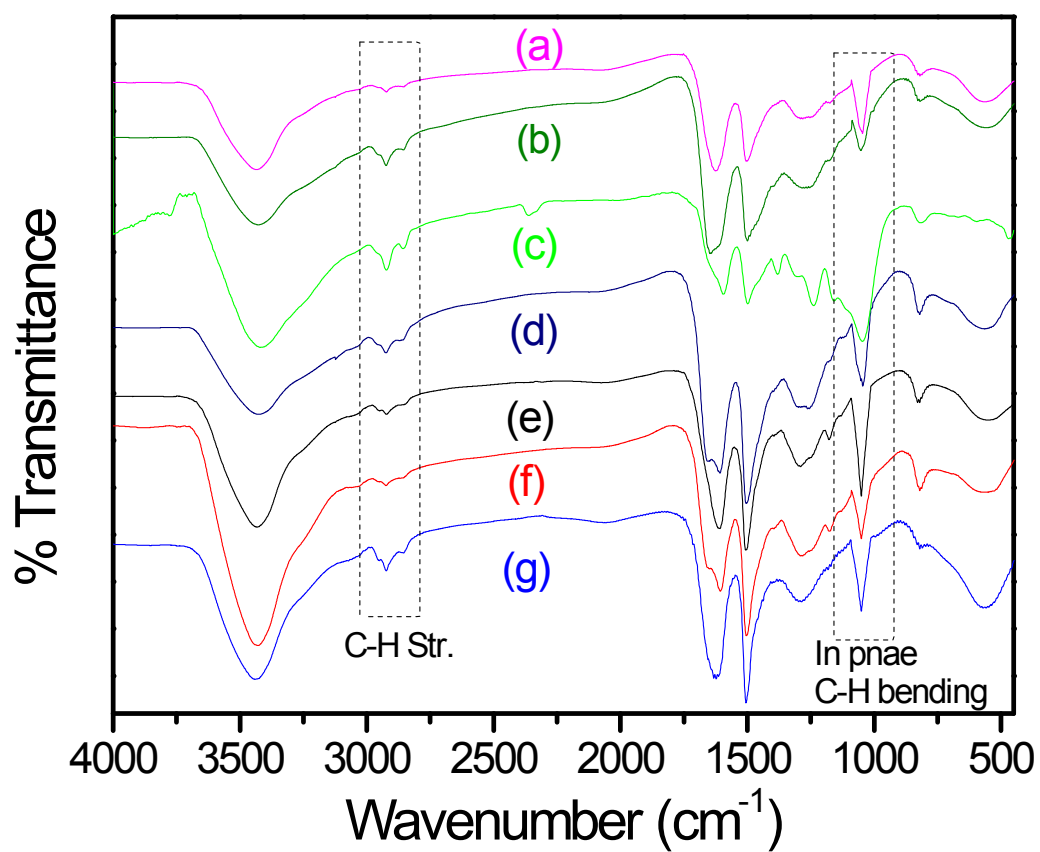


Fig. S2 FTIR spectra of (a) HCPANIS-1mL-120°C, (b) HCPANIS-1mL-140°C, (c) HCPANIS-1mL-160°C (d) HCPANIS-1mL-180°C, (e) HCPANIS-0.5mL-160°C (f) HCPANIS-2mL-160°C and (g) HCPANIS-3mL-160°C.

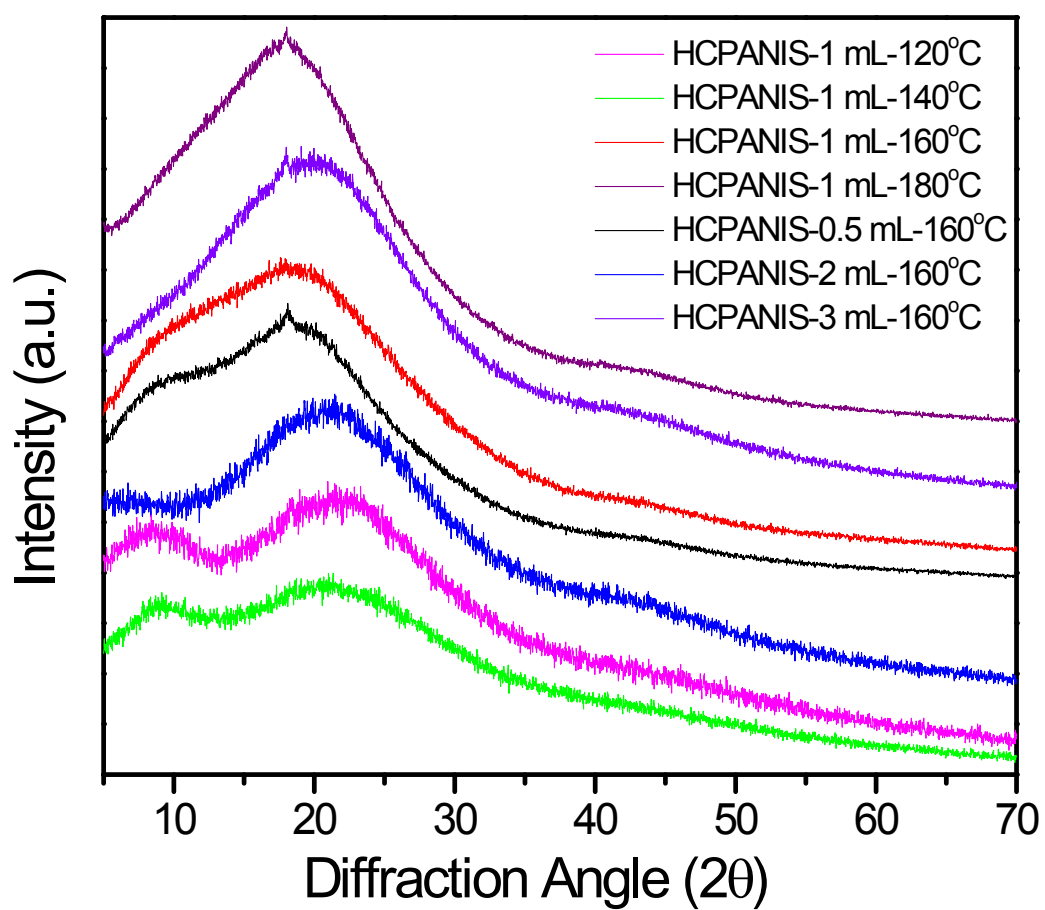


Fig. S3 XRD patterns of HCPANISs.

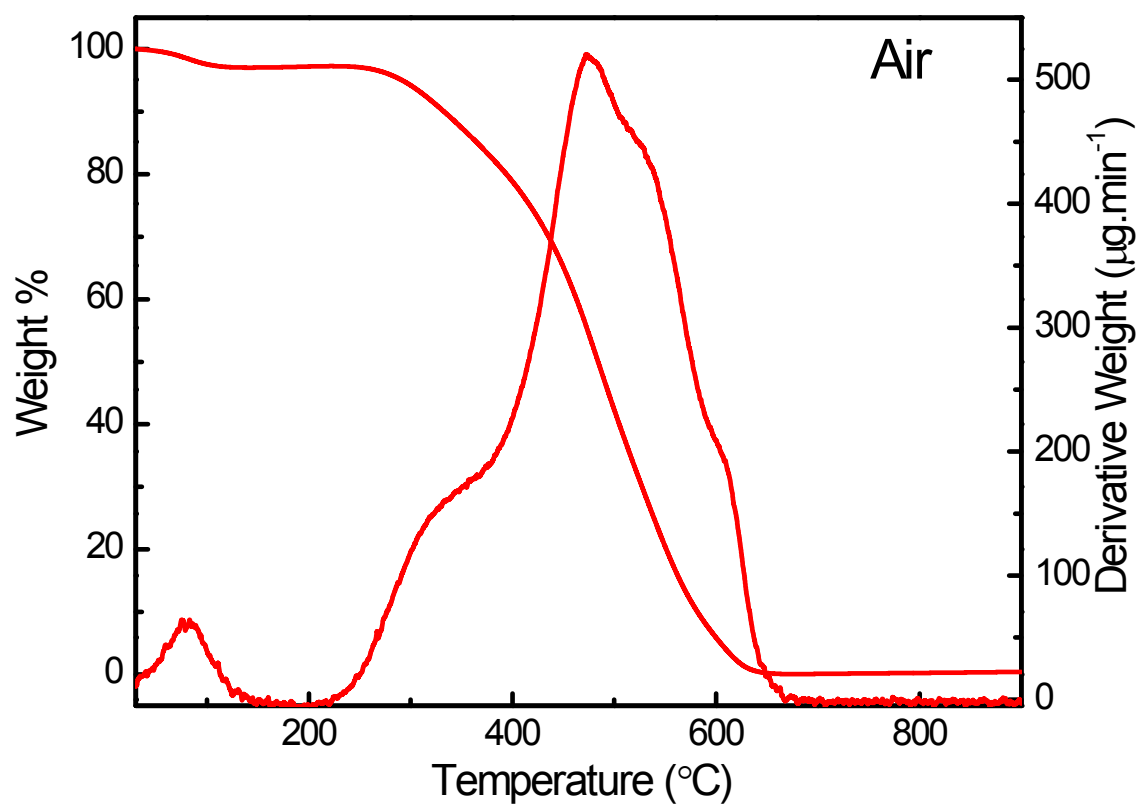


Fig. S4 TGA/DTG thermograms of HCPANIS-1 mL-160°C in air with heating rate of 10°C min⁻¹.

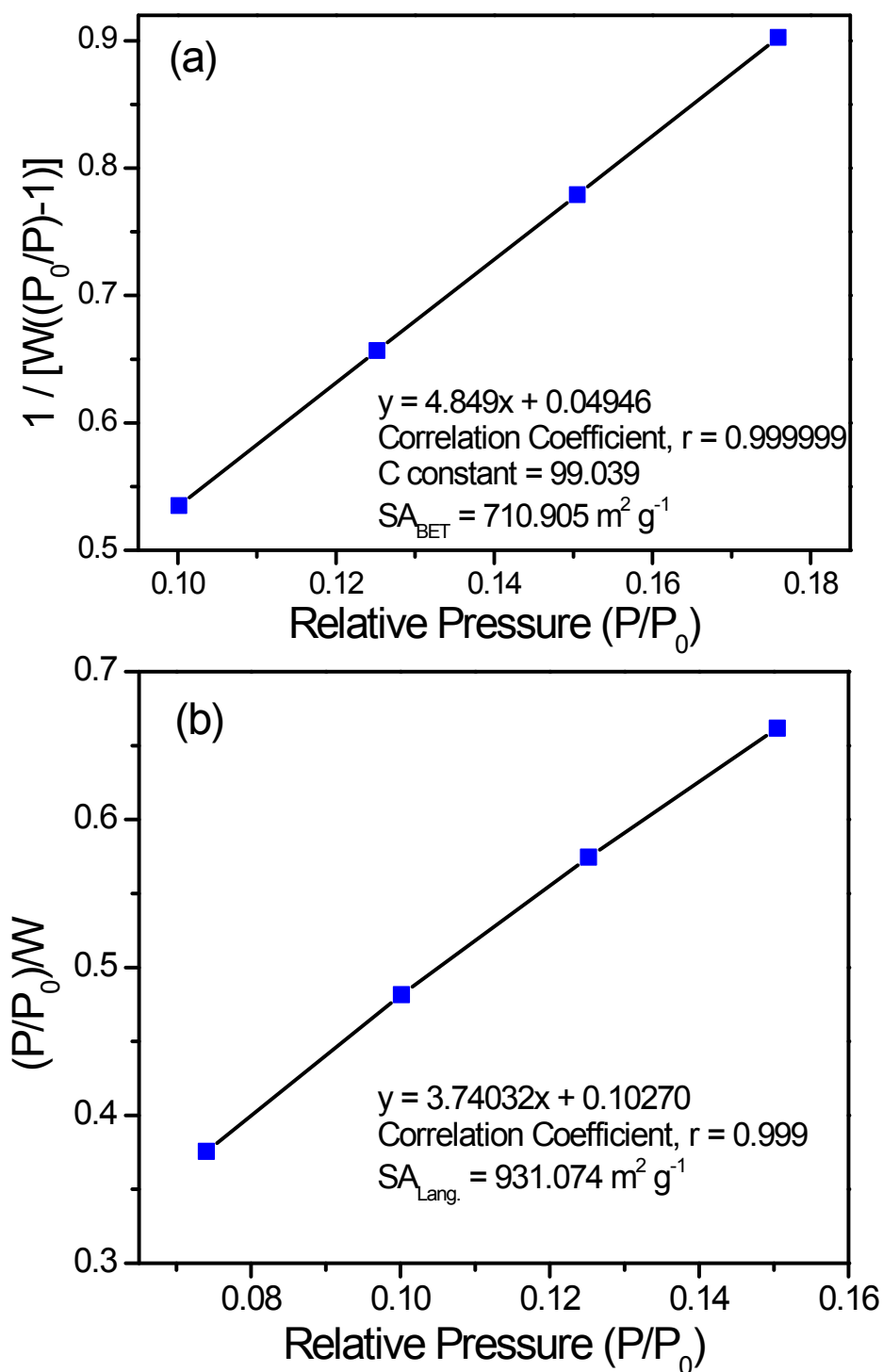


Fig. S5 Multi point (a) BET and (b) Langmuir plots of HCPANIS-1mL-160°C, calculated from N₂ sorption isotherm measured at -196°C.

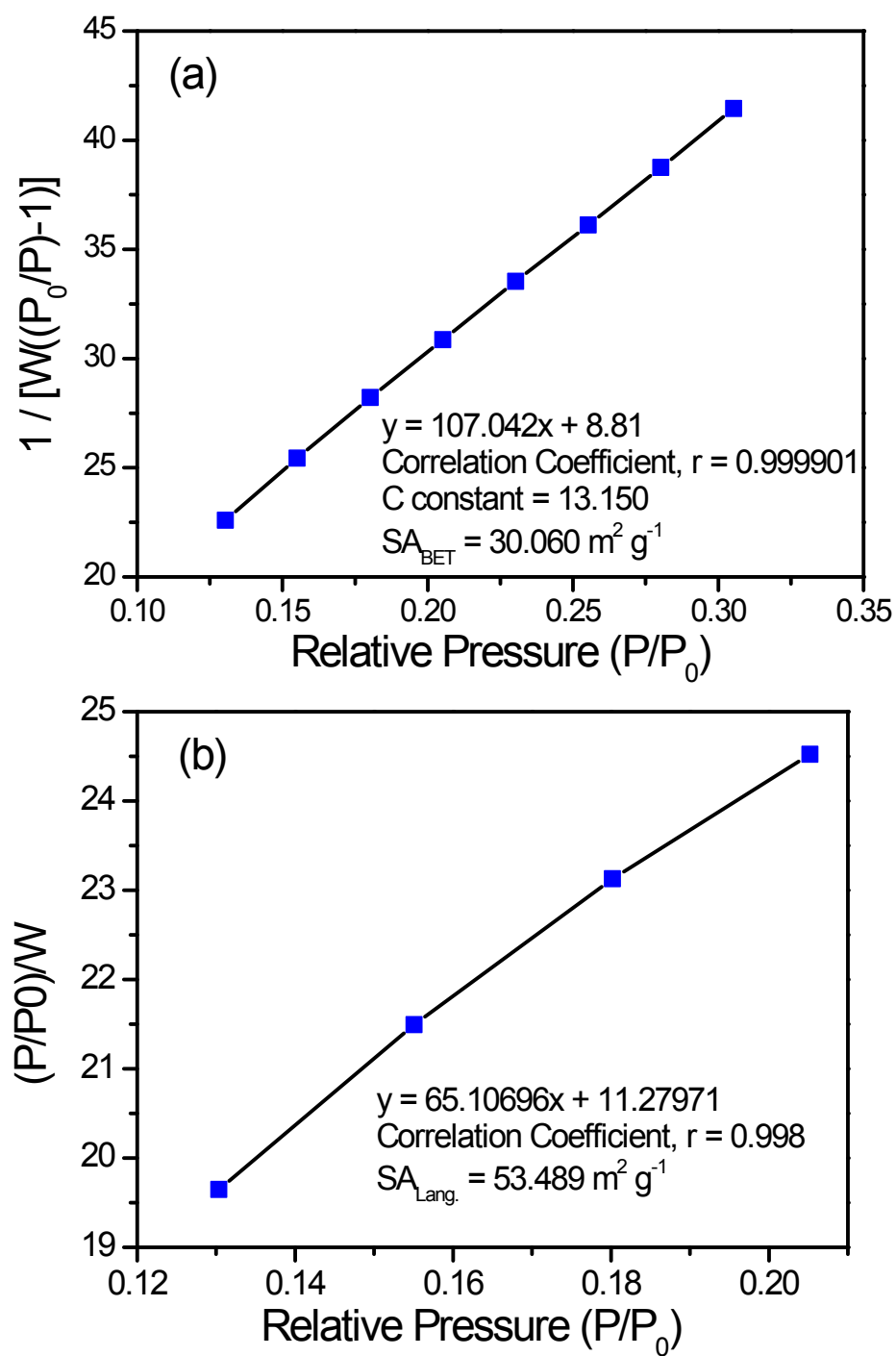


Fig. S6 Multi point (a) BET and (b) Langmuir plots of HCPANIS-1mL-120°C, calculated from N_2 sorption isotherm measured at -196°C.

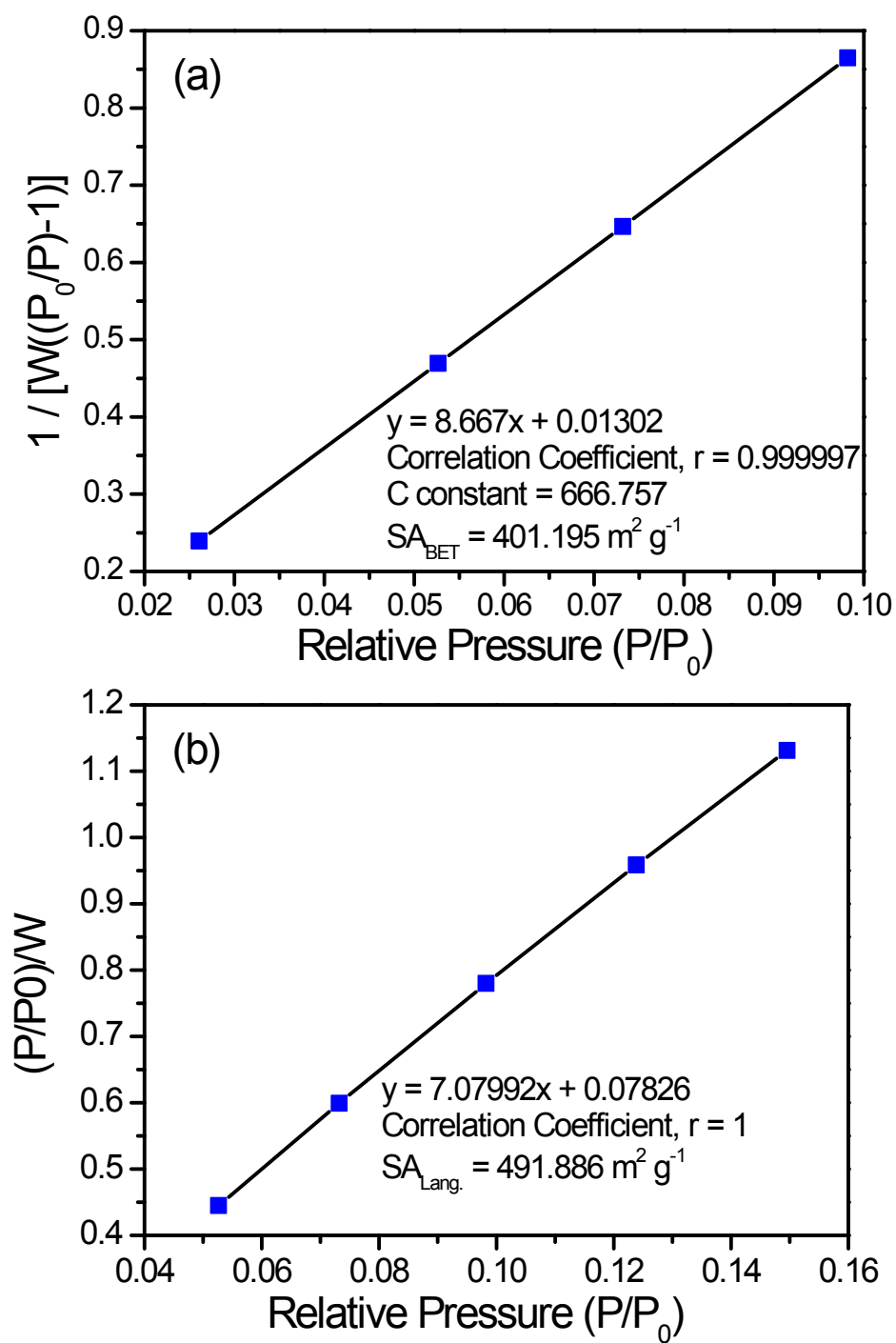


Fig. S7 Multi point (a) BET and (b) Langmuir plots of HCPANIS-1mL-140°C, calculated from N_2 sorption isotherm measured at -196°C.

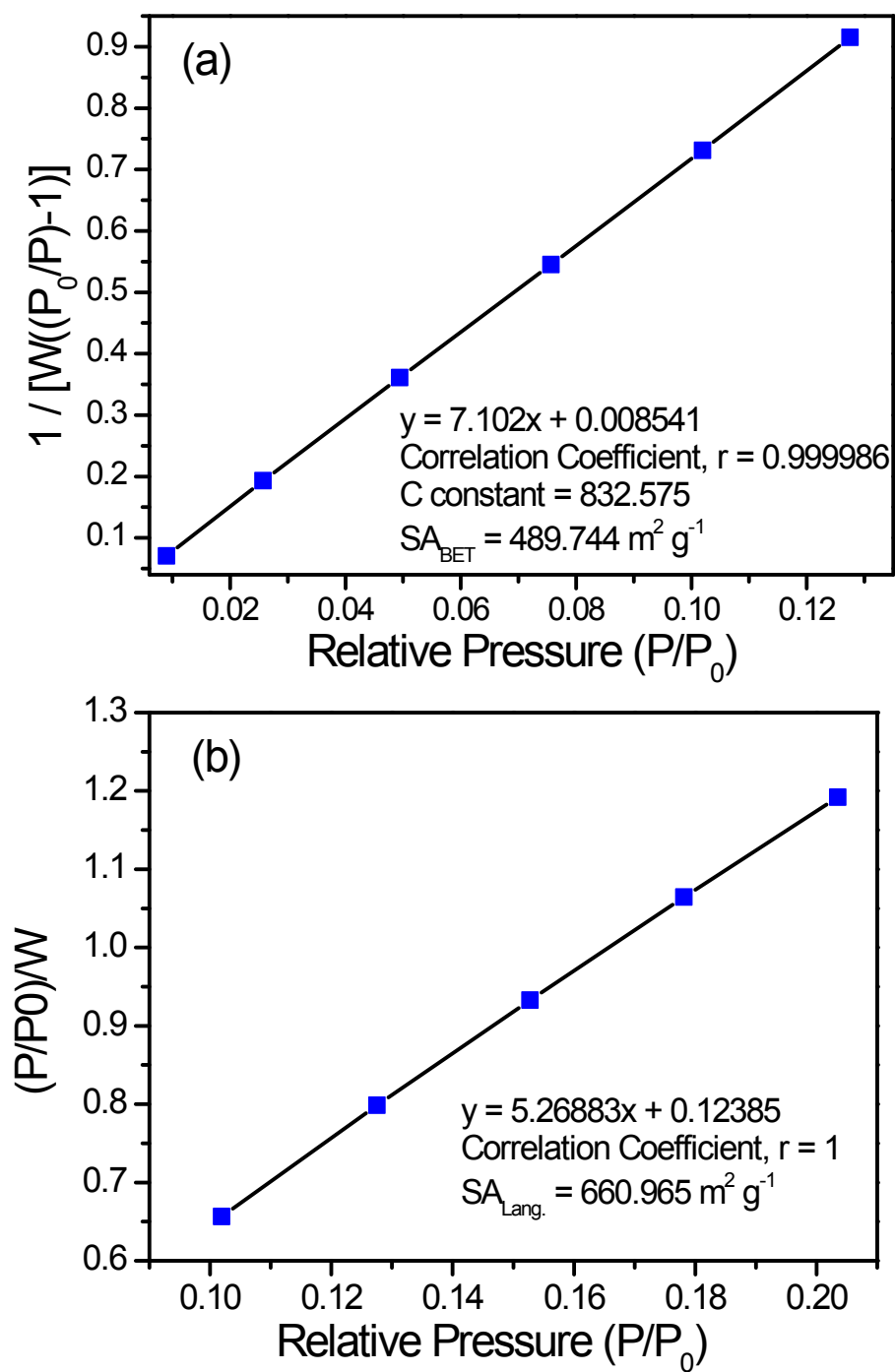


Fig. S8 Multi point (a) BET and (b) Langmuir plots of HCPANIS-1mL-180°C, calculated from N_2 sorption isotherm measured at -196°C.

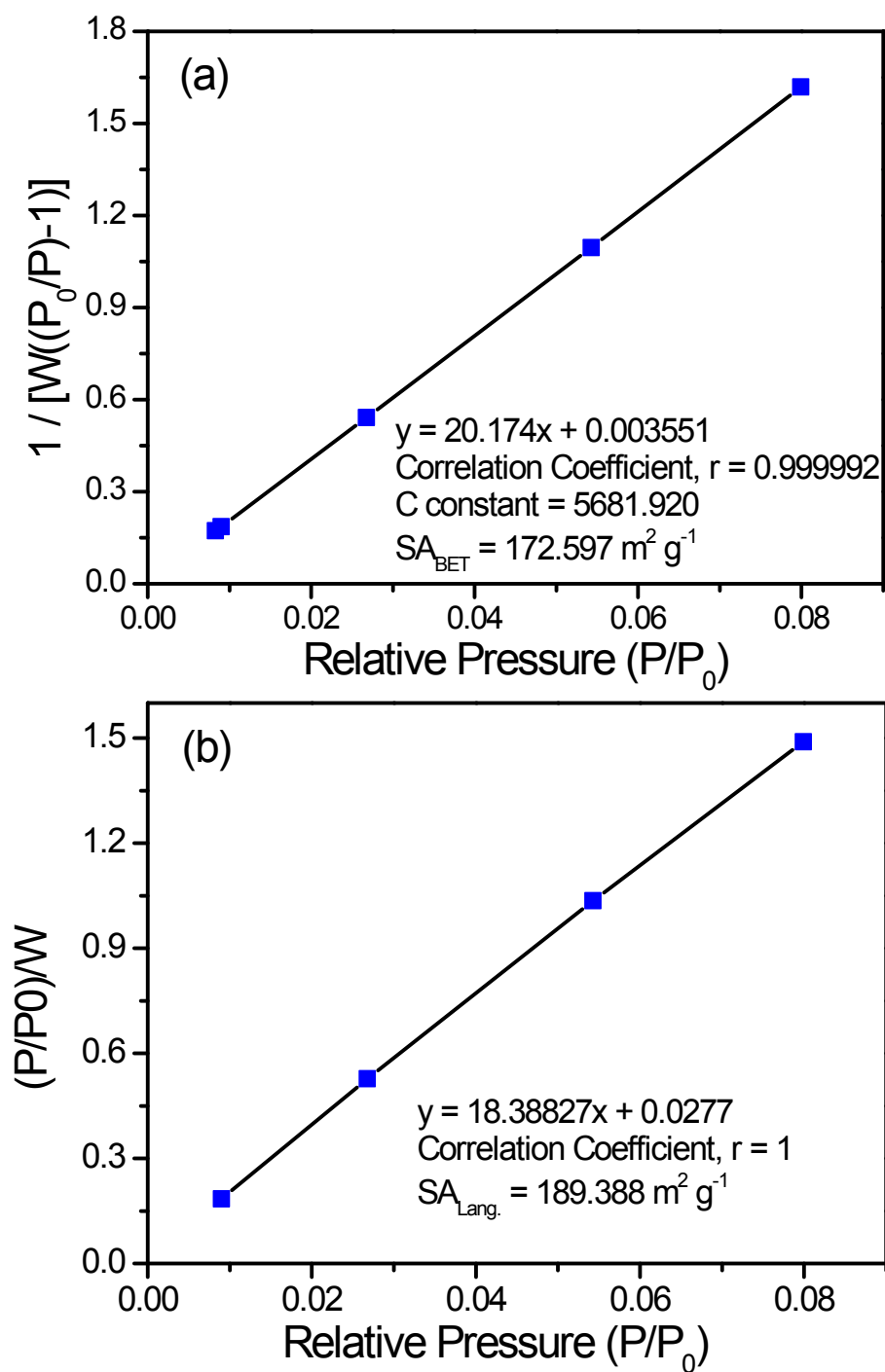


Fig. S9 Multi point (a) BET and (b) Langmuir plots of HCPANIS-0.5mL-160°C, calculated from N_2 sorption isotherm measured at -196°C.

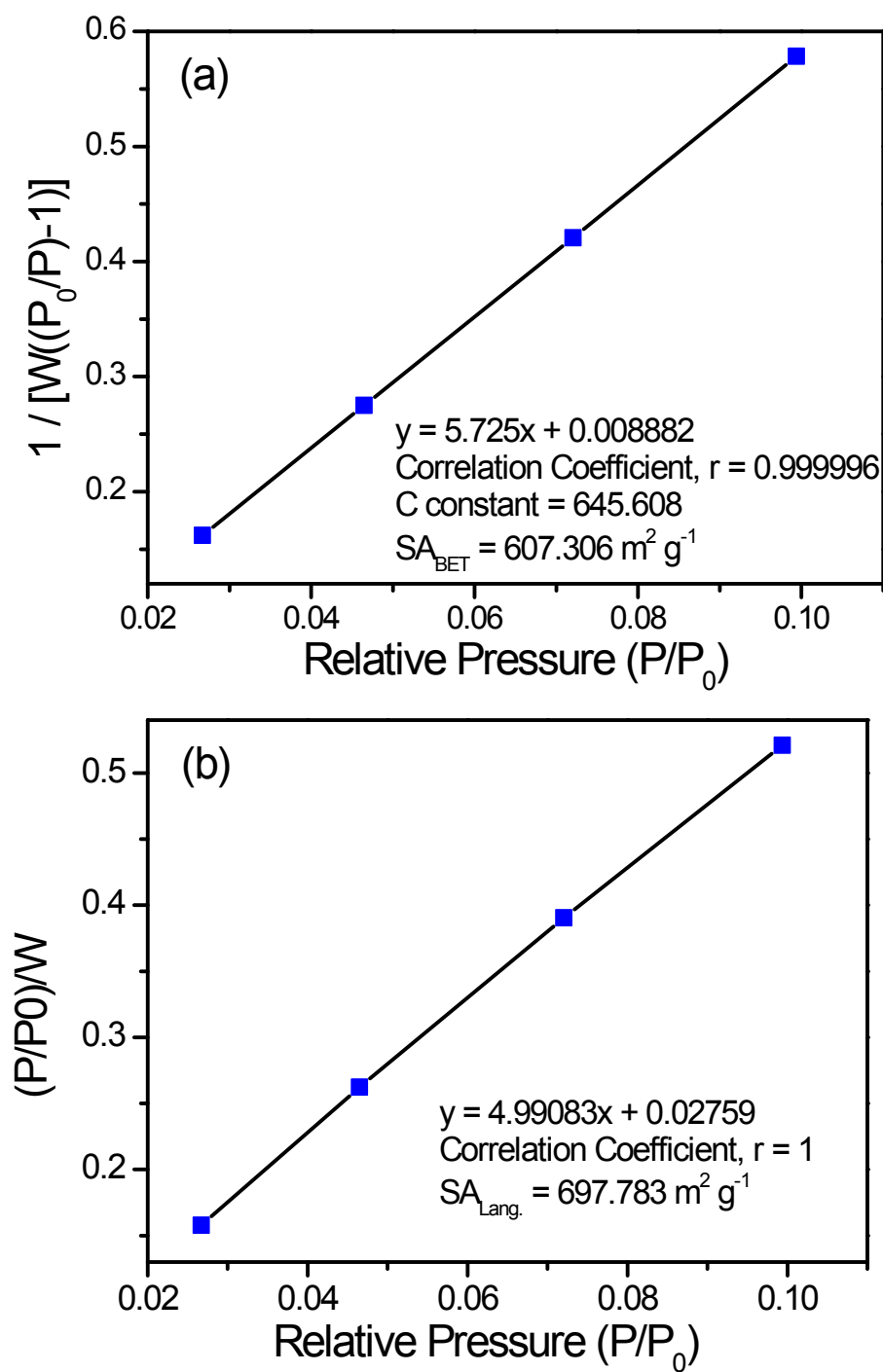


Fig. S10 Multi point (a) BET and (b) Langmuir plots of HCPANIS-2mL-160°C, calculated from N_2 sorption isotherm measured at -196°C.

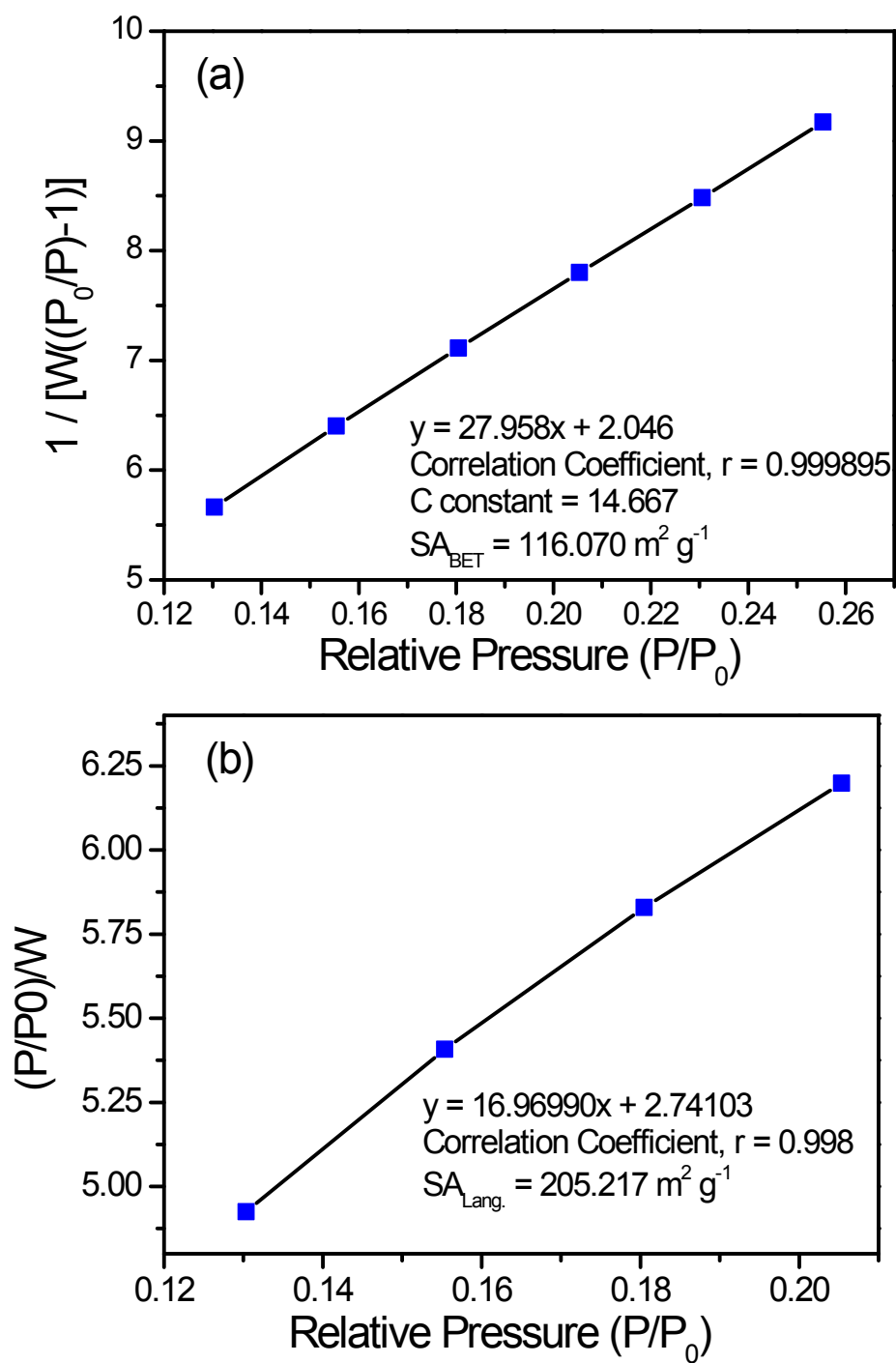


Fig. S11 Multi point (a) BET and (b) Langmuir plots of HCPANIS-3mL-160°C, calculated from N_2 sorption isotherm measured at -196°C.

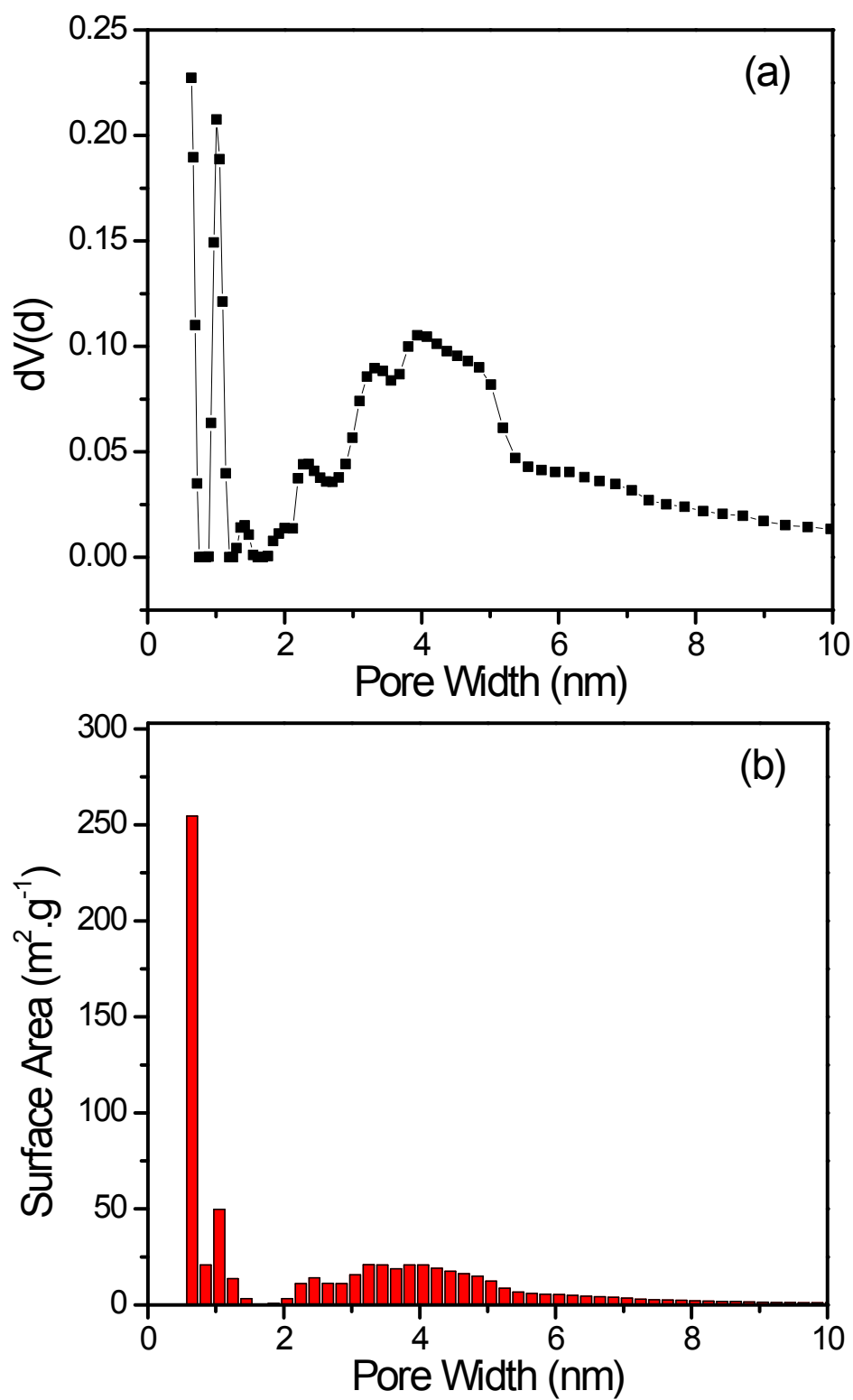


Fig. S12 (a) Pore size distribution and (b) surface area histogram of HCPANIS-1mL-160°C using DFT method (slit/cylindr. pores, QSDFT adsorption branch). (**Fitting Error: 0.252%**)

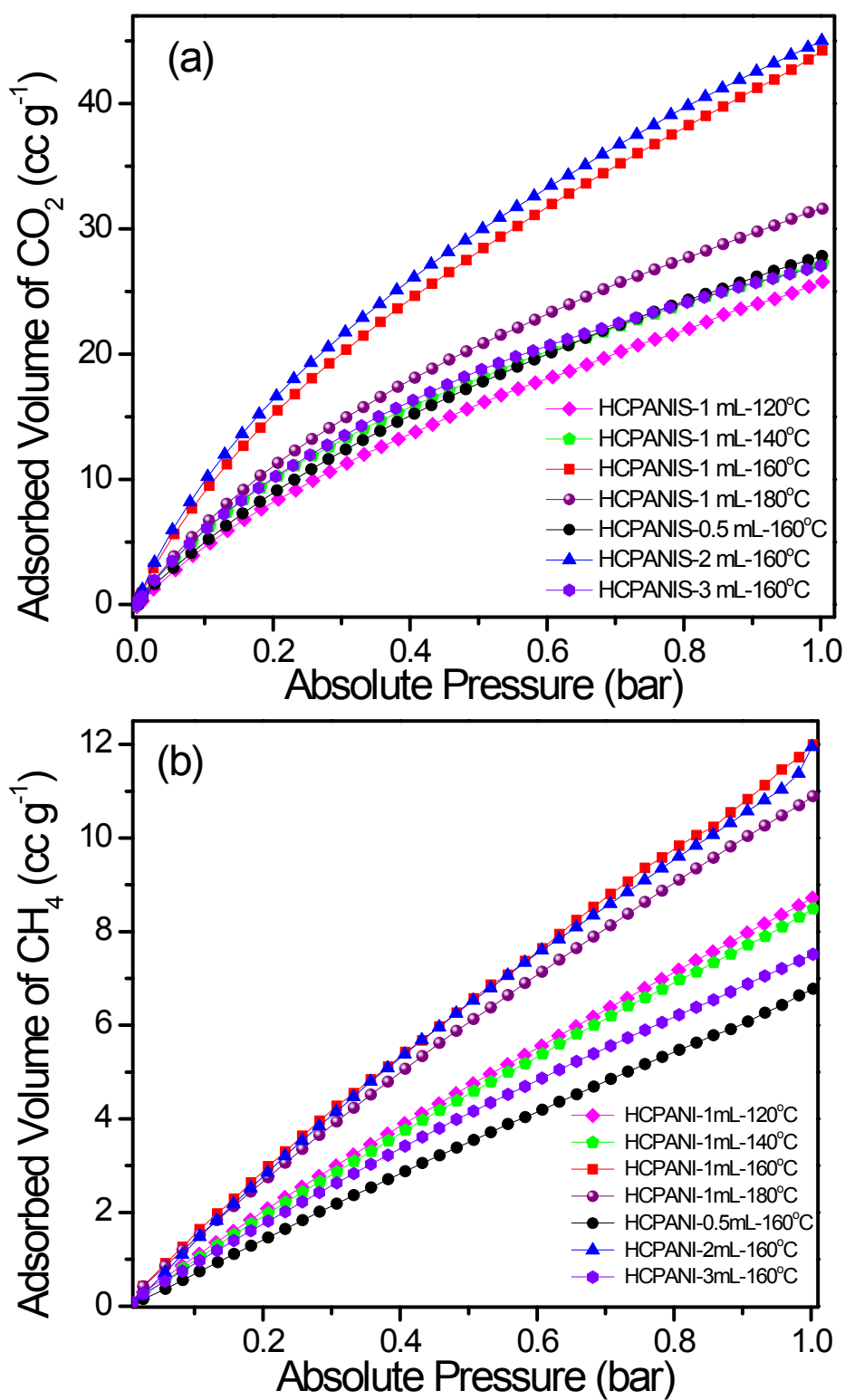


Fig. S13 (a) CO_2 and (b) CH_4 adsorption isotherms of HCPANISs measured at 25°C.

Table S1. CO₂ uptake capacities reported so far for organic framework polymers.

Material	SA _{BET} (m ² g ⁻¹)	CO ₂ uptake (wt%) at 0°C	Wt % CO ₂ Uptake per m ² SA _{BET}	Ref.
azo-POF-2	755	8.4	0.011	S1
BIPLP-1	1580	9.9	0.0063	S2
NPOF-4	1249	11.0	0.0088	S3
SMPs-6a	879	13.7	0.016	S4
box-COP-93	606	13.9	0.023	S5
P-2	1222	14.5	0.012	S6
PECONF-3	851	15.3	0.018	S7
HCPANI	1059	15.5	0.015	S8
BILP-1	1172	18.8	0.016	S9
CPOP-1	2220	21.2	0.009	S10
PPF-1	1740	26.7	0.015	S11
HCPANIS-1 mL-160°C	711	14.7	0.021	This work

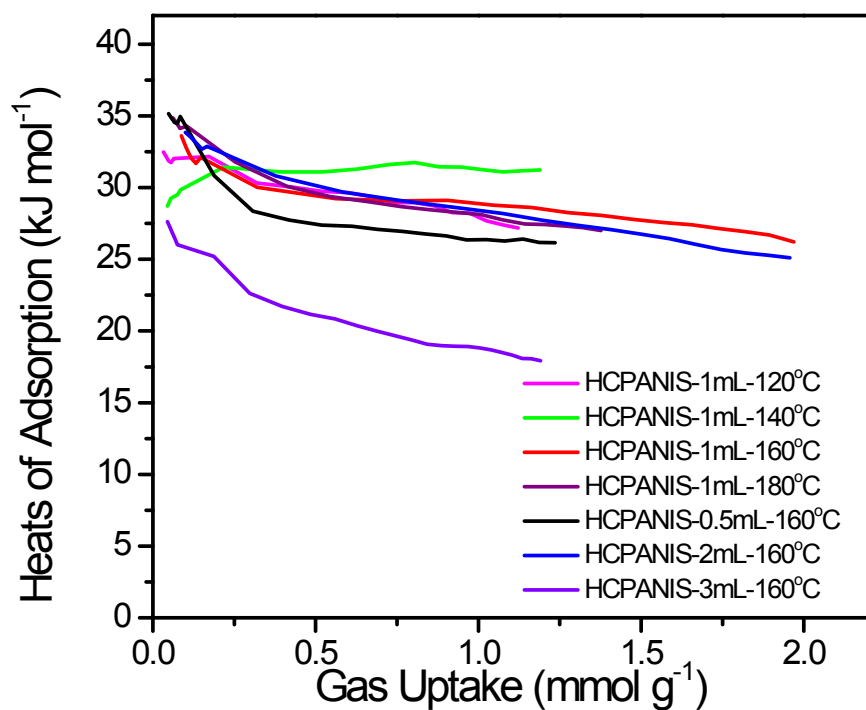


Fig. S14 Isosteric heats of adsorption of HCPANISs for CO₂ adsorption, calculated at 0°C and 25°C.

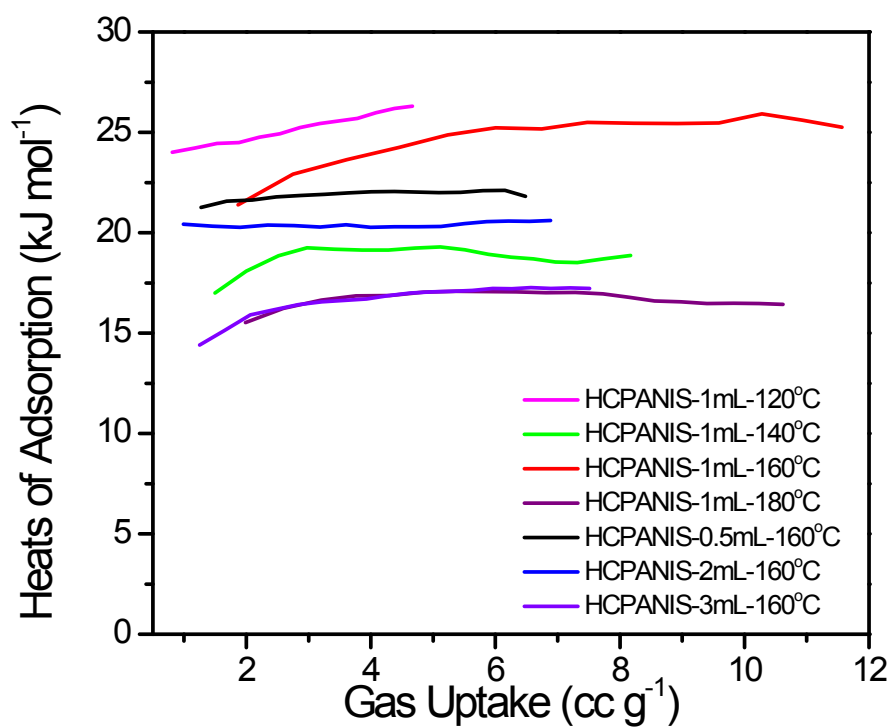


Fig. S15 Isosteric heats of adsorption of HCPANISs for CH₄ adsorption, calculated at 0°C and 25°C.

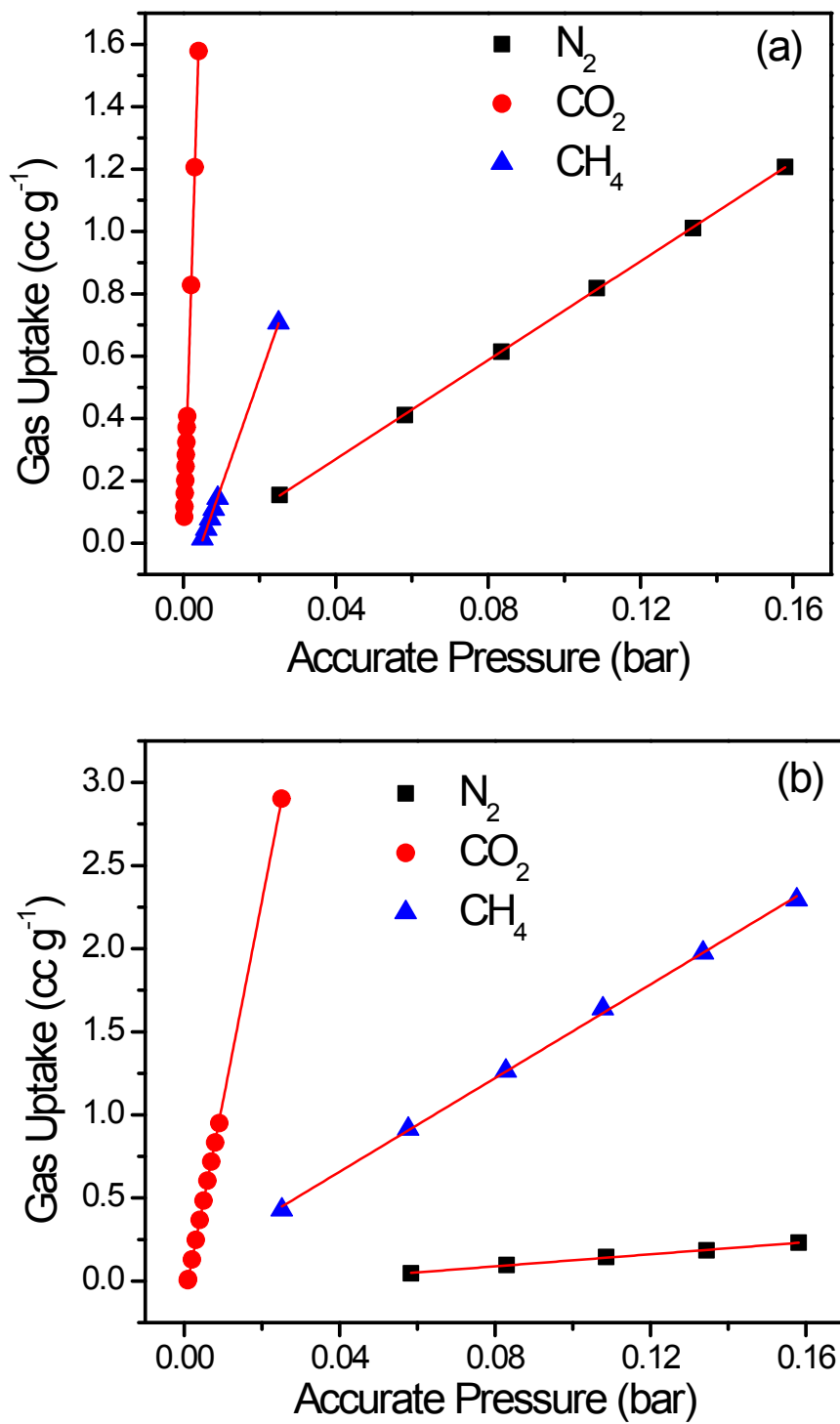


Fig. S16 Gas selectivity of HCPANIS-1mL-160°C at (a) 0°C and (b) 25°C.

Table S2. H₂ storage capacities reported so far for organic framework polymers.

Material	SA _{BET} (m ² g ⁻¹)	H ₂ storage capacity (wt%) at -196°C	Wt % H ₂ Uptake per m ² SA _{BET}	Ref.
Polyaniline	255	0.92	0.0036	S12
Hypercrosslinked Polyaniline	630	0.96	0.0015	S13
P-1	611	1.05	0.0017	S6
MPN-6	1299	1.29	0.0010	S14
SMPs-6a	879	1.37	0.0016	S4
PPN-1	1249	1.37	0.0010	S15
CMP-0	1018	1.38	0.0013	S16
OFP-3	1159	1.56	0.0013	S17
Trip-PIM	1064	1.65	0.0015	S18
PPF-1	1740	2.75	0.0016	S11
CPOP-1	2220	2.80	0.0013	S10
HCPANI	1059	1.85	0.0017	S8
HCPANIS-2 mL-160°C	607	1.20	0.0020	This work

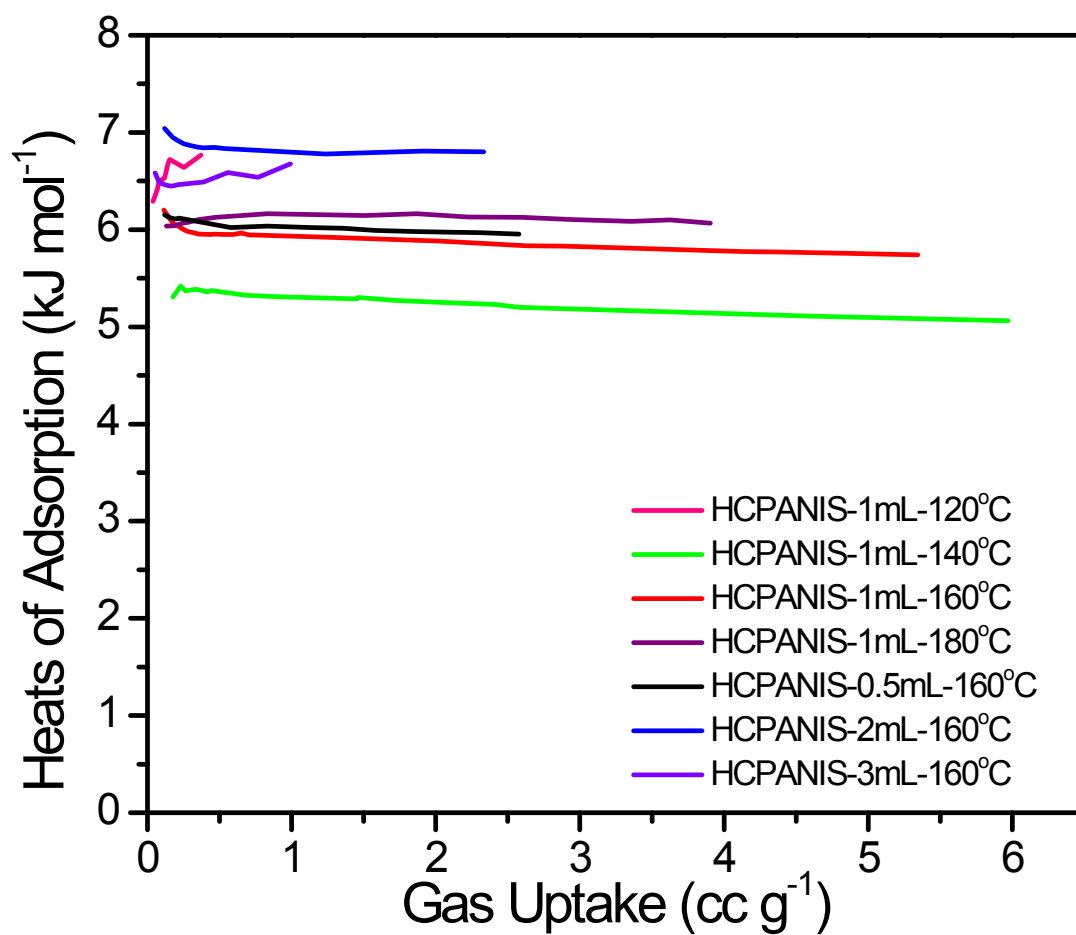


Fig. S17 Isosteric heats of adsorption of HCPANISs for H₂ adsorption calculated at -196°C and -5°C.

Table S3. Cyclic voltammetry analysis

Scan rate (mV s ⁻¹)	Specific capacitance (F g ⁻¹)	Energy density (Wh kg ⁻¹)	Power density (kW kg ⁻¹)
3	580	65.25	0.78
5	510	57.38	1.15
10	435	48.94	1.96
20	381	42.86	3.43
30	326	36.68	4.40
50	300	33.75	6.75
80	277	31.16	9.97
100	267	30.04	12.02

Table S4. Constant current charge discharge analysis

Current density (A g ⁻¹)	Specific capacitance (F g ⁻¹)	Energy density (Wh kg ⁻¹)	Power density (kW kg ⁻¹)
2	564	63.45	0.90
5	479	53.89	2.25
8	378	42.52	3.60
10	346	38.92	4.50

References

- [S1] J. Lu and J. Zhang, *J. Mater. Chem. A*, 2014, **2**, 13831-13834.
- [S2] P. Arab, A. Verlander and H. M. El-Kaderi, *J. Phys. Chem. C*, 2015, **119**, 8174-8182.
- [S3] T. Islamoglu, M. G. Rabbani and H. M. El-Kaderi, *J. Mater. Chem. A*, 2013, **1**, 10259-10266.
- [S4] B. Li, Z. Guan, X. Yang, W. D. Wang, W. Wang, I. Hussain, K. Song, B. Tan and T. Li, *J. Mater. Chem. A*, 2014, **2**, 11930-11939.
- [S5] H. A. Patel, D. Ko and C. T. Yavuz, *Chem. Mater.*, 2014, **26**, 6729-6733.
- [S6] S. Qiao, Z. Du, and R. Yang, *J. Mater. Chem. A*, 2014, **2**, 1877-1885.
- [S7] P. Mohanty, L. D. Kull and K. Landskron, *Nat. Commun.*, 2011, **2**, 401, DOI: 10.1038/ncomms1405.
- [S8] V. Sharma, A. Sahoo, Y. Sharma and P. Mohanty, *RSC Adv.*, 2015, **5**, 45749-45754.
- [S9] M. G. Rabbani and H. M. El-Kaderi, *Chem. Mater.*, 2011, **23**, 1650-1653.
- [S10] Q. Chen, M. Luo, P. Hammershoj, D. Zhou, Y. Han, B. W. Laursen, C. G. Yan and B. H. Han, *J. Am. Chem. Soc.*, 2012, **134**, 6084-6087.
- [S11] Y. Zhu, H. Long and W. Zhang, *Chem. Mater.*, 2013, **25**, 1630-1635.
- [S12] J. Germain, F. Svec and J. M. J. Frechet, *Chem. Mater.*, 2008, **20**, 7069-7076.
- [S13] J. Germain, J. M. J. Frechet and F. Svec, *J. Mater. Chem.*, 2007, **17**, 4989-4997.
- [S14] B. Li, X. Huang, L. Liang and B. Tan, *J. Mater. Chem.*, 2010, **20**, 7444-7450.

- [S15] W. Lu, D. Yuan, D. Zhao, C. I. Schilling, O. Plietzsch, T. Muller, S. Brase, J. Guenther, J. Blumel, R. Krishna, Z. Li and H. C. Zhou, *Chem. Mater.*, 2010, **22**, 5964-5972.
- [S16] J. X. Jiang, F. Su, A. Trewin, C. D. Wood, H. Niu, J. T. A. Jones, Y. Z. Khimyak and A. I. Cooper, *J. Am. Chem. Soc.*, 2008, **130**, 7710-7720.
- [S17] S. Makhseed and J. Samuel, *Chem. Commun.*, **2008**, 4342-4344.
- [S18] B. S. Ghanem, N. B. McKeown, K. D. M. Harris, Z. Pan, P. M. Budd, A. Butler, J. Selbie, D. Book and A. Walton, *Chem. Commun.*, 2007, 67-69.