

How Metal Organic Frameworks Can Be Used As Carbon Capturing Technologies



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Introduction: A Solution to Carbon Emissions

- Global climate change caused by greenhouse emissions is a huge issue.
- Current techniques to reduce emissions are very effective but have Very high energy cost
- Metal Organic Frameworks are aiming to capture emissions at a cheap and energy saving mark.

Easy Carbon Capture Through Selective Interactions

- Can be made to selectively uptake carbon dioxide
- There are three things that could affect direct air capture rate:
 - i. Modifications to the metal unit
 - ii. Modifications to the linker unit
 - iii. Confinement of solvents within MOFs
- Hybrid membranes need to be made with materials that can both capture CO₂ but also maximize adhesion and solubility.
- Minimize the sieve-in-a-cage morphology that impacts the gas selectivity.

MOF	Solvent/amount	CO2 Uptake wt % [a]
InOF-1	-	5.4
InOF-1	Water/20 % RH	11
InOF-1	MeOH/2 %	6.9
InOF-1	EtOH/2.6 %	14.1

Energy and monetary incentives grapple chemical “cages”

- MOFs provide excellent entrapment of CO₂ due to their high adsorption capacities.
- Can compete with Amine Scrubbing such as Diamine functionalized Mg₂(dobpdc).
- The cheap synthesis and low energy cost may allow MOFs to become more widespread

Background: A Cage and a Highway

- Metal Organic Frameworks(MOFs) are crystalline selectively porous materials
- They act as a “highway” for different compounds.
- Large surface area allows space for particles to become “trapped” once inside of the molecular cage.

- Shows the cage like structure of MOFS

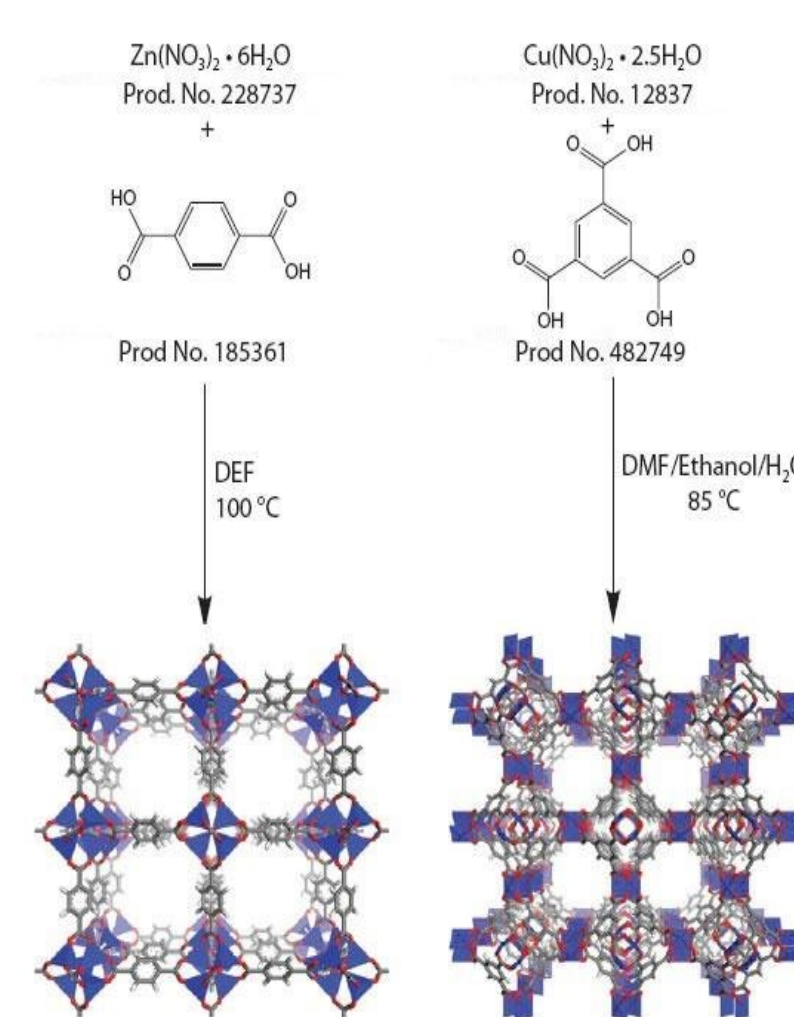
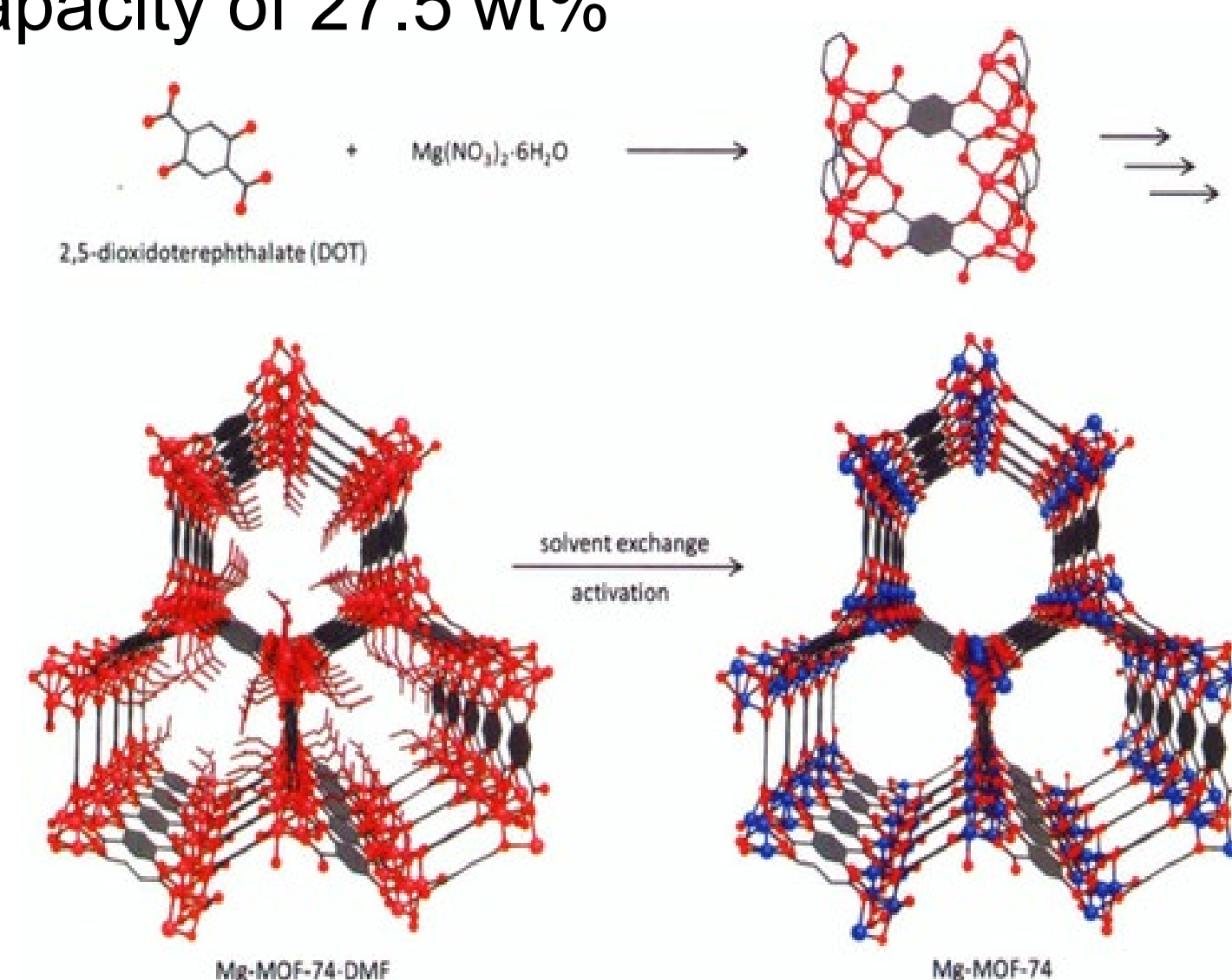


Figure 1: Mg-MOF-74 exhibits the highest reported CO₂ adsorption capacity of 27.5 wt%



Key Points: Cost, Selectivity, & Adsorption

- MOFs are a cost effective way to pull carbon emissions.
- MOFs must have high CO₂ selectivity and adsorption capacities.
- Low energy method needed to desorb the CO₂ out of the MOF afterwards to compete with current techniques

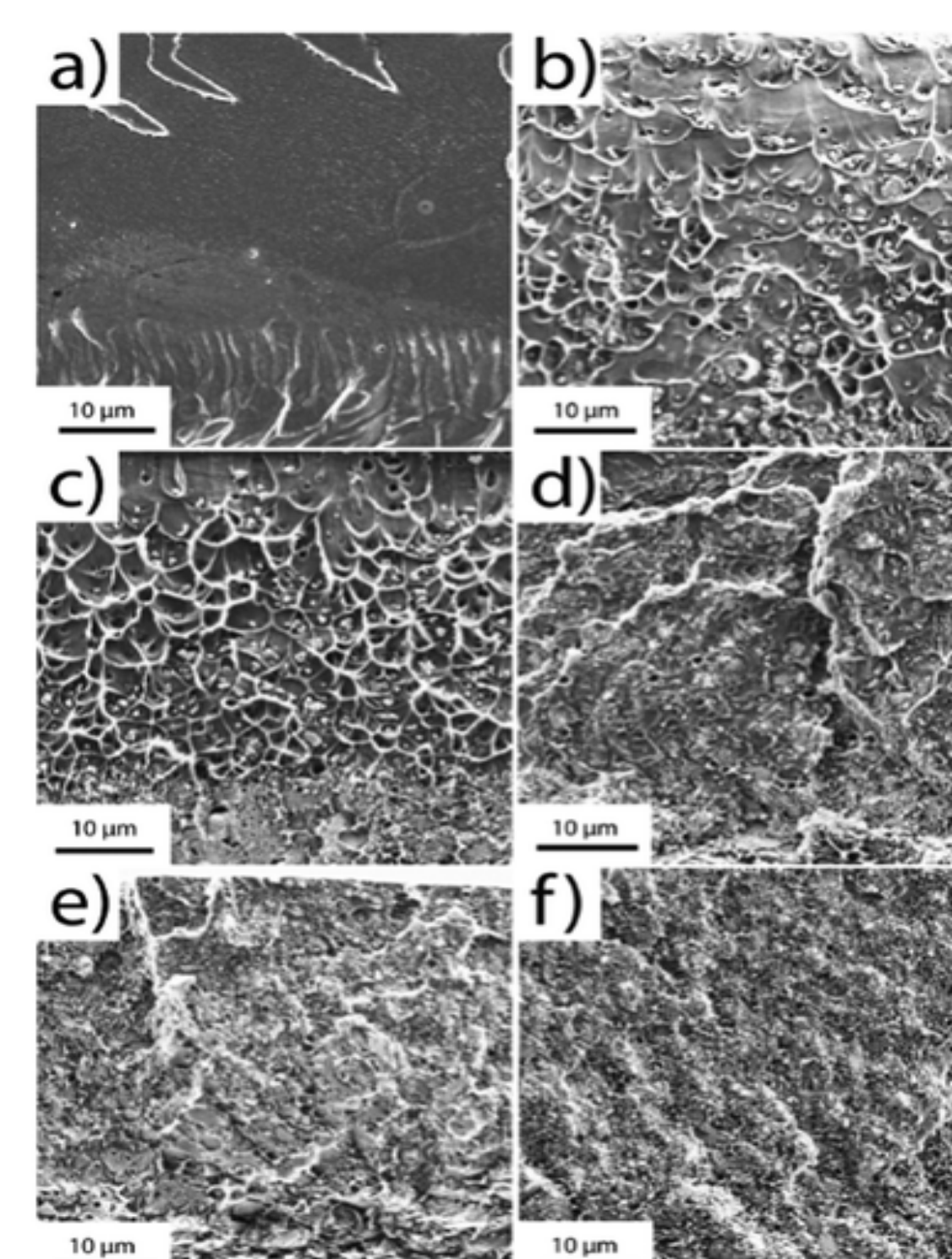
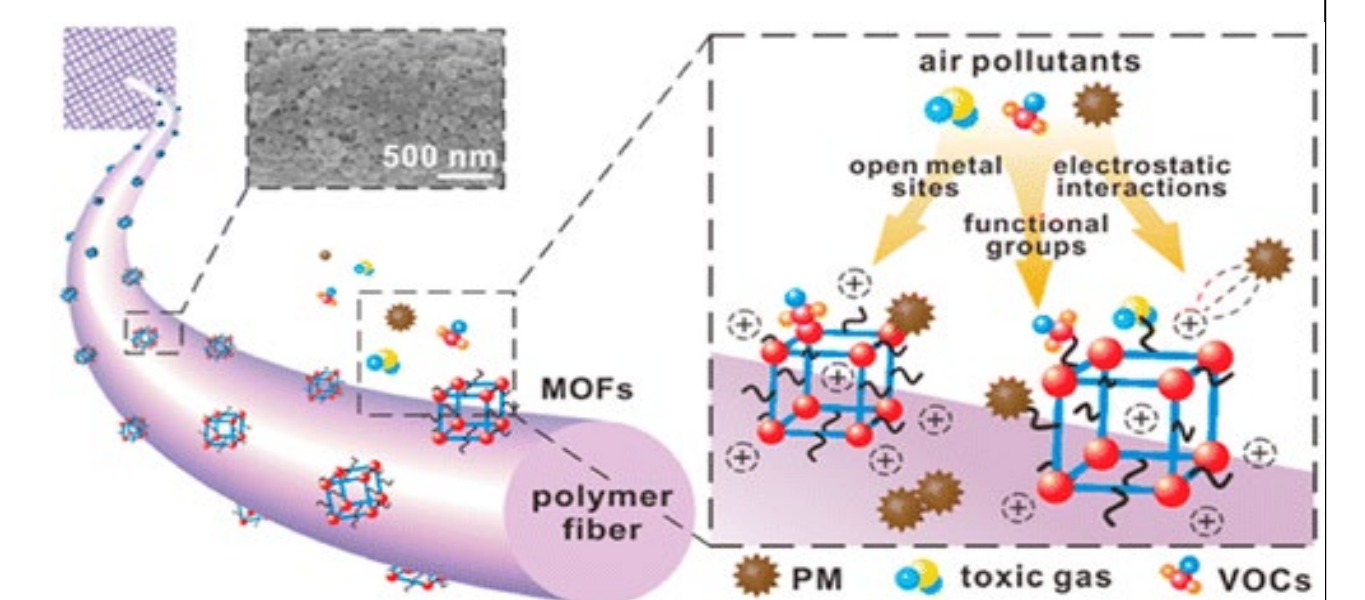


Figure 2:
a) Polysulfonone polymer not coated with UiO-66-NH₂ MOF

e and f) over 40% UiO-66-NH₂ makes an interconnected framework

The Next Technique in Industry

- The future of MOFs is the large scale implementation of MOF coated filters currently being researched
- highly selective and adsorbent MOFs to replace current post combustion CO₂ Amine Scrubbing Techniques.



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