



Synthesis and Adsorption Properties of Defect-Engineered Metal-Organic Frameworks

Motivation and challenge

UiO-66 is one of the most widely studied metal-organic frameworks (MOFs) in the world. However, it has limited potential for adsorption based applications due to its relatively modest porosity.

Fortunately, we have recently discovered that it's possible to increase its porosity by >50 % by intentionally introducing defects to the framework. The defects require compensation by terminal ligands whose identity may vary (trifluoroacetate fulfils this role in part c of the figure). It is likely that the adsorption properties of the material will vary significantly depending on the amount of defects and the identity of the terminal ligands, prompting the necessity of this systematic investigation.

Objectives and scope

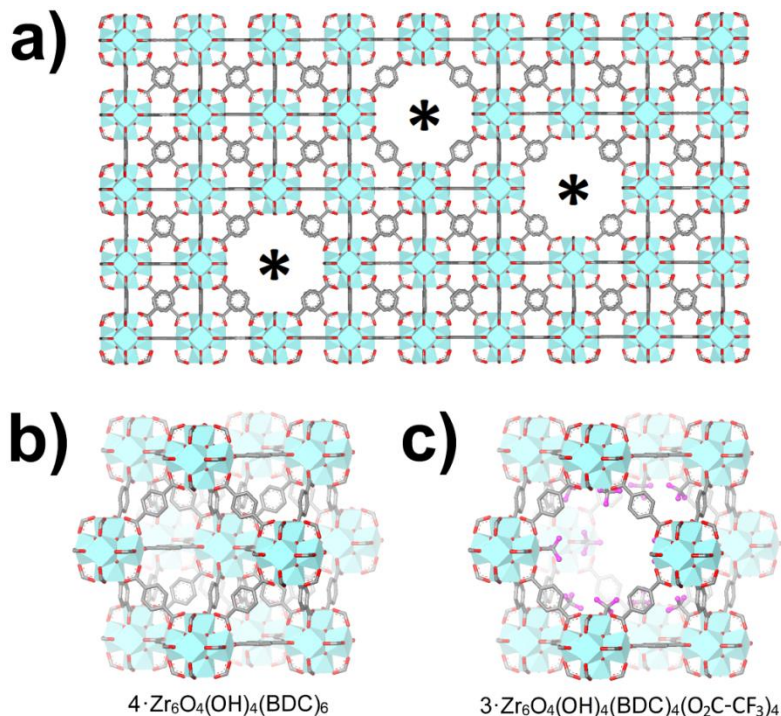
The student will synthesize a variety of defect-engineered UiO MOFs and investigate their adsorption capabilities towards a variety of strategic gases (CO_2 , H_2O , CH_4 ,...). The best materials may be promising for applications such as CO_2 capture, methane sorbents (for CH_4 fuelled vehicles), heat pumps, and the delivery of drinking water to remote areas.

Skills to be developed

MOF synthesis, adsorption, characterization (PXRD, NMR, TGA, SEM), systematic thinking.

Contact information

Dr. Greig Charles Shearer, ØU46, greigcs@kjemi.uio.no, 93916783



a) Extended (& simplified) 2D structural projection of a defective UiO-66 sample. Defects are highlighted by asterisks. b) Unit cell of defect-free UiO-66. c) Unit cell of defective UiO-66 with trifluoroacetate terminal ligands. Cyan polyhedra = Zr (+IV), Grey = carbon, Red = oxygen, Magenta = fluorine.