Synthesis of Fluorinated Inorganic – Organic Materials for Hydrogen Storage

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Research solving "REAL" World Problems

Real World	Research
	
In need of a cleaner alternative!	Hydrogen could be the answer!

Research Goals

- Synthesize new porous materials that will absorb hydrogen (H_2) strongly.
- Determine if absorption capacity or strength of hybrid structures is increased by use of fluorinated linkers (organic compounds).

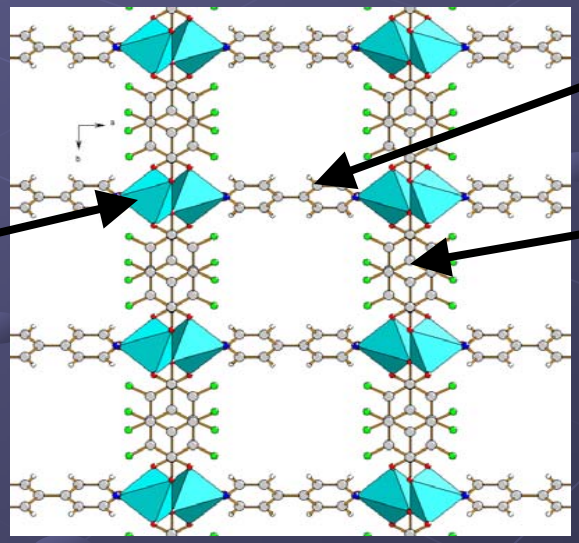
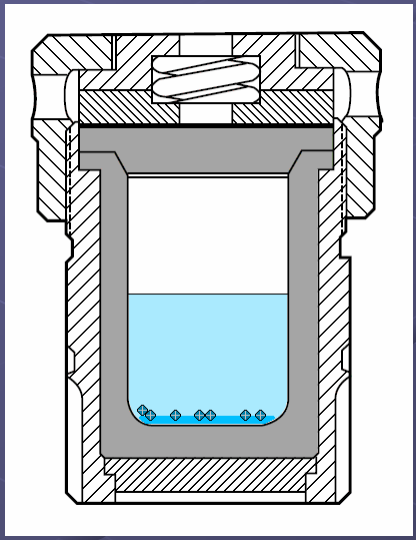


Photo courtesy of UCSB

Reactions

- Reaction of metal salt, organic linkers, and solvent in closed vessels
- Heat at 100-150 °C for 2 days
- Filter and wash solid

- Reaction conditions varied to get single crystals

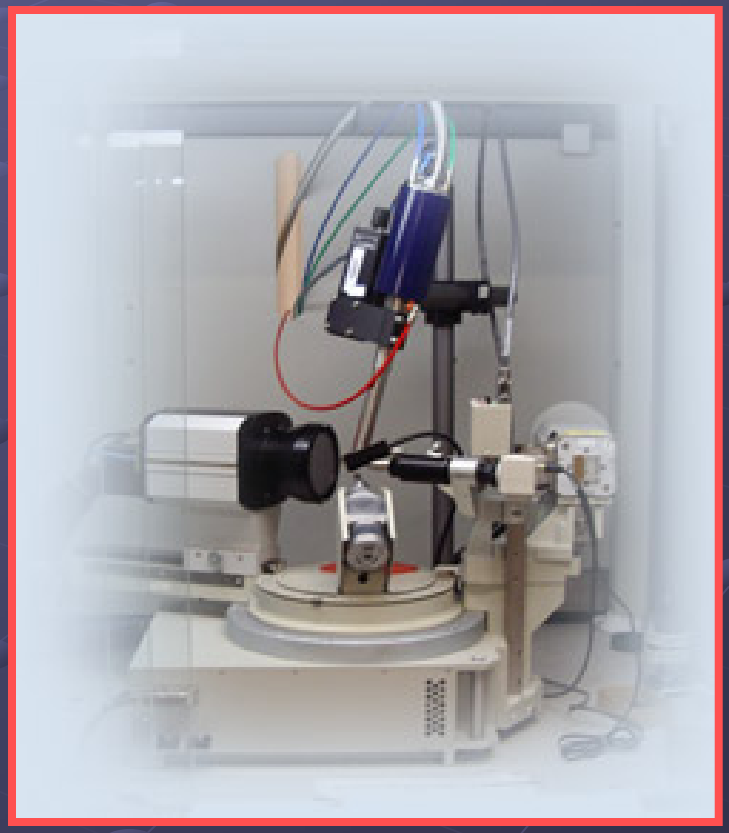


Teflon-lined stainless steel autoclaves

Single crystal X-Ray Diffraction

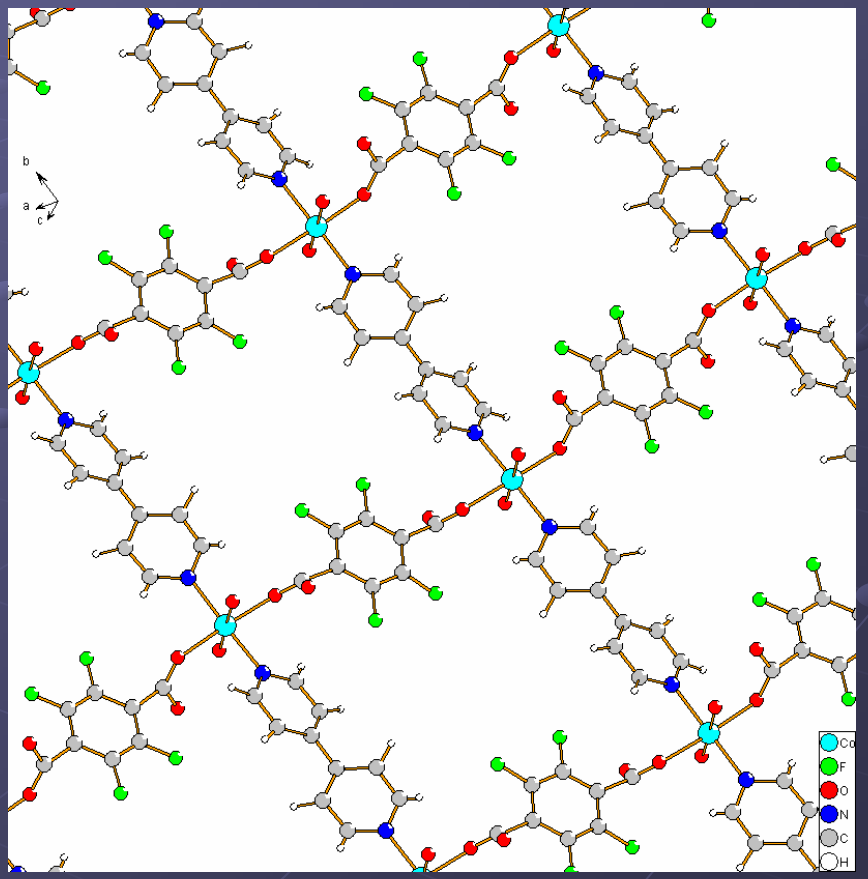
- Best method for determining crystal structure of solids
- X-rays reflected by repeating planes of atoms in structure

1. Obtain a good crystal!
2. Mount on fiber and align in X-ray beam
3. Collect diffraction data at all angles and orientations
4. Computer programs used to integrate data and refine structure



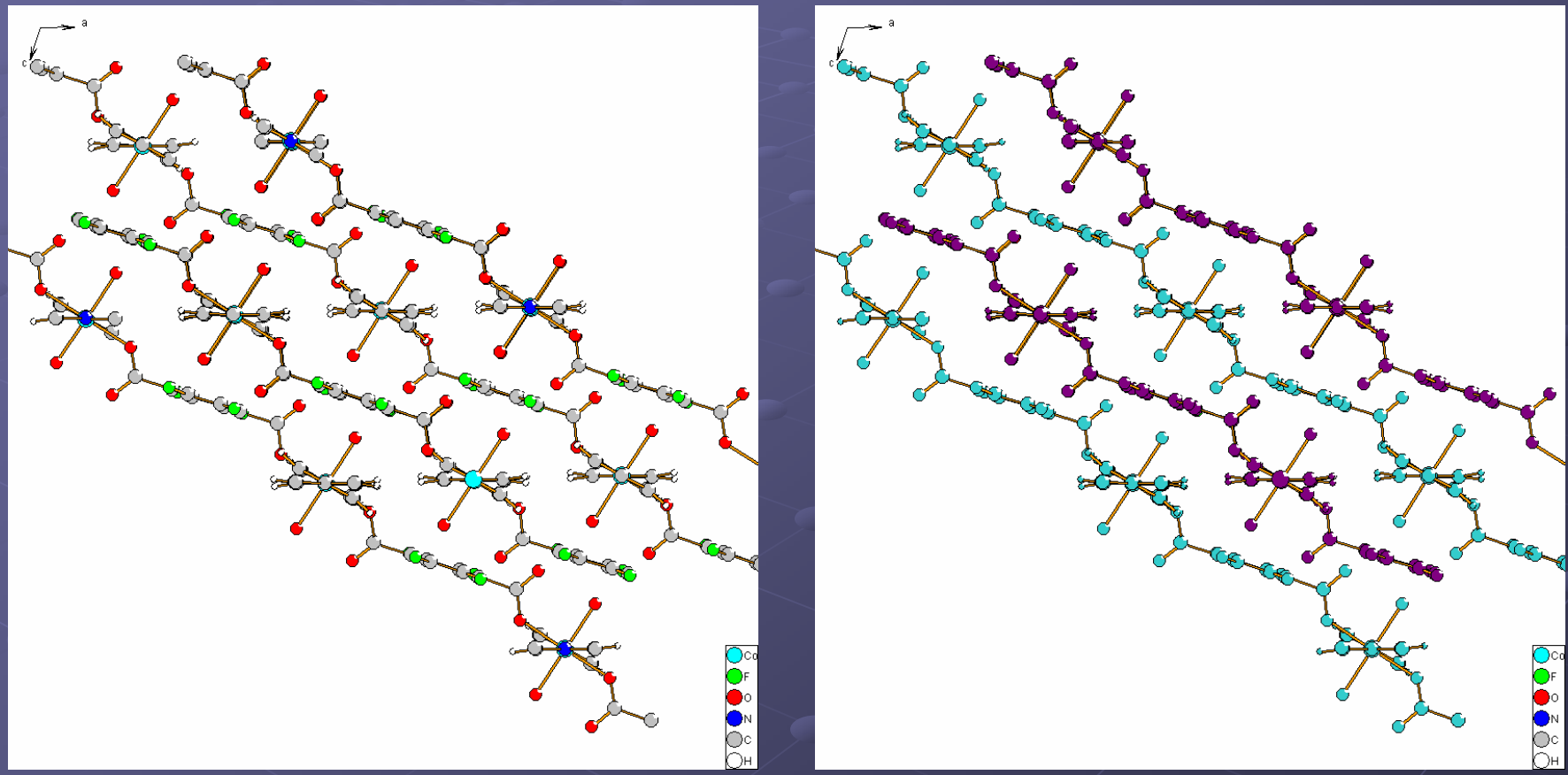
$Co(tpa)(bpy)(H_2O)_2$

- 0.4 mmol $Co(acetate)_2$,
  0.2 mmol tetrafluoroterephthalic acid (tpa),
  0.1 mmol bipyridine (bpy),
  3 mL H_2O
  125° C for 2 days
- Layered structure—not porous



(view of single layer)

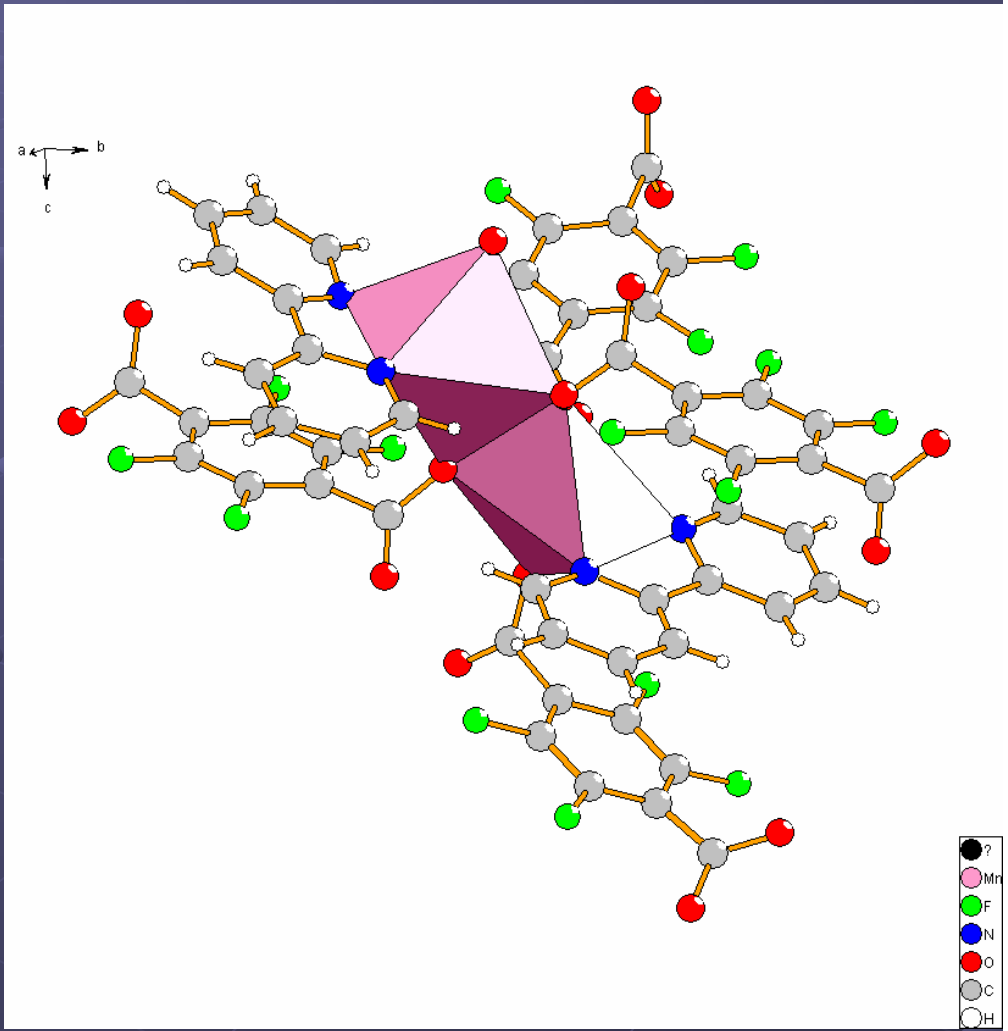
$Co(tpa)(bpy)(H_2O)_2$



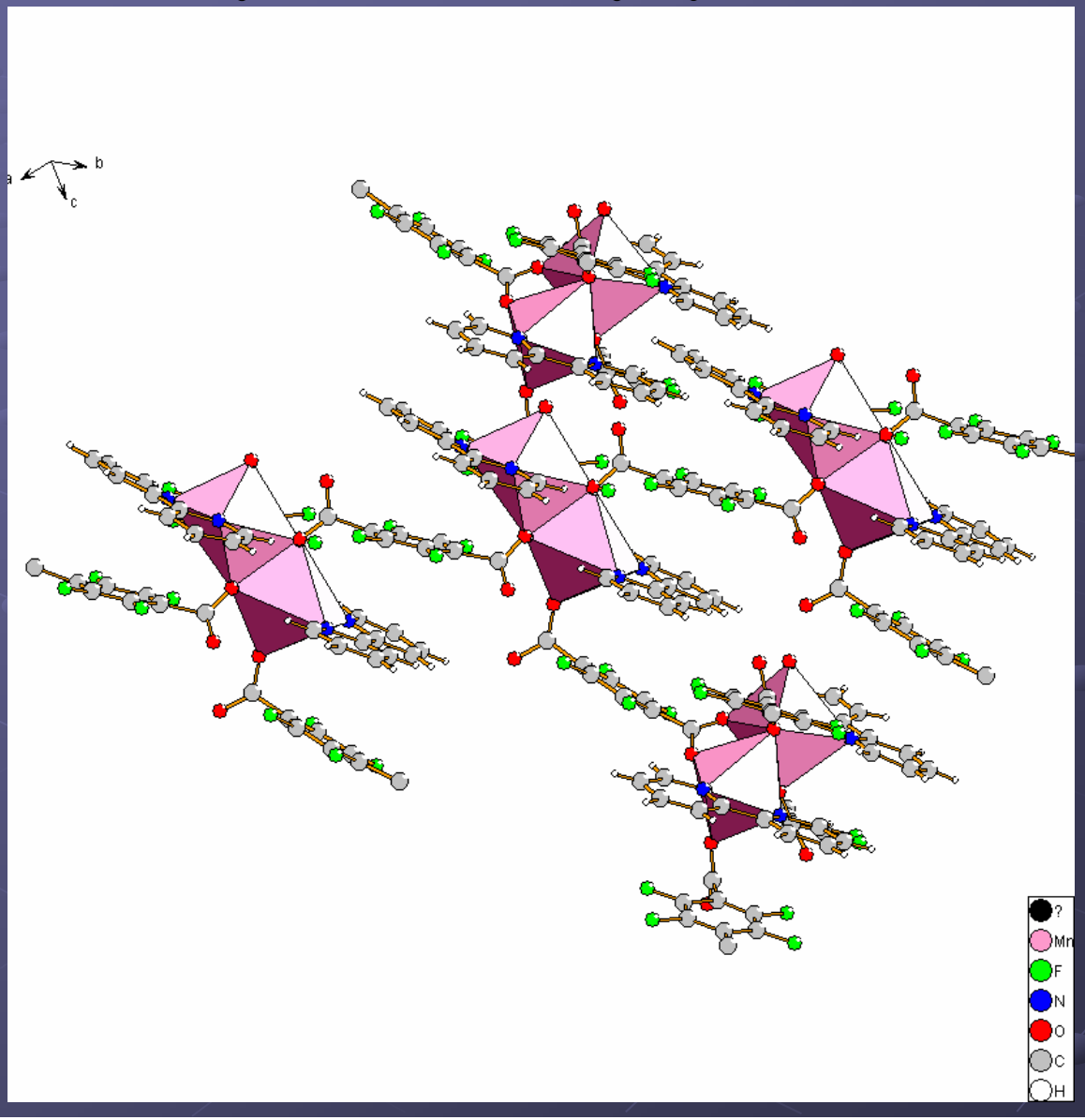
View of layer stacking

$Mn_2(tpa)_2(bpy)_2(H_2O)$

- 0.4 mmol $MnCl_2$,
  0.2 mmol tetrafluoroterephthalic acid (tpa),
  0.1 mmol bipyridine (bpy),
  3 mL H_2O
  100 ° C for 2 days
- Potential for porosity if water can be removed without decomposition



$Mn_2(tpa)_2(bpy)_2(H_2O)$



Summary & Future Work

- Synthesized two new materials
- Continue to synthesize similar structures using bipyridine, fluorinated acids, and metals

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