Exceptional CO_2 adsorption capacity and enhanced hydrophobicity in a perfluorinated covalent triazine-based framework

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Covalent Triazine Frameworks (CTFs), a nitrogen-rich subclass of Porous Organic Polymers (POPs), show high potential in applications such as gas adsorption and separation, heterogeneous catalysis and waste water treatment owing to their distinctive large surface area, low skeleton density, good thermal and chemical stability combined with enhanced tunability and functionality of the materials.[1] The incorporation of fluorine groups into MOF or COF materials has been proven to lead to enhanced hydrophobicity of the matrix, which can be beneficial for gas sorption/purification and heterogeneous catalysis.[2] Herein, a novel perfluorinated covalent triazine-based framework based on 2, 2', 3, 3', 5, 5', 6, 6' – octafluoro - 4, 4' - biphenyldicarbonitrile (F-DCBP) as the monomer was synthesized under ionothermal conditions (Figure 1a). The resulting porous framework was fully characterized by elemental analysis, FT-IR, XRD, TGA, N_2 sorption, SEM and TEM-EDX mapping, solid state NMR, CO_2 and water vapor adsorption etc. Notably, the perfluorinated CTF material exhibits an exceptional high CO_2 adsorption capacity (5.39 mmol/g, at 273 K and 1 bar), which is one of the highest among all the reported CTF materials to date (Figure 1b). Additionally, the material possesses significantly enhanced hydrophobicity due to the hydrophobic fluorine groups as evidenced by water sorption isotherms.

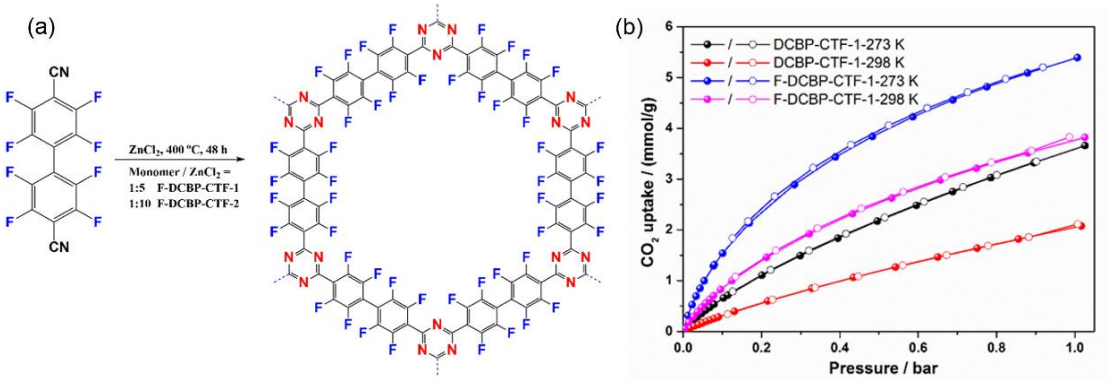

Figure 1. (a) Representation of ideal synthesis of perfluorinated CTFs; (b). CO_2 adsorption isotherms of F-DCBP-CTF and DCBP-CTF measured at 273 K and 298 K.

Reference

1. K. Sakaushi and M. Antonietti, *Accounts of Chemical Research*, 2015, **48**, 1591-1600.
2. Y. Zhao, K. X. Yao, B. Teng, T. Zhang and Y. Han, *Energy & Environmental Science*, 2013, **6**, 3684-3692.

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