Teaching Sponges New Tricks:
Designer Porous Materials for Energy, Catalysis, and the Environment

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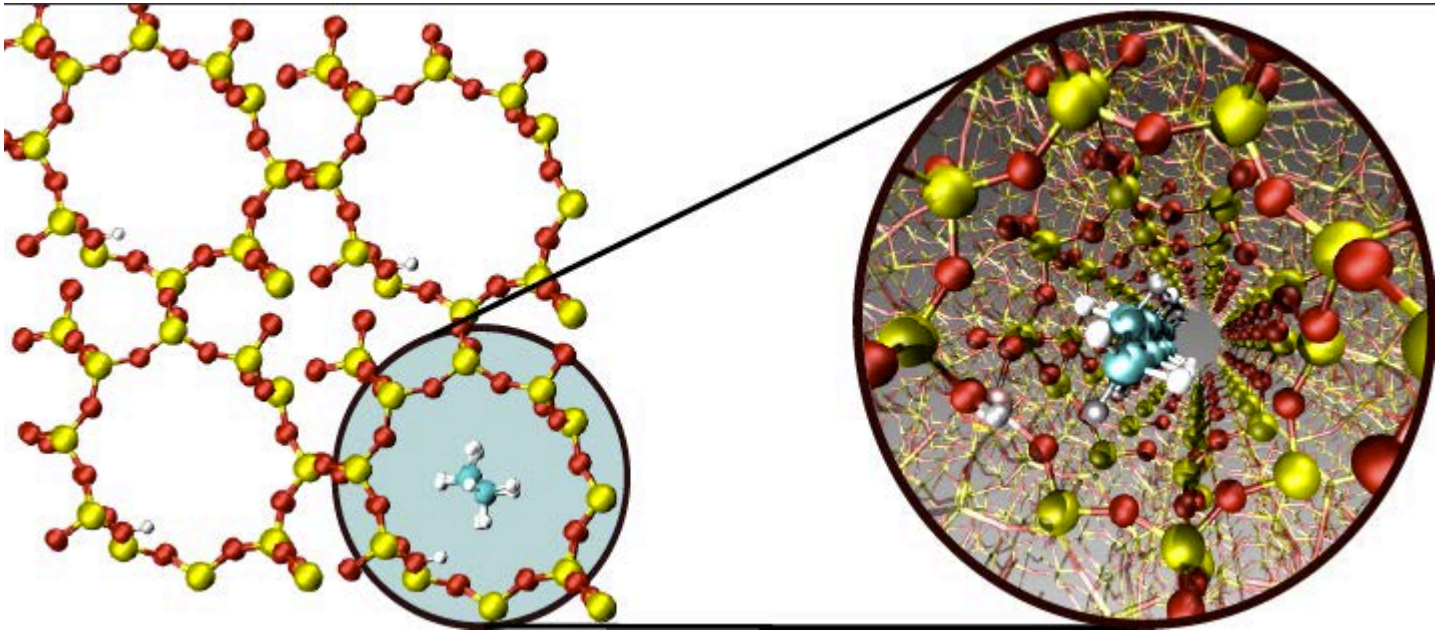
Material design is key to modern chemistry and industry

In catalysis:

Heterogeneous catalysts represent the vast majority of catalytic processes in the industry

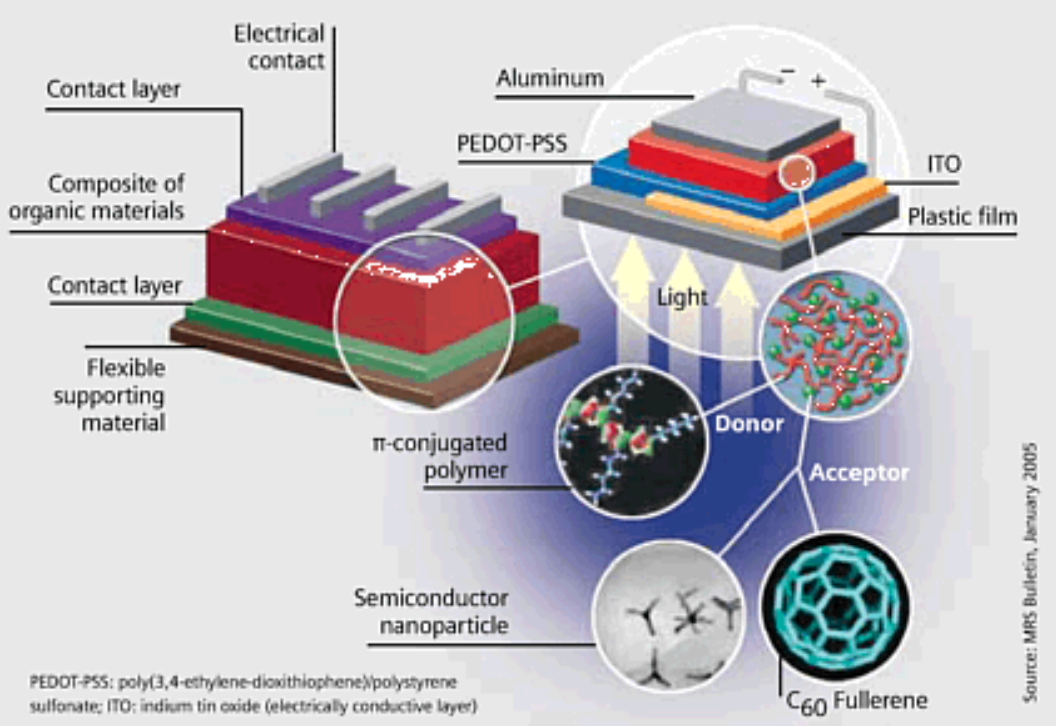


but despite the many levels of improvements, still do not offer good structural control, unlike homogeneous catalysts which offer control but not long-term stability

Material design is key to modern chemistry and industry

In materials for renewable energy:

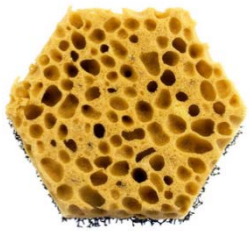
Organic solar cells have come a long way in the past decade



But efficiency is still plagued by lack of control over the macromolecular/interfacial structure!

From sponges to tunable high-surface area adsorbents

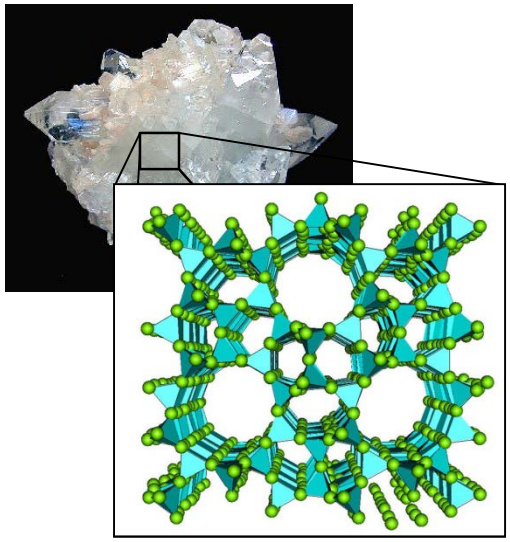
10^{-2} m



10^{-3} mm

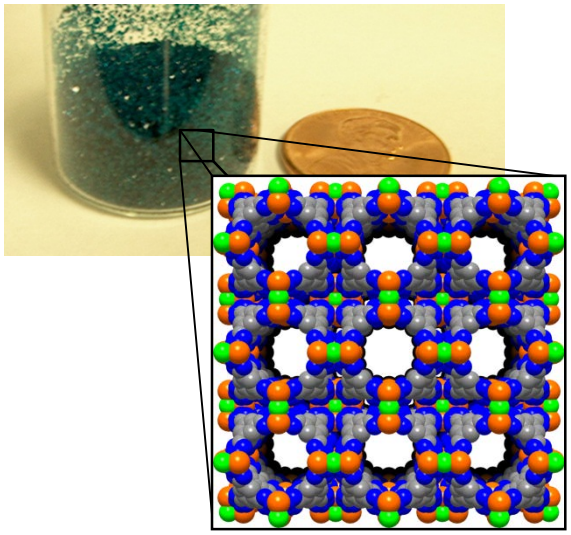
Zeolites

10^{-9} m

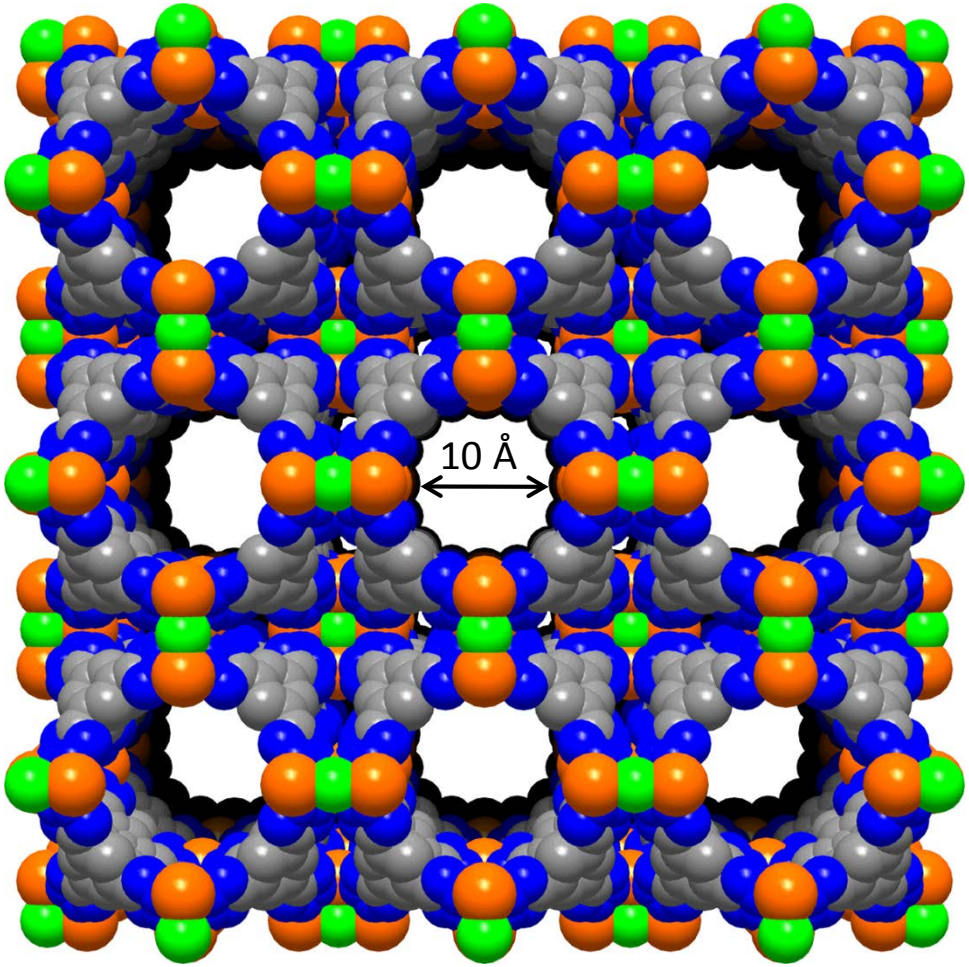


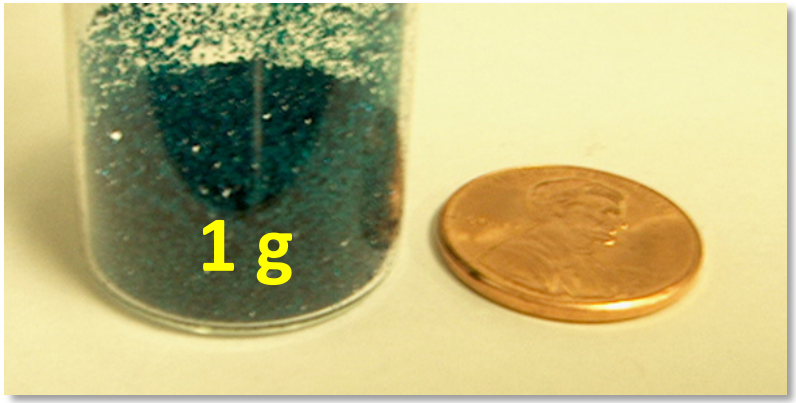
Metal-organic Frameworks

10^{-9} m (1 atom ~ 10^{-10} m)

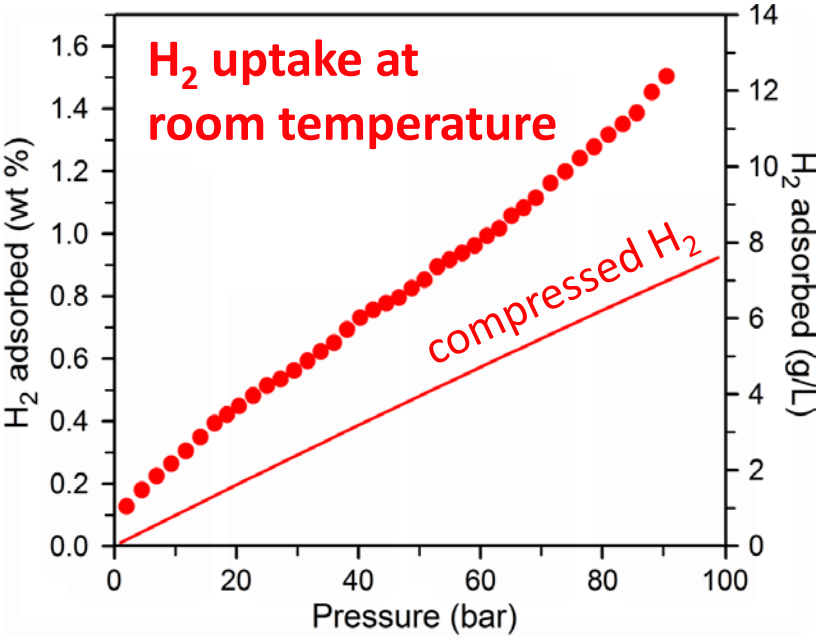


MOFs have the highest surface areas known to mankind



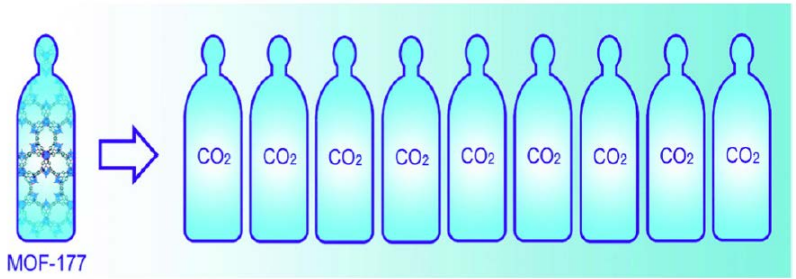


… and they store more gas than any other materials



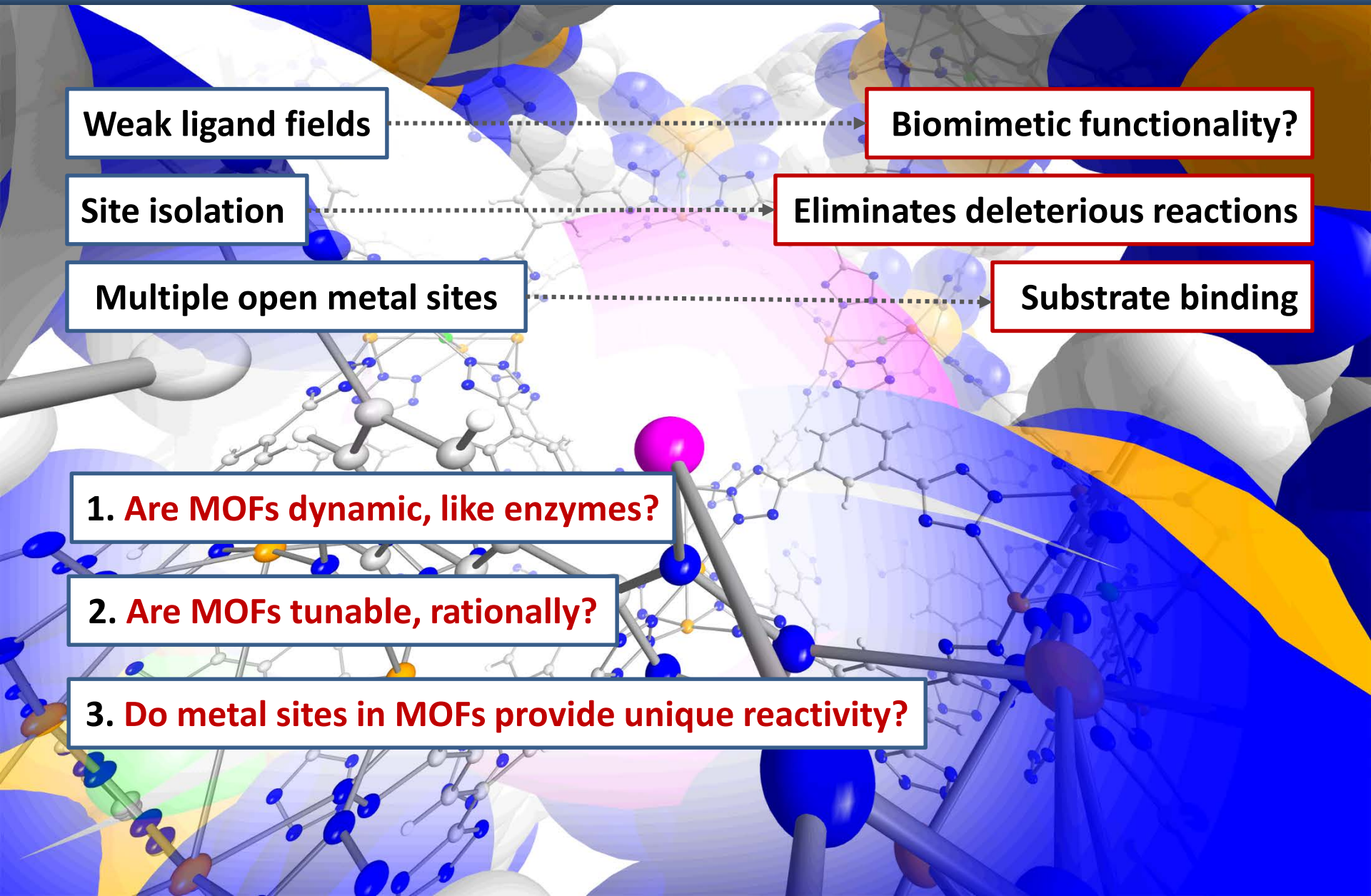
Dinca, Long *J. Am. Chem. Soc.* **2006**, *128*, 16876.

CO_2 uptake:
9 times that of a cylinder!

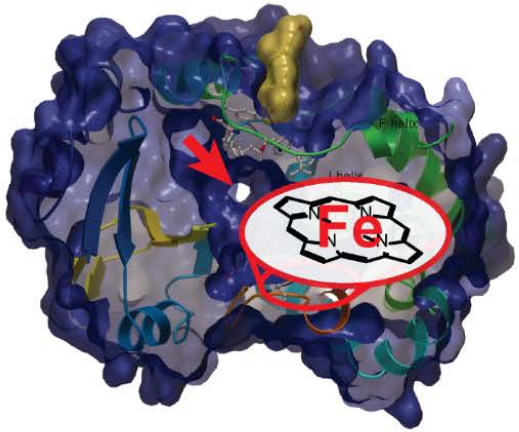


Yaghi et al. *J. Am. Chem. Soc.*, **2005**, *127*, 17998.

MOFs could be ideal platforms for *new* heterogeneous catalysis

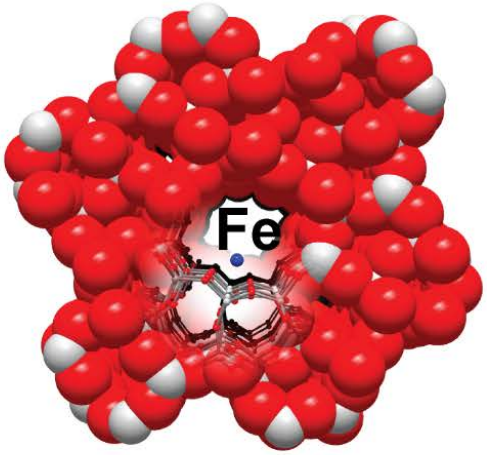


Marrying enzymatic and heterogeneous catalysis: getting the best of both worlds



Heme protein

?

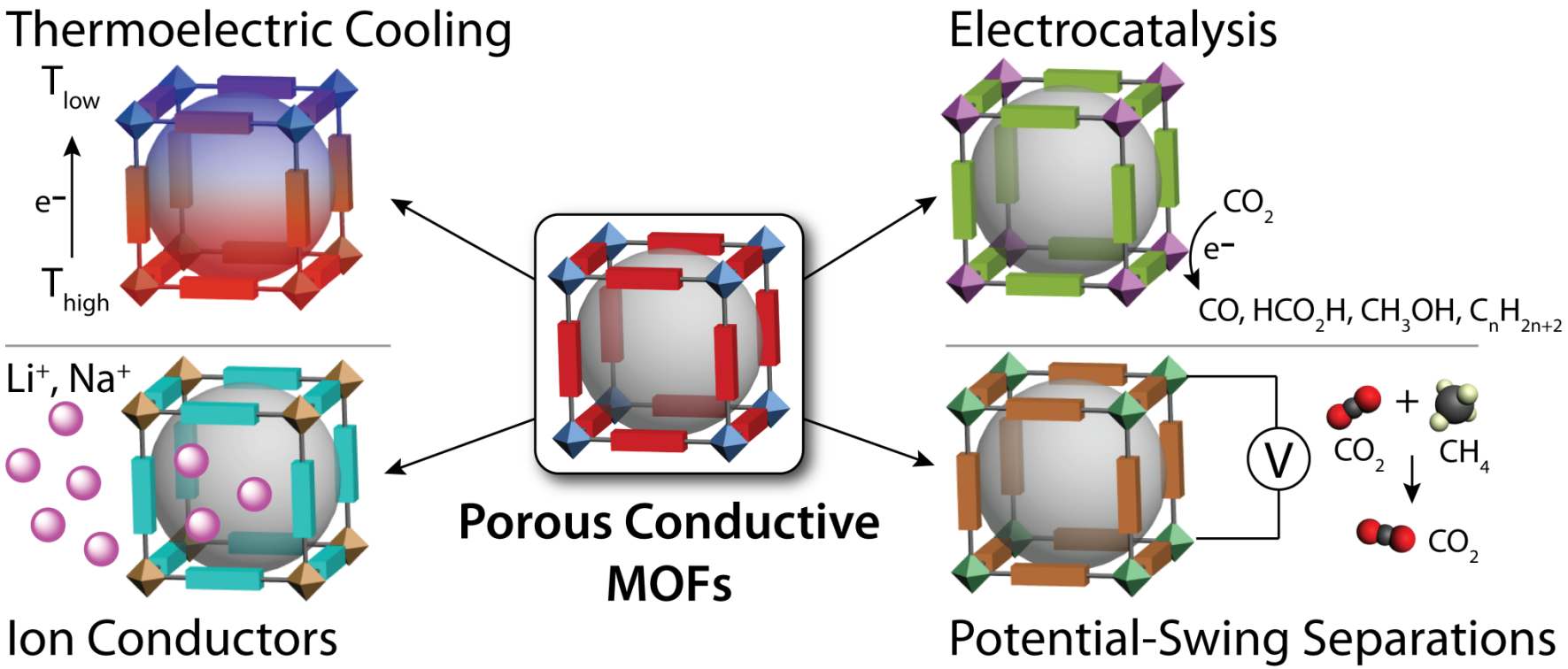


Iron Zeolite

$CH_4 \xrightarrow{?} CH_3OH, C_n$

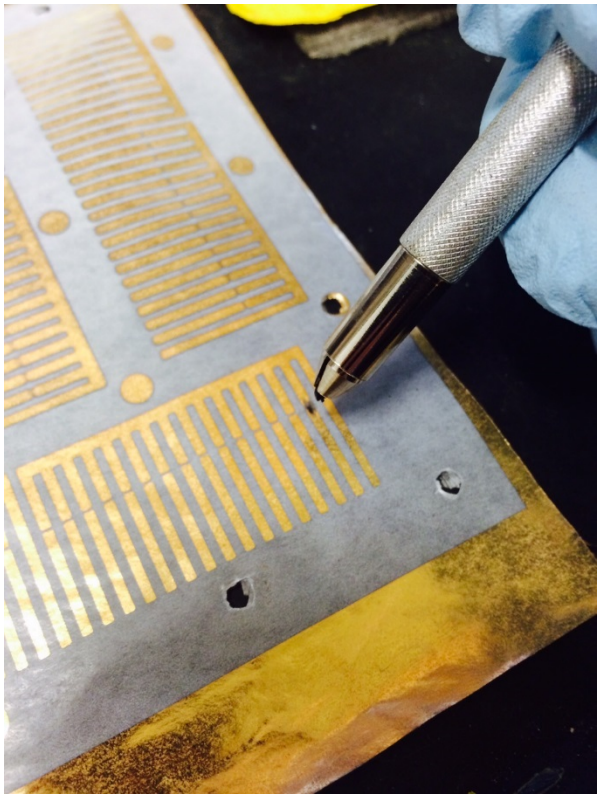
Metzger, Brozek, Comito, Dinca *ACS Central Science* **2016**, *2*, 148-153.

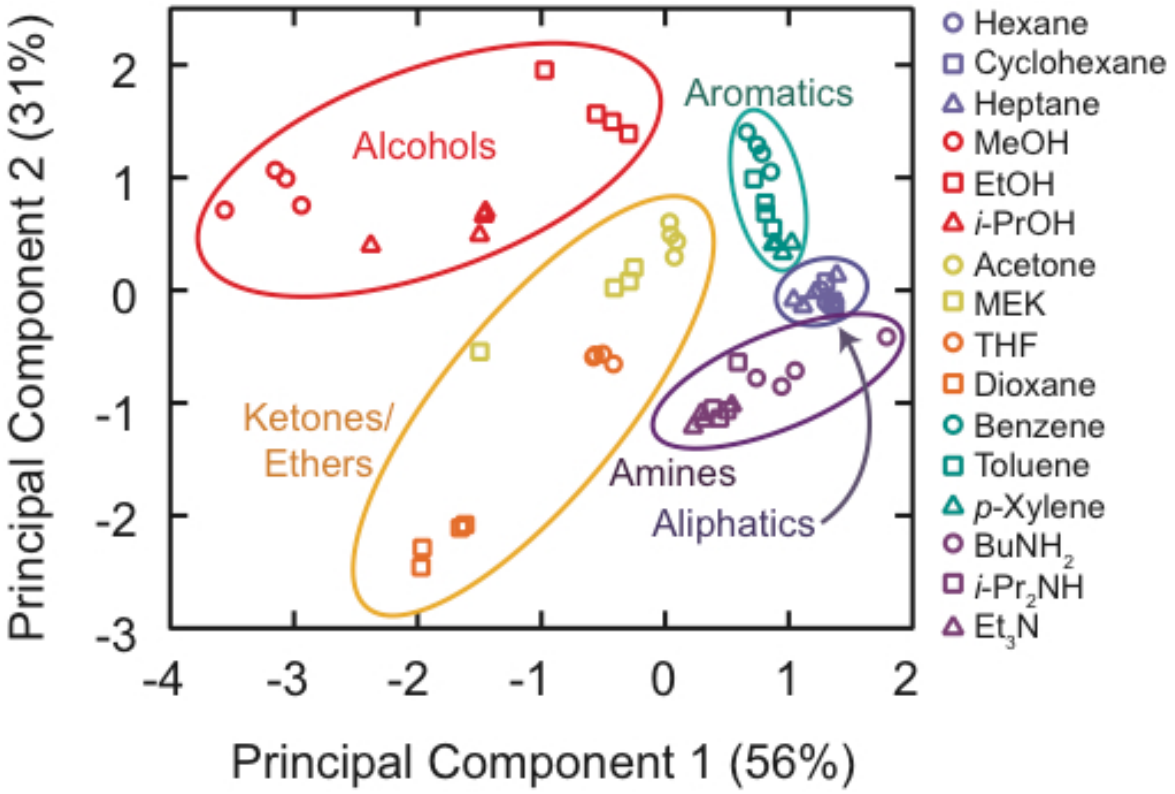
Why conducting metal-organic frameworks?



Review: Sun, Campbell, Dinca *Angew. Chem. Int. Ed.* **2016**, *55*, 3566-3579.

Making devices: as easy as drawing on paper





Campbell, Sheberla, Liu, Swager, Dincă, M. *Angew. Chem. Int. Ed.* **2015**, *54*, 4349-4352.

Campbell, Liu, Swager, Dincă, *J. Am. Chem. Soc.* **2015**, *137*, 13780.

World's first non-carbon based supercapacitor!

Watch at
https://nsf.gov/nsb/meetings/2016/0505/Presentations/DincaSlide11Video

Sheberla, Bachman, Elias, Shao-Horn, Dincă, *submitted.*

Nothing would get done without them!

the dincă group

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