

Hydrogen storage in metal-organic frameworks: a chemical perspective

Dr. Petra A. Szilágyi, Senior Lecturer, University of Greenwich, UK

Short Abstract

Metal-organic frameworks (MOFs) are capable of great gravimetric hydrogen uptake. However, owing to the weakness of the adsorption, high capacities may only be achieved at cryogenic conditions and/or high pressures. In this talk I will review the latest trends and future prospective to increase the hydrogen-adsorption strength on MOFs.

Extended Abstract

Porous materials are interesting hydrogen-storage materials owing to the fast sorption kinetics that can be achieved. [1-4] Particularly, metal-organic frameworks (MOFs) have been subject of a great scientific interest as they have unrivalled surface areas and small pore sizes, both of which contribute to high potential gravimetric uptakes. Furthermore, MOFs are highly designable therefore their pore geometries and chemical functionalities may be optimised for a maximum storage capacity. [5-9]

Main drawbacks of using MOFs for hydrogen storage include the weakness of the hydrogen-MOF bonds, which are based on the weak van der Waals interactions and therefore only offer appreciable uptake at cryogenic temperatures and/or high pressures. Considerable research effort has thus been invested in the increasing of the adsorption enthalpy of hydrogen on metal-organic frameworks. [10-14]

In this talk I will give an overview of the latest research on the above issue from a chemical perspective. Particularly, I will review how the chemistry of the building blocks of a MOF, *i.e.* the cationic unit, linker and pore (Figure 1), influence the strength of the hydrogen adsorption on metal-organic frameworks.



Figure 1 From left to right: Modification of the cationic unit; of the linker and embedding of a guest material in the pores.

Current research trends and future perspective will also be discussed.

References

- [1] Science, 2003, 300, 1127
- [2] Catal. Today, 2007, 120, 389
- [3] Carbon, 2005, 43, 2209
- [4] Chem. Commun. 2008, 668
- [5] Angew. Chem. Int. Ed. 2005, 44, 4670
- [6] Chem. Soc. Rev. 2009, 38, 1294
- [7] Chem. Rev. 2012, 112, 782
- [8] Angew. Chem. Int. Ed. 2008, 47, 6766
- [9] Micropor. Mesopor. Mater. 129, 2010, 335
- [10] J. Am. Chem. Soc. 2007, 129, 11172
- [11] Acc. Chem. Res. 2014, 47, 296
- [12] J. Phys. Chem. C, 2014, 118, 19572
- [13] CrystEngComm, 2013, 15, 9408
- [14] J. Am. Chem. Soc. 2014, 136, 17827

