The University Of Sheffield.

E-Futures

Metal-organic frameworks for gas storage

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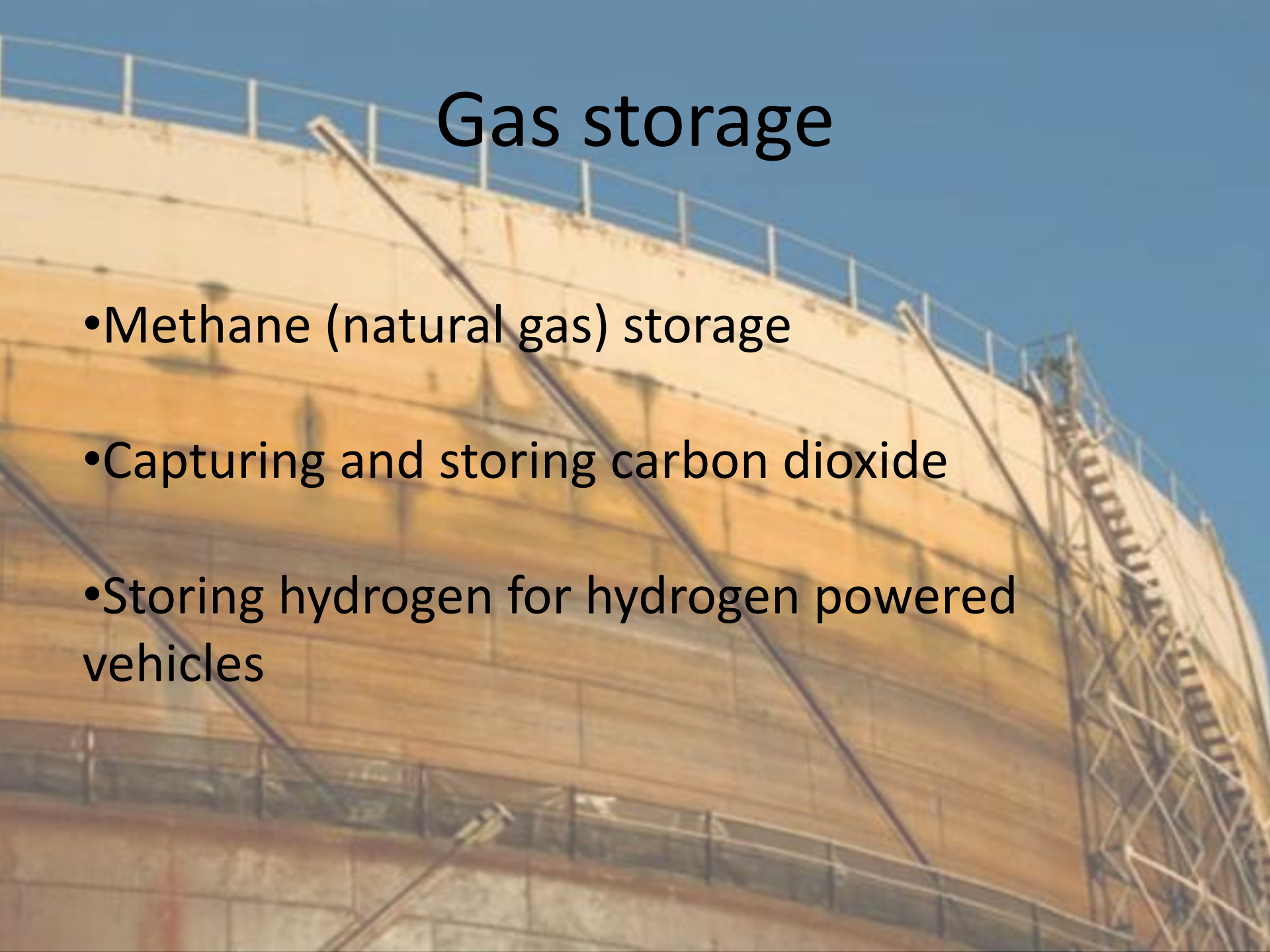
EPSRC
Pioneering research and skills

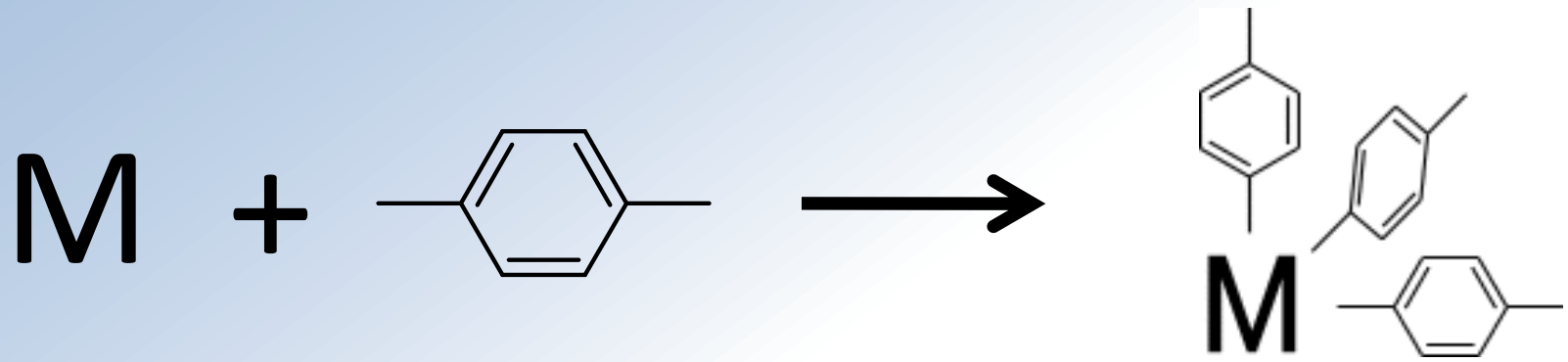
Gas storage



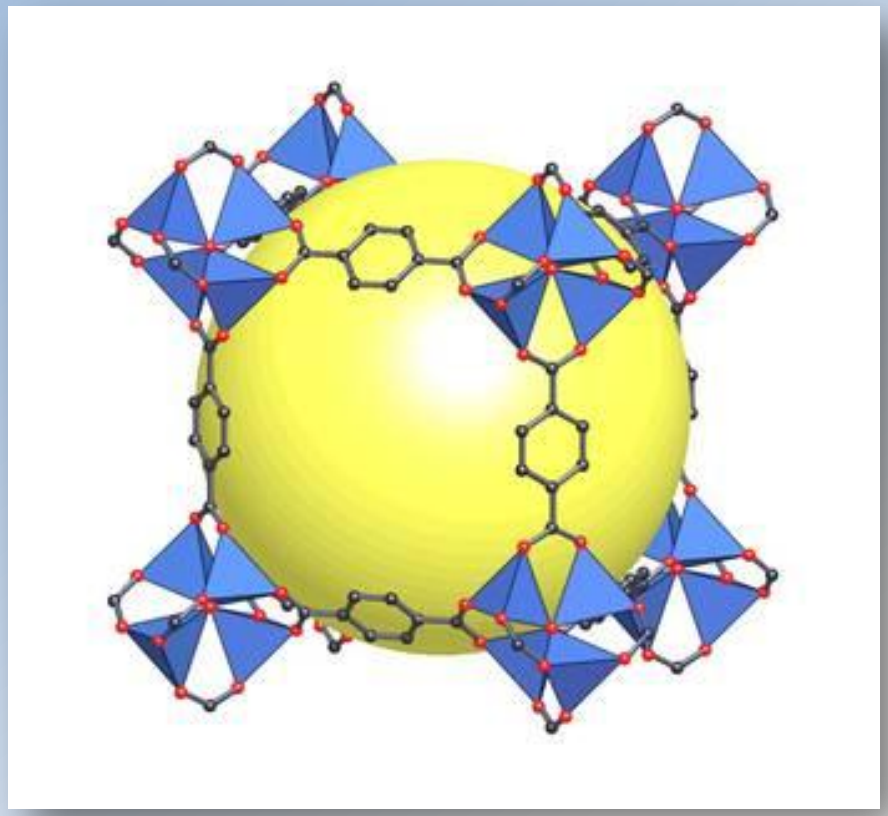
- Methane (natural gas) storage
- Capturing and storing carbon dioxide
- Storing hydrogen for hydrogen powered vehicles

Introduction to MOFs

- **Crystalline frameworks** consisting of **metal ions** or complexes linked by **organic groups**
- Structures have a large amount of **empty space**, leading to **high surface areas**
- Both the metal and the organic group can be varied, giving a **large range of possible structures**



Introduction to MOFs



MOF-5

MOFs for gas storage

- MOFs are **porous**, allowing for **uptake of gases**

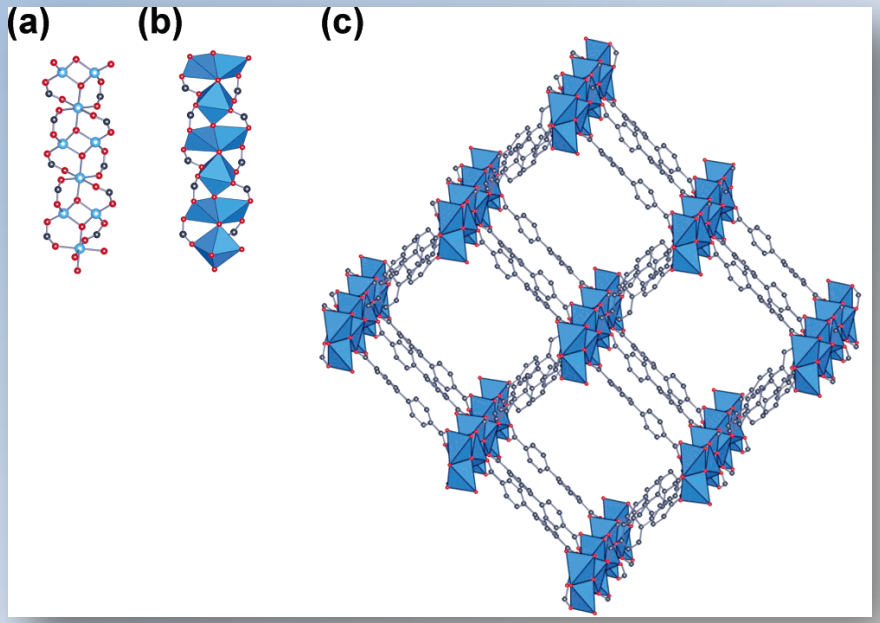
- Their **large surface areas** allow lots of gas to be absorbed by the structure

- Different organic linking groups can be used to give **different pore sizes**

- The organic linking groups can also be '**functionalized**'

Aims

•To recreate compounds prepared by Sam Hawxwell, a former PhD student in the Brammer group.



MOF-69A

Aims

- To prepare new compounds with ‘functionalized’ organic linking groups.

Terephthalic acid and 2-amino-terephthalic acid

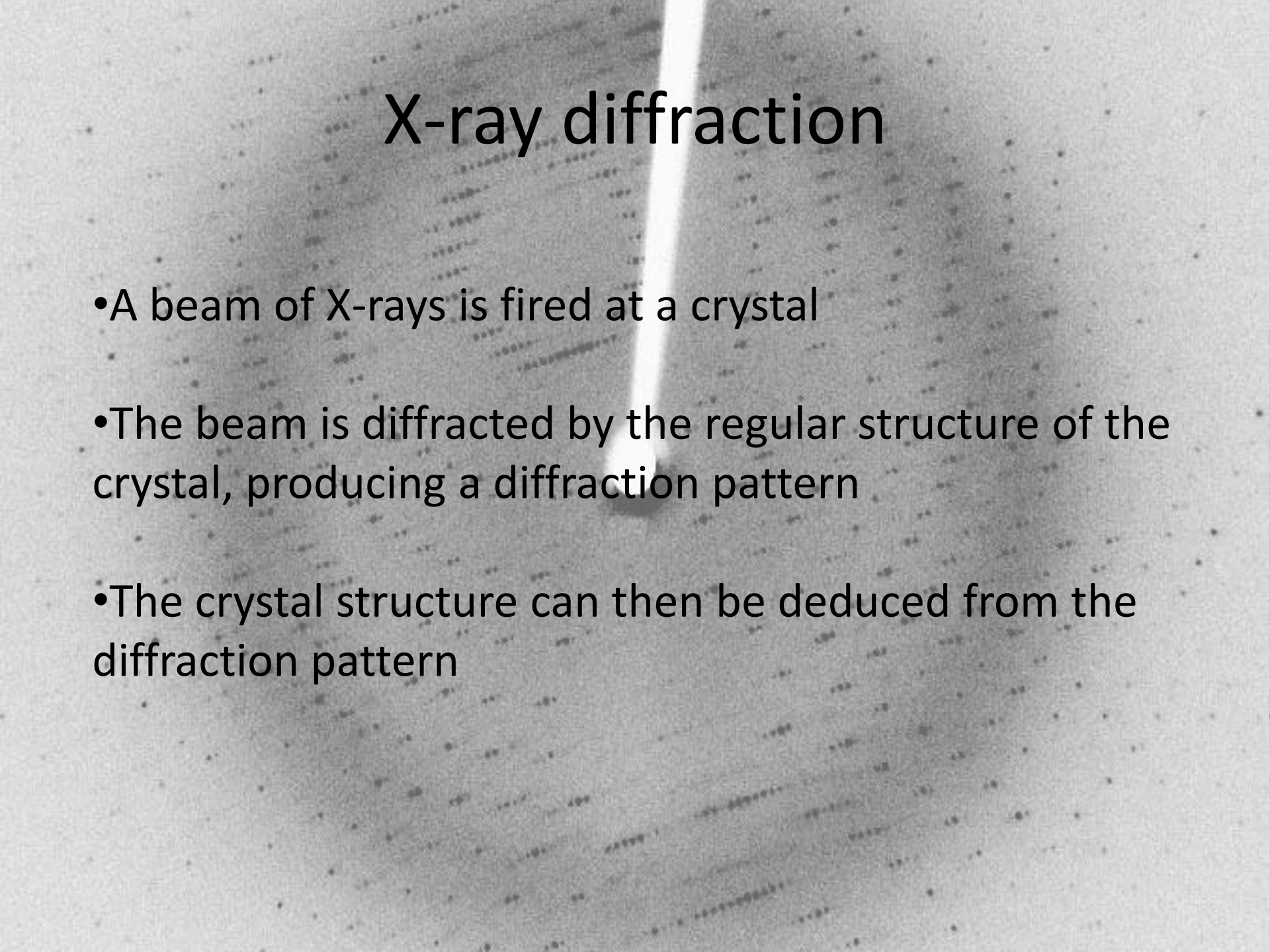
Synthesis

- ‘Solvothermal’ synthesis: heat reactants and solvent in a sealed vessel and hold at a high temperature

- As the solution cools, crystallization can occur

- Vessels used were ‘bombs’ and glass vials

X-ray diffraction



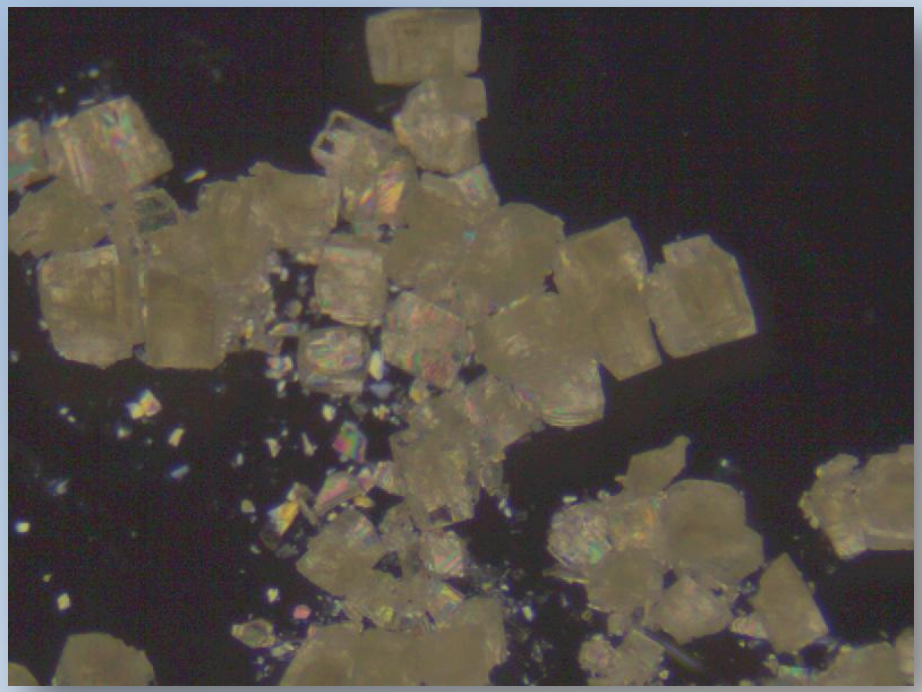
- A beam of X-rays is fired at a crystal
- The beam is diffracted by the regular structure of the crystal, producing a diffraction pattern
- The crystal structure can then be deduced from the diffraction pattern

Results

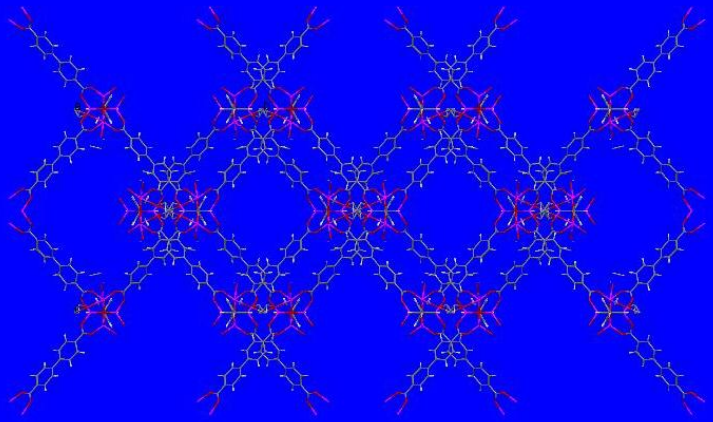
Metal salt + dicarboxylic acid $\xrightarrow{\text{Solvent}}$ Metal-organic framework

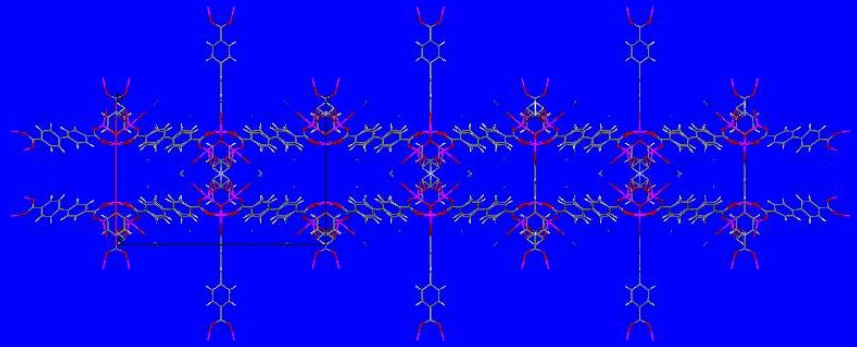
- Varied ratio of metal salt to dicarboxylic acid
- Varied concentration of reactants
- Varied amount of solvent

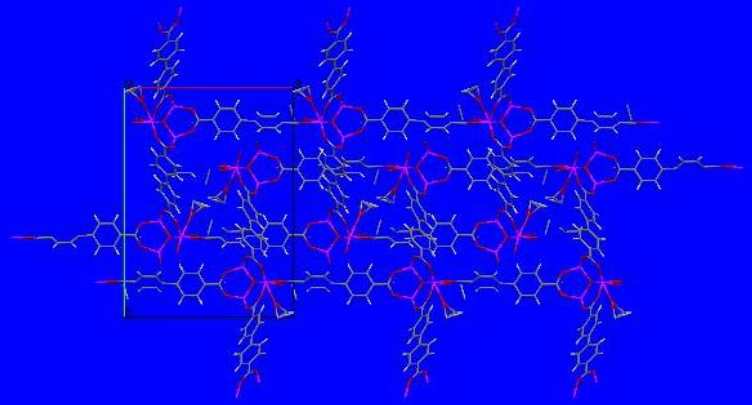
Results



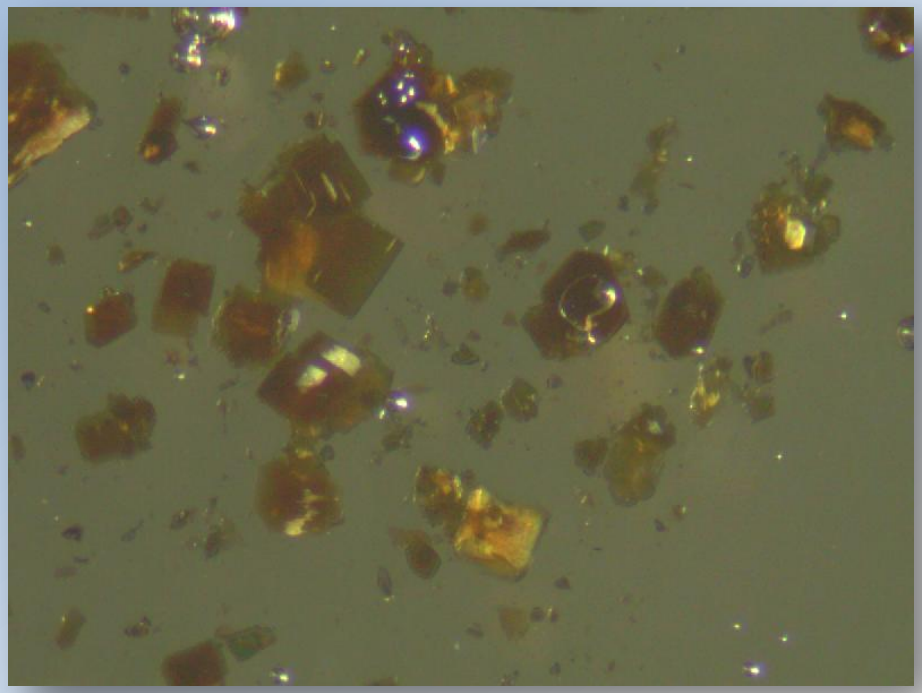
Results







Results



Thanks to:

- Prof. Brammer
- The Brammer group
- Harry Adams