Functional Metal Organic Frameworks: Chemistry and Applications

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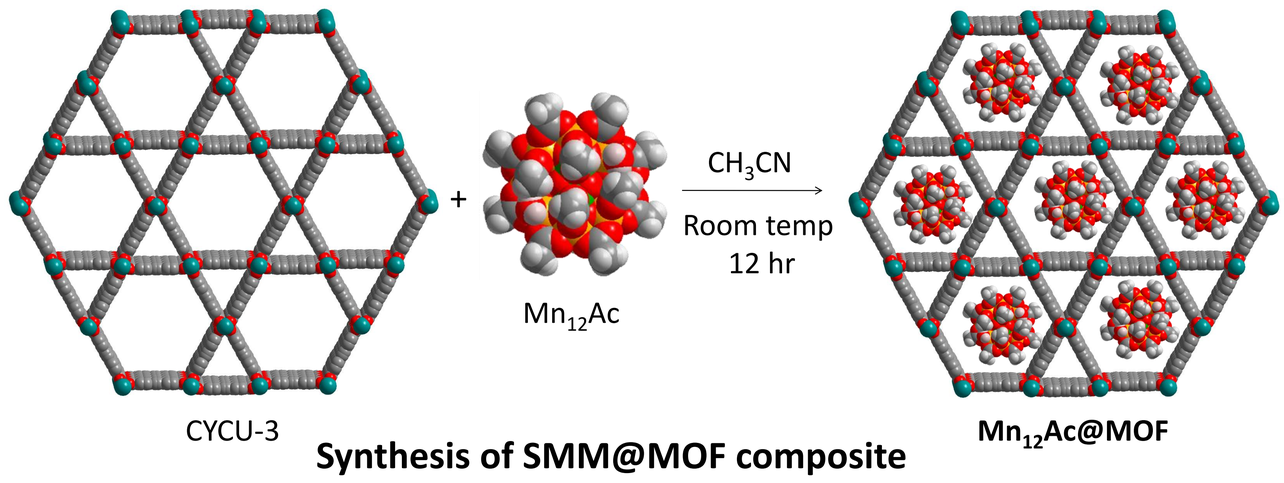
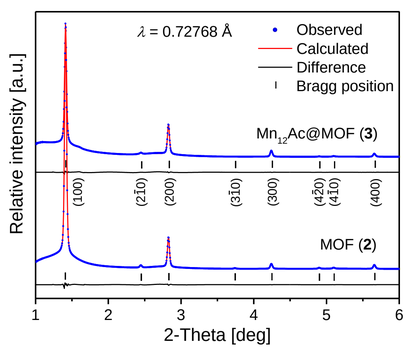
MOFs as Platforms for the Controlled Nanostructuring of Single Molecule Magnets

The materials currently used for data storage are rapidly approaching their limits (meaning we will no longer be able to store more information in increasingly smaller spaces with the current technologies).[1] Therefore, new and smaller materials are in high demand. Nanomagnets, such as single molecule magnets (SMM), are an intriguing solution to this problem as they could potentially increase data storage capacities thousands of times. However, these materials are delicate and need to be contained in a type of nanostructure in order to make them possibly viable for data storage.[2-4] Metal-organic frameworks (MOFs), with their well defined multi-dimensional cavities can act as excellent hosts for these nanomagnets. Loading the nanomagnets into the pores of the MOF would allow for the individual molecules to be separated from one another, as well as providing protection for them. Hopefully, this technique can eventually be used to produce a macroscopic material with the intent to increase data storage capacities.

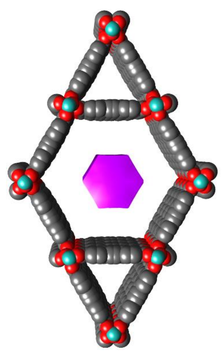


Synthesis of SMM@MOF composite

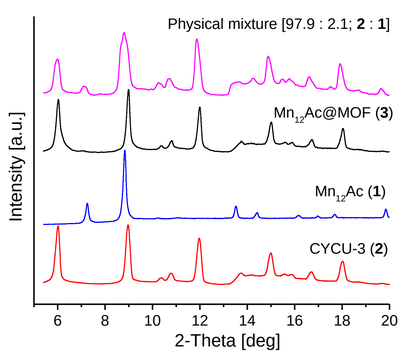
Powder X-Ray Diffraction Analysis



Synchrotron PXRD data

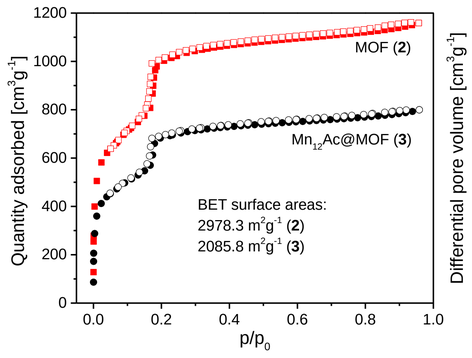


Difference Envelope Density

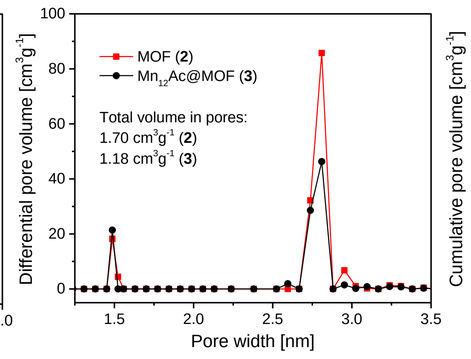


Experimental

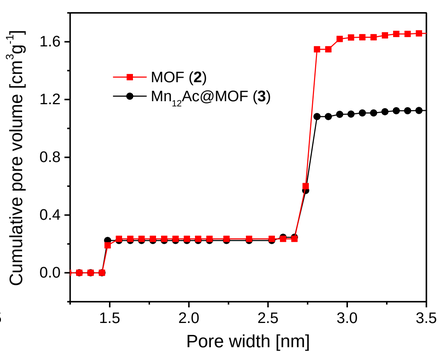
Adsorption Analysis



N_2 Adsorption Isotherm

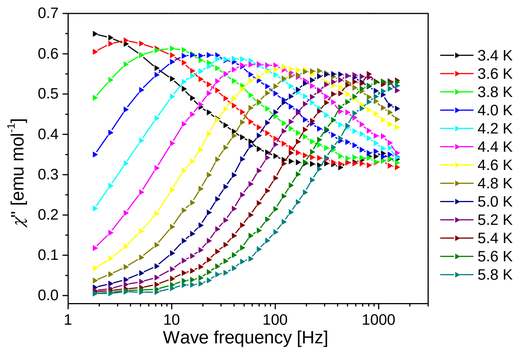


Pore Size Distribution

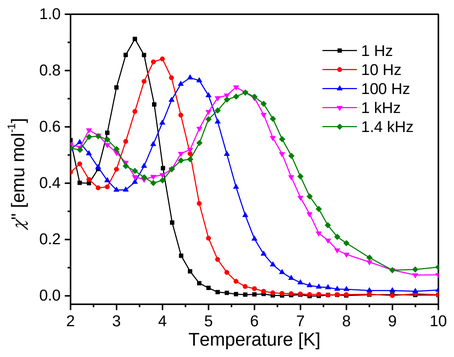


Cumulative Pore Volume

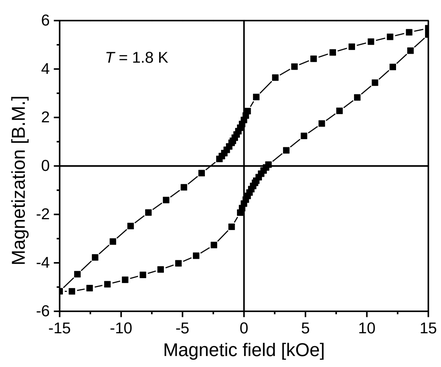
Magnetic Properties Analysis



Frequency Dependence of Magnetic AC Susceptibility



Temperature Dependence of Magnetic AC Susceptibility

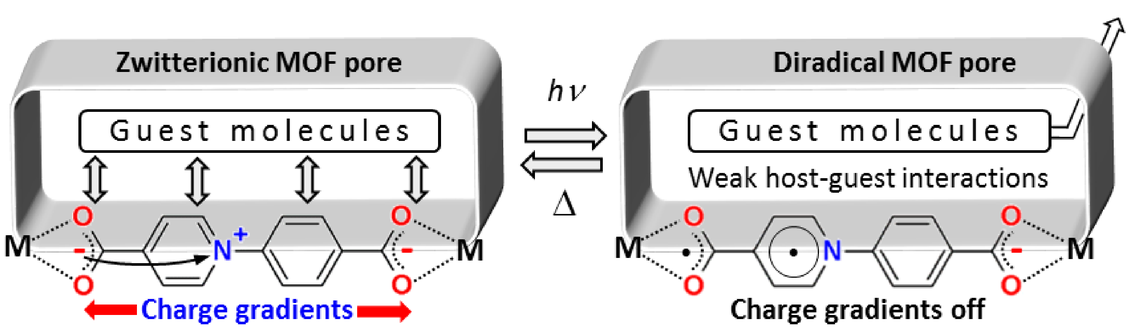


Magnetic Field Hysteresis

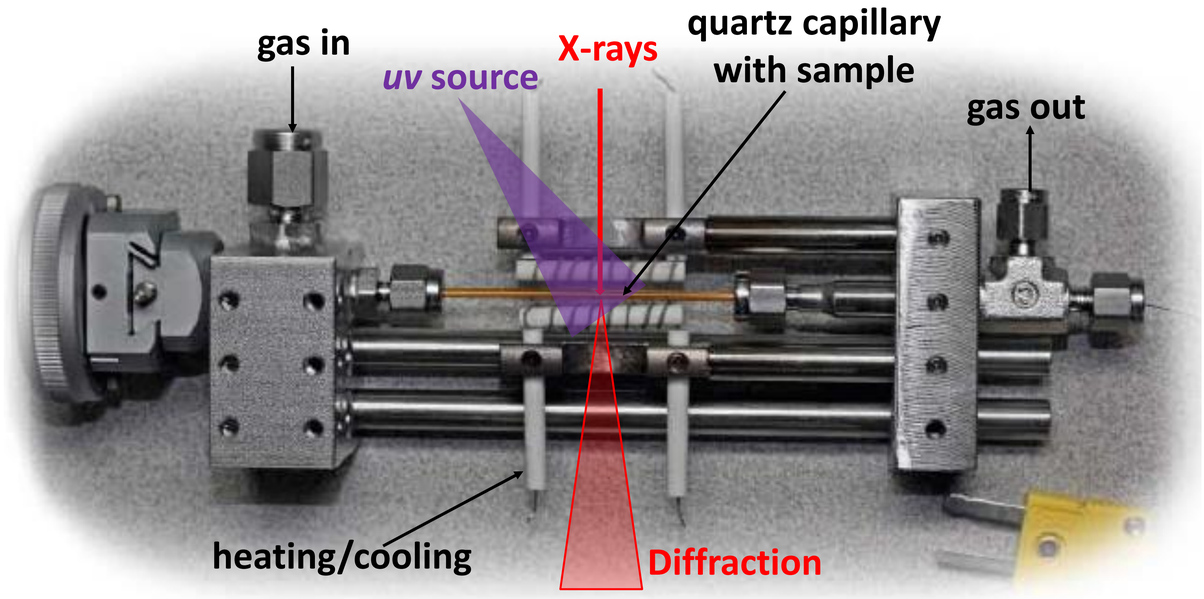
Conclusions

- Successful insertion of SMM $Mn_{12}Ac$ into a mesoporous host
- Sufficiently large pore size and relatively unreactive interior of framework facilitate insertion and preservation of SMM's unique magnetic properties
- Only a single SMM cluster is loaded in transverse direction of pores, yielding a long range ordered crystalline composite material while showing significantly enhanced thermal stability
- These findings will pave way for new venues for development of novel advanced high density information storage devices

Photofunctional Zwitterionic MOFs with Tunable Adsorption Properties

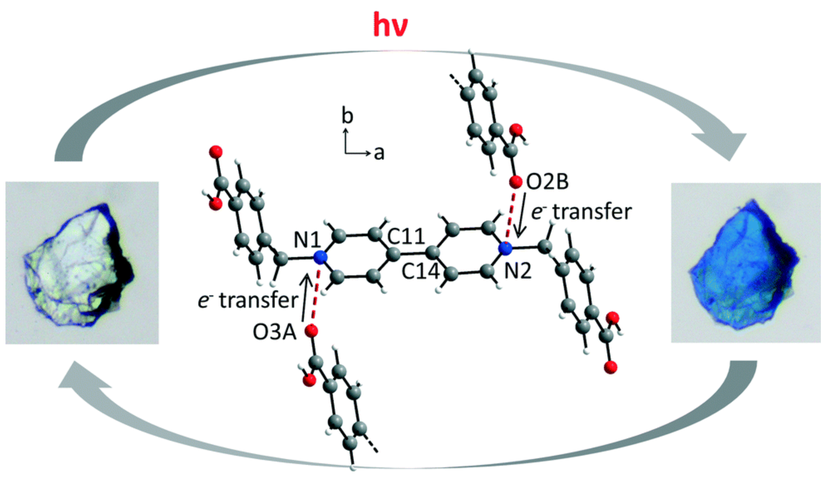


Stimuli responsive adsorption behavior



This set up will be used at 17-BM for *in-situ* investigation of MOFs exhibiting photochromic behavior

Photochromic behavior



References

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