Crystal Engineering of Hybrid Ultramicroporous Materials

Michael Zaworotko
University of Limeric

That composition and structure profoundly impact the properties of crystalline solids has provided impetus for exponential growth in the field of *crystal engineering*[1] over the past 25 years. Today, crystal engineering, when coupled with molecular modeling, can offer a paradigm shift from the more random, high-throughput methods that have traditionally been utilized in materials discovery and development, i.e. how to custom-design the right crystalline material for the right application. Porous crystalline materials exemplify this situation. Whereas purely inorganic materials (e.g. zeolites) and those based upon coordination chemistry (e.g. Metal-Organic Frameworks, MOFs, and Porous Coordination Polymers, PCPs) are well studied and offer great promise for separations and catalysis, they are handicapped by cost or performance (e.g. poor chemical stability, interference from water vapour, low selectivity) limitations. ***Hybrid Ultramicroporous Materials***, ***HUMs***, are a class of porous material built from metal or metal cluster "nodes" and combinations of organic and inorganic "linkers" and their pore chemistry and size (< 0.7 nm) can overcome the weaknesses of existing classes of porous material. Three families (platforms) of HUMs will be detailed with emphasis upon how the pore structure and chemistry of HUMs impacts gas sorption performance.

References

1. (a) Desiraju, G.R. *Crystal engineering*: *The design of organic solids* Elsevier, 1989; (b) Moulton, B.; Zaworotko, M.J. *Chemical Reviews* 2001, 101, 1629-1658.
2. (a) Nugent, P.; Belmabkhout, Y.; Burd, S.D.; Cairns, A.J.; Luebke, R.; Forrest, K.; Pham, T.; Ma, S.; Space, B.; Wojtas, L.; Eddaoudi, M.; Zaworotko, M.J. *Nature* 2013, 495, 80-84. (b) Kumar, A.; Madden, D.G.; Lusi, M.; Chen, K.J.; Daniels, E.A.; Curtin, T.; Perry IV, J.J.; Zaworotko, M.J. *Angewandte Chemie*, 2015, 54, 14372-14377.
3. Cui, X.; Chen, K.J.; Xing, H.; Yang, Q.; Krishna, R.; Bao, Z.; Wu, H.; Zhou, W.; Dong, X.; Li, B.; Ren, Q.; Zaworotko, M.J.; Chen, B. *Science*, 353, 141-144, 2016.
4. Mohamed, M.; Elsaidi, S.; Wojtas, L.; Pham, T.; Forrest, K.A.; Tudor, B.; Space, B.; Zaworotko, M.J. *J. Amer. Chem. Soc.* 2012, 134, 19556-19559.
5. Zaworotko, M.J. *Chem. Soc. Rev*. 1994, 23, 283-288.