Electronic Supplementary Information

Fabrication and Properties of Sn(IV)Porphyrin-Linked Porous Organic Polymer for Environmental Applications

Chang-Ju Lee, Nirmal Kumar Shee, and Hee-Joon Kim*

Department of Chemistry and Bioscience, Kumoh National Institute of Technology, Gumi 39177, Republic of Korea. E-mail: hjk@kumoh.ac.kr

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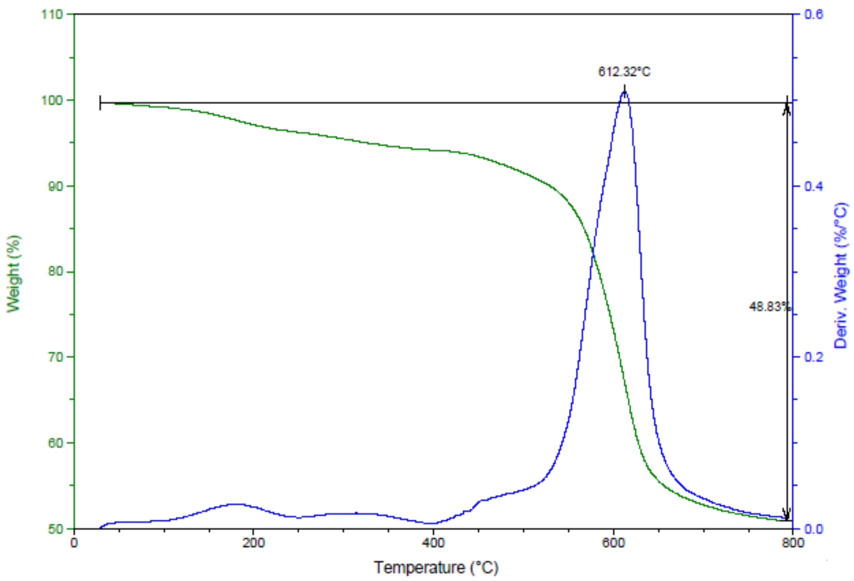

Fig. S1 TGA curves of **SnPOP**.

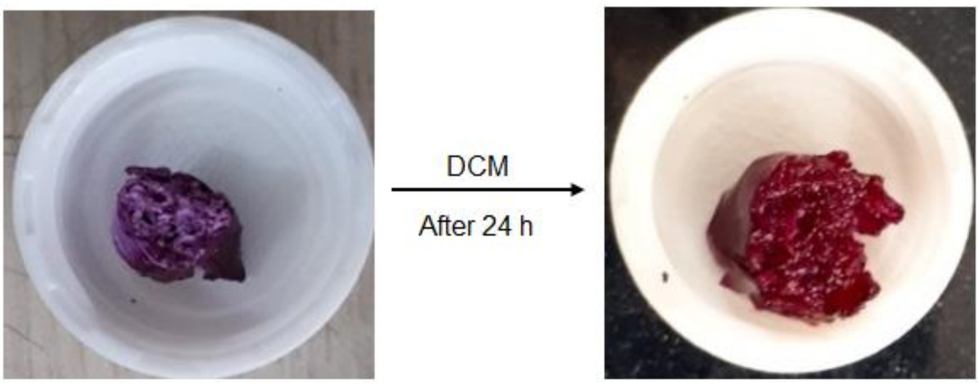

Fig. S2 Photographs of **SnPOP** before and after swelling with dichloromethane (DCM).

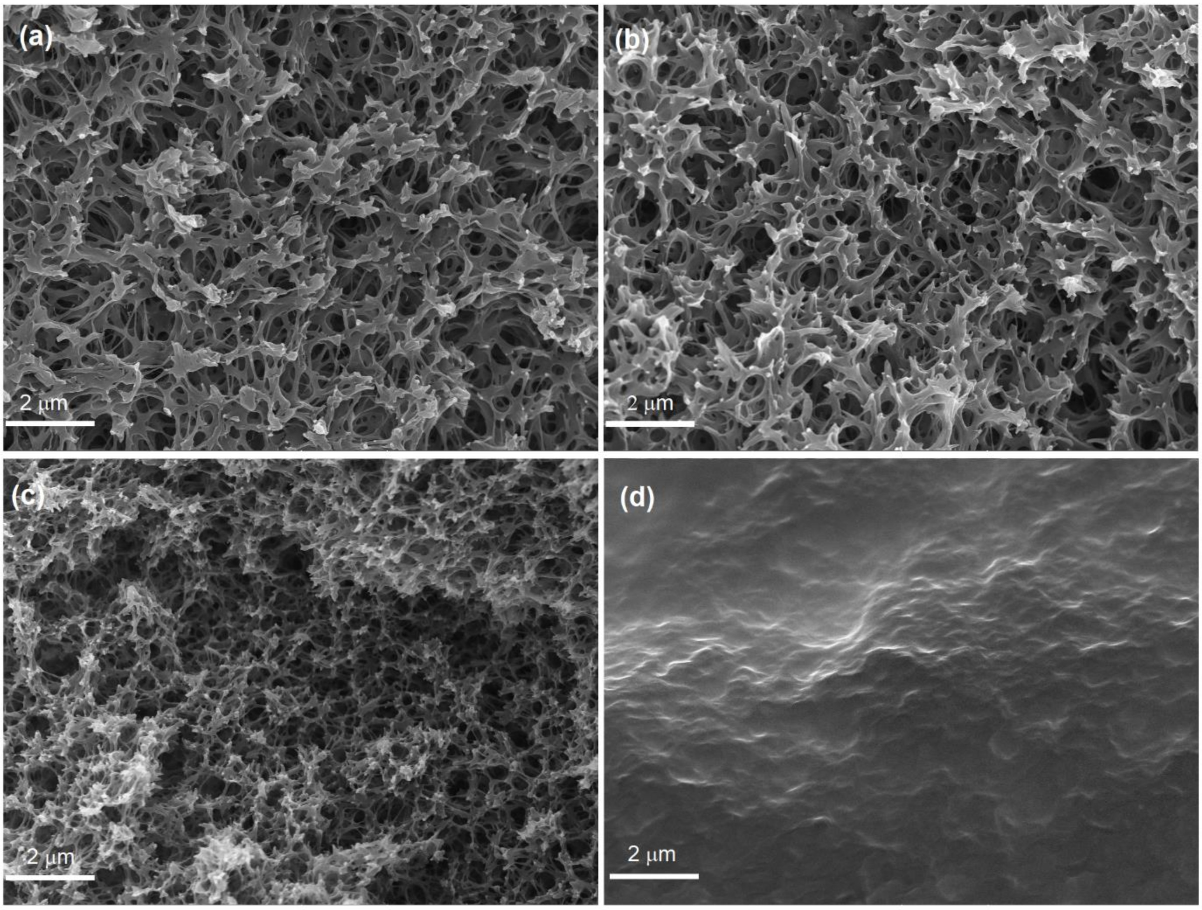

Fig. S3 FE-SEM images of **SnPOP** after treatment with 10 M NaOH solution (a), 10 M HCl solution (b), boiling water (c), and DMF (d).

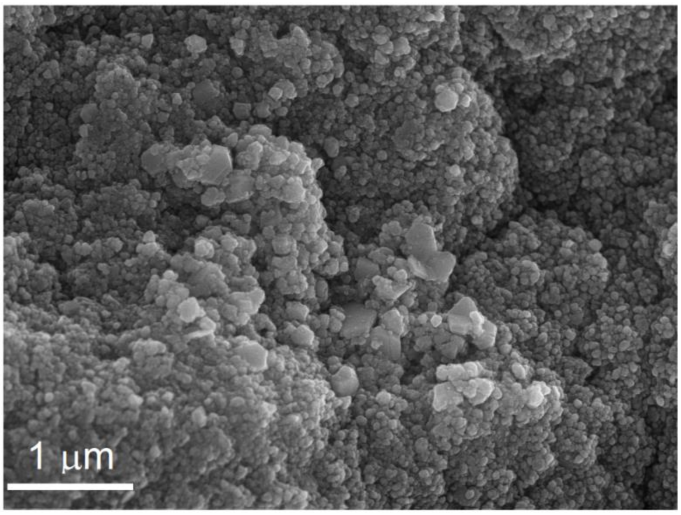

Fig. S4 FE-SEM images for as-prepared Ag nanoparticles on **SnPOP**.

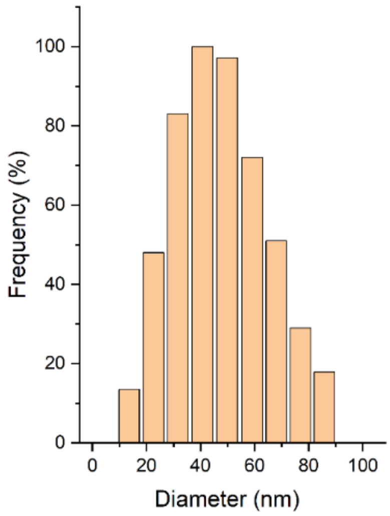

Fig. S5 Histogram of size distribution with an average diameter of 47.2 ± 12.7 nm for Ag nanoparticles.

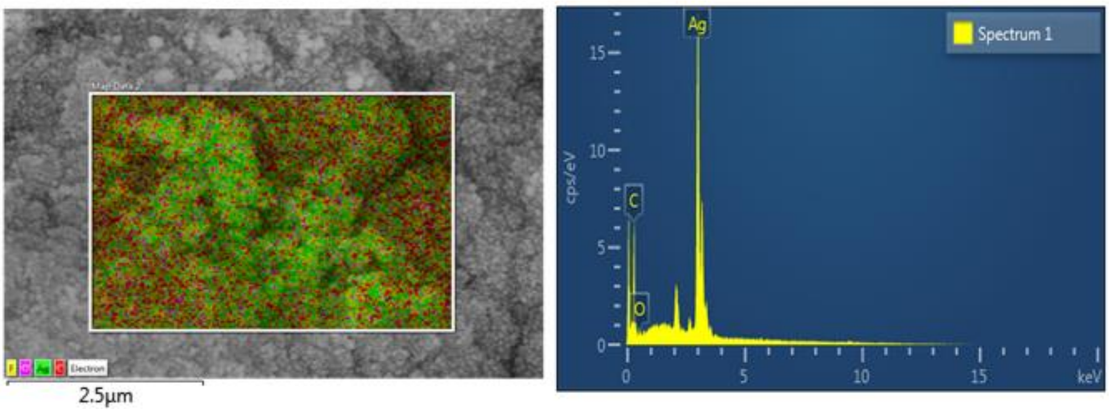

Fig. S6 EDX spectroscopy display the purity and chemical composition of Ag nanoparticles.

Table S1. Comparison of BET surface area, and CO_2 uptake in reported porphyrin-based porous materials.

Adsorbent	BET surface area ($m^2 g^{-1}$)	CO_2 uptake capacity ($cm^3 g^{-1}$) at 273 K	References
Ni-Por-4	778	51	[1]
POP-3	750	46	[2]
CuPor-BPDC	442	28	[3]
MMPF-7	600	55	[4]
HOF-7a	124	18	[5]
$[Et]_{100}$-H_2PCOF	187	21	[6]
$[HC{\equiv}C]_{50}$-H_2PCOF	962	26	[6]
Al-CMP	839	22	[7]
CoP-HOF	98	42	[8]
PBILP	557	62	[9]
PyP	428	18	[10]
MOPA2	420	42	[11]
Ru-BBT-POP	655	58	[12]
HTM	5	40	[13]
HTM-MA	582	94	[13]
POP1-Fe	34	28	[14]
POP2-Fe	33	30	[14]
PP-Br-Zn-0.09	12	16	[15]
ZFs-TCPP-Ni	105	11	[16]
PCN-TCP	757	64	[17]
Co@PCN-TCP	689	70	[17]
SnPOP	227	32	This work

Table S2. Comparison of dye adsorption capacity in reported porphyrin-based porous materials.

Adsorbent	Dye	Adsorption capacity (mg g^{-1})	References
$[Ca(HDCPP)_2(H_2O)_2]_n(DMF)_{1.5\,n}$	MB	952	[18]
MOPA2	MB	315	[11]
PCN-222	MB	112	[19]
LIFM-WZ-3	MB	983	[20]
PCP1	MB	521	[21]
PPOPs-SO_3H	MB	980	[22]
1.5 wt %-TPA	MB	191	[23]
Py-POP	MB	140	[24]
SnPOP	MB	187	This work
PCN-222	MO	128	[19]
1.5 wt %-TPA	MO	16	[23]
PorphCat-Fe MOF	MO	232	[25]
SnPOP	MO	175	This work

References

1. Z. Wang, S. Yuan, A. Mason, B. Reprogle, D.-J. Liu and L. Yu, Nanoporous porphyrin polymers for gas storage and separation, *Macromolecules*, 2012, **45**, 7413–7419.
2. A. Modak, M. Nandi, J. Mondal and A. Bhaumik, Porphyrin based porous organic polymers: Novel synthetic strategy and exceptionally high CO_2 adsorption capacity, *Chem. Commun.*, 2012, **48**, 248–250.
3. V. S. P. K. Neti, X. Wu, S. Deng and L. Echegoyen, Selective CO_2 capture in an imine linked porphyrin porous polymer, *Polym. Chem.*, 2013, **4**, 4566–4569.
4. W.-Y. Gao, Z. Zhang, L. Cash, L. Wojtas, Y.-S. Chen and S. Ma, Two rare indium-based porous metal–metalloporphyrin frameworks exhibiting interesting CO_2 uptake, *CrystEngComm*, 2013, **15**, 9320–9323.
5. W. Yang, B. Li, H. Wang, O. Alduhaish, K. Alfooty, M. A. Zayed, P. Li, H. D. Arman and B. Chen, A Microporous Porphyrin-Based Hydrogen-Bonded Organic Framework for Gas Separation, *Cryst. Growth Des.*, 2015, **15**, 2000–2004.
6. N. Huang, R. Krishna and D. Jiang, Tailor-Made Pore Surface Engineering in Covalent Organic Frameworks: Systematic Functionalization for Performance Screening, *J. Am. Chem. Soc.*, 2015, **137**, 7079–7082.
7. X.-F. Sheng, H.-C. Guo, Y.-S. Qin, X.-H. Wang and F.-S. Wang, A novel metalloporphyrin-based conjugated microporous polymer for capture and conversion of CO_2, *RSC Adv.*, 2015, **5**, 31664–31669.
8. Z. Zhang, J. Li, Y. Yao and S. Sun, Permanently Porous Co(II) Porphyrin-Based Hydrogen Bonded Framework for Gas Adsorption and Catalysis, *Cryst. Growth Des.*, 2015, **15**, 5028–5033.
9. V. S. P. K. Neti, J. Wang, S. Deng and L. Echegoyen, Selective CO_2 Adsorption in a Porphyrin Polymer with Benzimidazole Linkages, *RSC Adv.*, 2015, **5**, 10960–10963.
10. V. S. P. K. Neti, J. Wang, S. Deng and L. Echegoyen, Synthesis of a Polyimide Porous Porphyrin Polymer for Selective CO_2 Capture, *J. Chem*., 2015, **2015**, 1–7.
11. X. Zhao, L. Yuan, Z.-Q. Zhang, Y.-S. Wang, Q. Yu and J. Li, Synthetic Methodology for the Fabrication of Porous Porphyrin Materials with Metal–Organic–Polymer Aerogels, *Inorg. Chem.*, 2016, **55**, 5287–5296.
12. G. M. Eder, D. A. Pyles, E. R. Wolfson and P. L. McGrier, A ruthenium porphyrin-based porous organic polymer for the hydrosilylative reduction of CO_2 to formate, *Chem. Commun.*, 2019, **55**, 7195–7198.
13. G. Jiangfei, W. Lizhi, D. Zhang and J. Huang, Amino-Functionalized Porphyrin-Based Porous Organic Polymers for CO_2 Capture and Hg^{2+} Removal, *Energy Fuels*, 2020, **34**, 9771–9778.

14. X. Yao, K. Chen, L. Q. Qiu, Z. W. Yang and L. N. He, Ferric Porphyrin-Based Porous Organic Polymers for CO_2 Photocatalytic Reduction to Syngas with Selectivity Control, *Chem. Mater.*, 2021, **33**, 8863–8872.
15. L. Liu, S. Jayakumar, J. Chen, L. Tao, H. Li, Q. Yang and C. Li, Synthesis of Bifunctional Porphyrin Polymers for Catalytic Conversion of Dilute CO_2 to Cyclic Carbonates, *ACS Appl. Mater. Interfaces,* 2021, **13**, 29522–29531.
16. S. Liang, X. Zhong, Z. Zhong, B. Han, W. Chen, K. Song, H. Deng and Z. Lin, Biomimetic inspired porphyrin-based nanoframes for highly efficient photocatalytic CO_2 reduction, *Chem. Eng. J.*, 2021, **411**, 128414.
17. G. Li, X. Zhou and Z. G. Wang, Construction of Hierarchical Porous Polycyanurate Networks with Cobaltoporphyrin for CO_2 Adsorption and Efficient Conversion to Cyclic Di- and Tri-Carbonates, *Macromolecules*, 2022, **55**, 4832–4840.
18. Y. Hou, J. Sun, D. Zhang, D. Qi and J. Jiang, Porphyrin-alkaline earth MOFs with the highest adsorption capacity for methylene blue, *Chem. Eur. J.*, 2016, **22**, 6345−6352.
19. H. Li, X. Cao, C. Zhang, Q. Yu, Z. Zhao, X. Niu, X. Sun, Y. Liu, L. Ma and Z. Li, Enhanced adsorptive removal of anionic and cationic dyes from single or mixed dye solutions using MOF PCN-222, *RSC Adv.*, 2017, **7**, 16273–16281.
20. Z. Wang, J.-H. Zhang, J.-J. Jiang, H. Wang, Z.-W. Wei, X. Zhu, M. Pan and C.-Y. Su, A Stable Metal Cluster-Metalloporphyrin MOF with High Capacity for Cationic Dye Removal, *J. Mater. Chem. A*, 2018, **6**, 17698–17705.
21. X. Xu, Q. Yu, D. Zhao, W. Zhang, N. Wang and J. Li, Synthesis and characterization of porphyrin-based porous coordination polymers obtained by supercritical CO_2 extraction, *J. Mater. Sci.*, 2018, **53**, 10534–11054.
22. T. Liu, L. Jing, L. Cui, Q. Liu and X. Zhang, Facile one-pot synthesis of a porphyrin based hydrophilic porous organic polymer and application as recyclable absorbent for selective separation of methylene blue, *Chemosphere*, 2018, **212**, 1038–1046.
23. Y. Keum, B. Kim, A. Byun and J. Park, Synthesis and Photocatalytic Properties of Titanium-Porphyrinic Aerogels, *Angew. Chem. Int. Ed.*, 2020, **59**, 21591–21596.
24. M. Li, H. Zhao and Z.-Y. Lu, Porphyrin-based porous organic polymer, Py-POP, as a multifunctional platform for efficient selective adsorption and photocatalytic degradation of cationic dyes, *Microporous Mesoporous Mater.*, 2020, **292**, 109774.
25. S. Daliran, M. Khajeh and A. R. Oveisi, A porous Fe-based porphyrinic metal–organic framework for highly effective removal of organic azo-dye, *Appl. Organomet. Chem*., 2022, **36**, e6830.