

Chemical weavings and coloured nets



Presenter: Benjamin Thompson (PhB Science) Research supervisor: Prof. Stephen Hyde



Metal Organic Frameworks (MOFs)



- Mixture separation
- Gas storage
- Speeding up chemical reactions
- Drug delivery



MOF structures



The geometry and topology (shape) of the organic (non-metal) frameworks are complicated.

Question: What are the possible frameworks MOFs can have?



Other types of interwoven nets





Complicated, '3D'

Simple, '2D'



Weavings to coloured nets







Weavings to coloured nets





Simplifying coloured nets





Weavings to coloured nets









MOF world

Pattern world





MOF world

Pattern world





We can classify MOFs with this correspondence!







Studying coloured nets



Question: How do we go about classifying coloured nets?



Studying coloured nets



Question: How do we go about classifying coloured nets?

- Delaney-Dress tiling theory
- Conway crankshafts



Conway Crankshafts



Pattern world

Crank world

We can classify MOFs by classifying cranks!

Classifying Conway cranks

Question: How do we classify cranks?

Classifying Conway cranks

Question: How do we classify cranks?

- Mathematics
- (and a computer)

Example output: triangular nets

Computer says

Example output: triangular nets

Example output: triangular nets

What patterns do these cranks correspond to?

We can also consider a square pattern where every corner has 6 squares (this lives in the hyperbolic plane)...

Let's see the corresponding 3D net!

Thanks for listening!

Image credits

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- Illustration of [Cu₂^I(CN){N(CN)₂}₂]⁻ taken from "Interpenetrating nets: Ordered, periodic entanglement. (Batten and Robson, 1998)
- Illustrations of MOFs by Stephen Hyde used with permission.