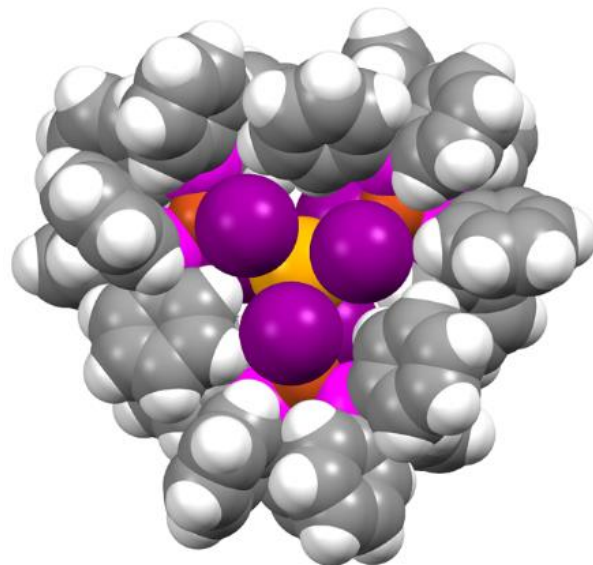


Research in the Pike Lab

What We Do:

Synthesis and characterization of inorganic complexes

- X-ray crystallography
- NMR (^1H , ^{13}C , and ^{31}P)
- Atomic absorption spectroscopy
- Infrared spectroscopy
- Thermogravimetry
- Fluorescence spectroscopy
- Crystallization
- Hydrothermal reactions
- Inert atmosphere methods
- Mass spectrometry



An X-ray Structure: $[\text{Cu}_6\text{I}_6(\text{P}(\text{OPh})_3)_6]$

Research Goals:

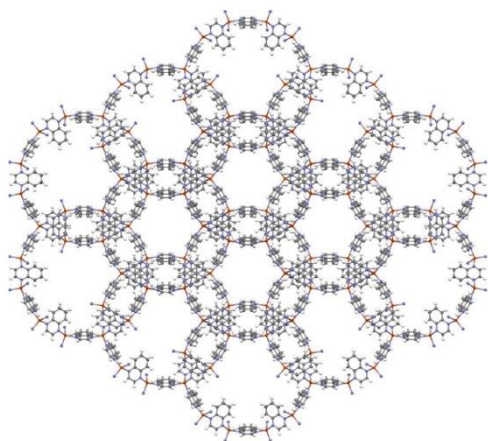
- Environmental sensors
- Environmental control
- Photoemissive devices
- Optical data storage materials

Communication of Results:

- publication of results
- presentations at conferences
- annual research symposium
- weekly summer group meetings

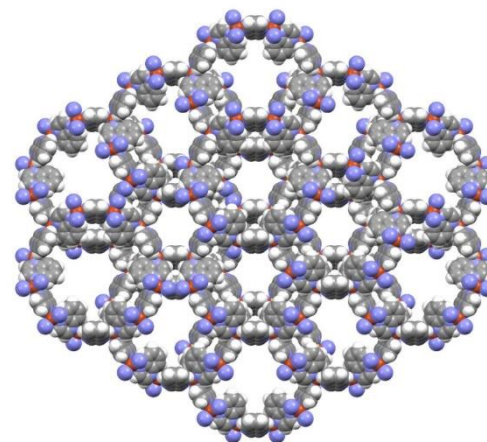
Metal-Organic Materials

Metal-organic materials consist of metal ion “nodes” and organic or inorganic linker ligands (Lewis bases). They usually self-assemble from these components, forming molecules or polymeric networks.



Characteristics:

- Porous
- Reactive
- Redox active
- Chiral
- Photoactive

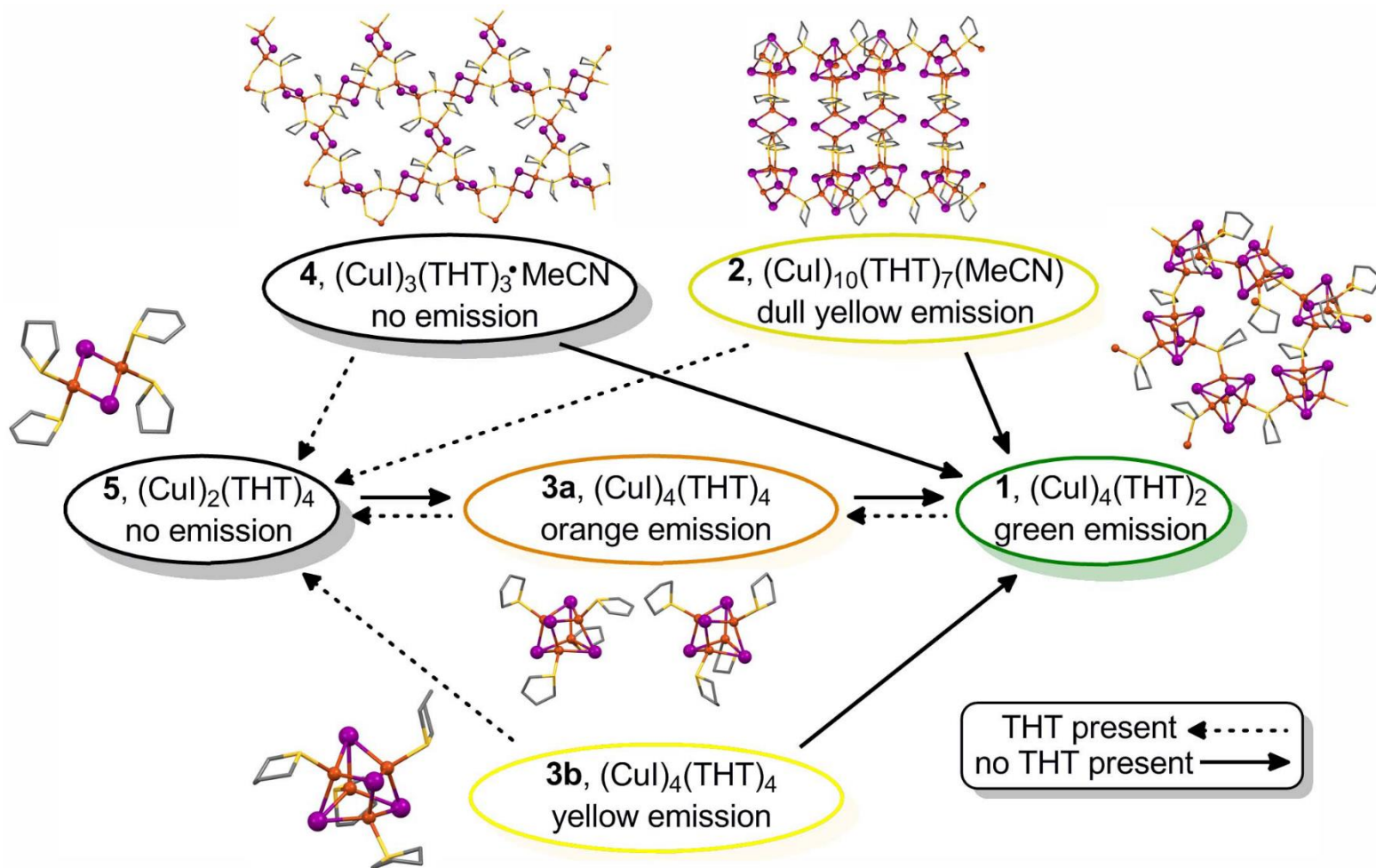


Applications:

- Separations
- Catalysts
- Sensors
- Displays
- Electronics

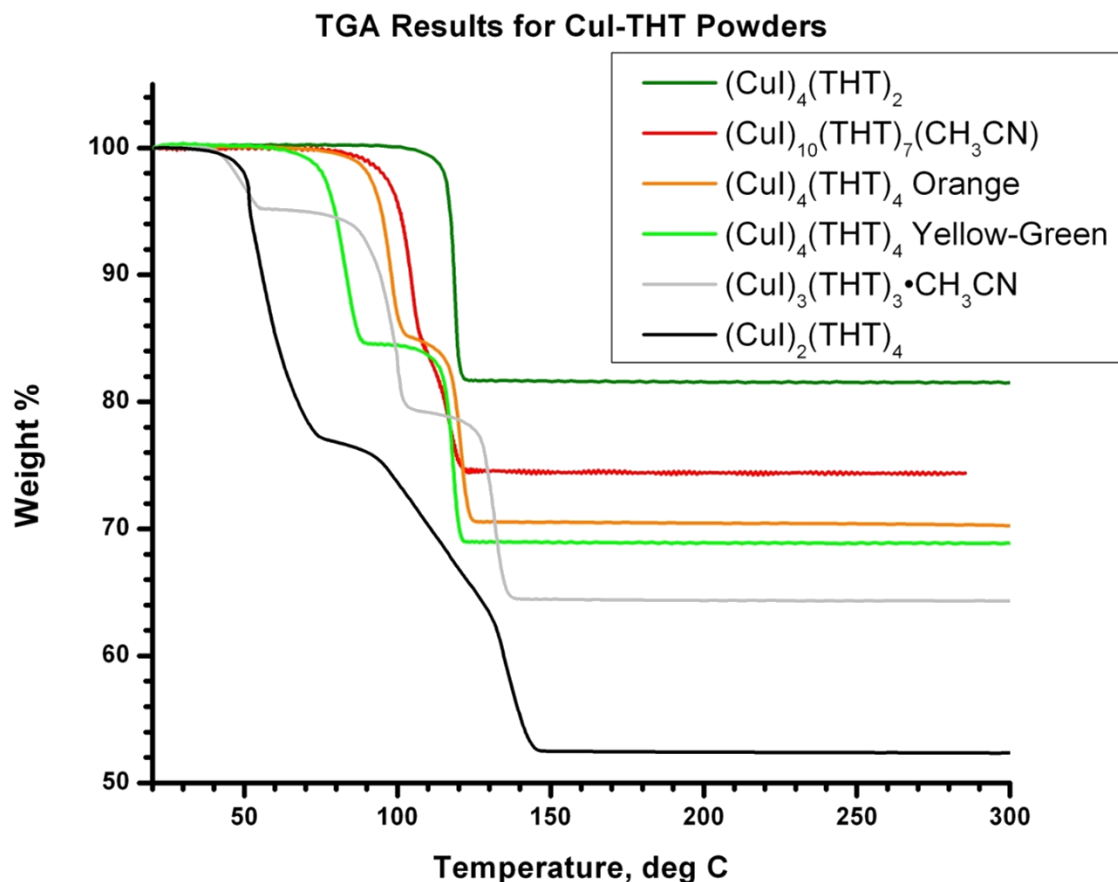
Network Types Vary with Metal-Ligand Ratio

Example: CuI networks with tetrahydrothiophene (THT)



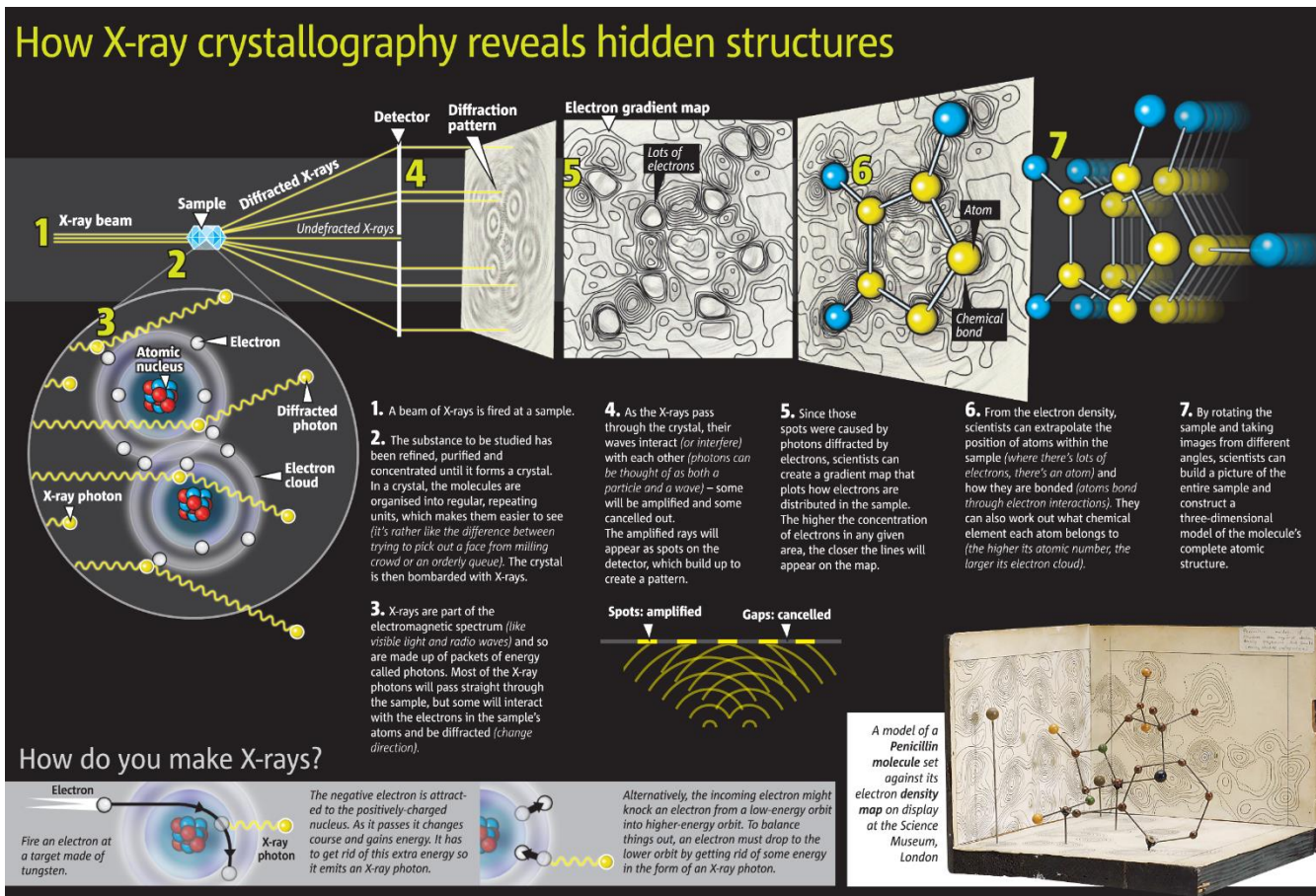
Thermal Analysis

Percent mass loss determined using thermogravimetry (TGA), which is a microbalance in a furnace. In this case all final masses after THT loss closely match the theoretical mass value for CuI

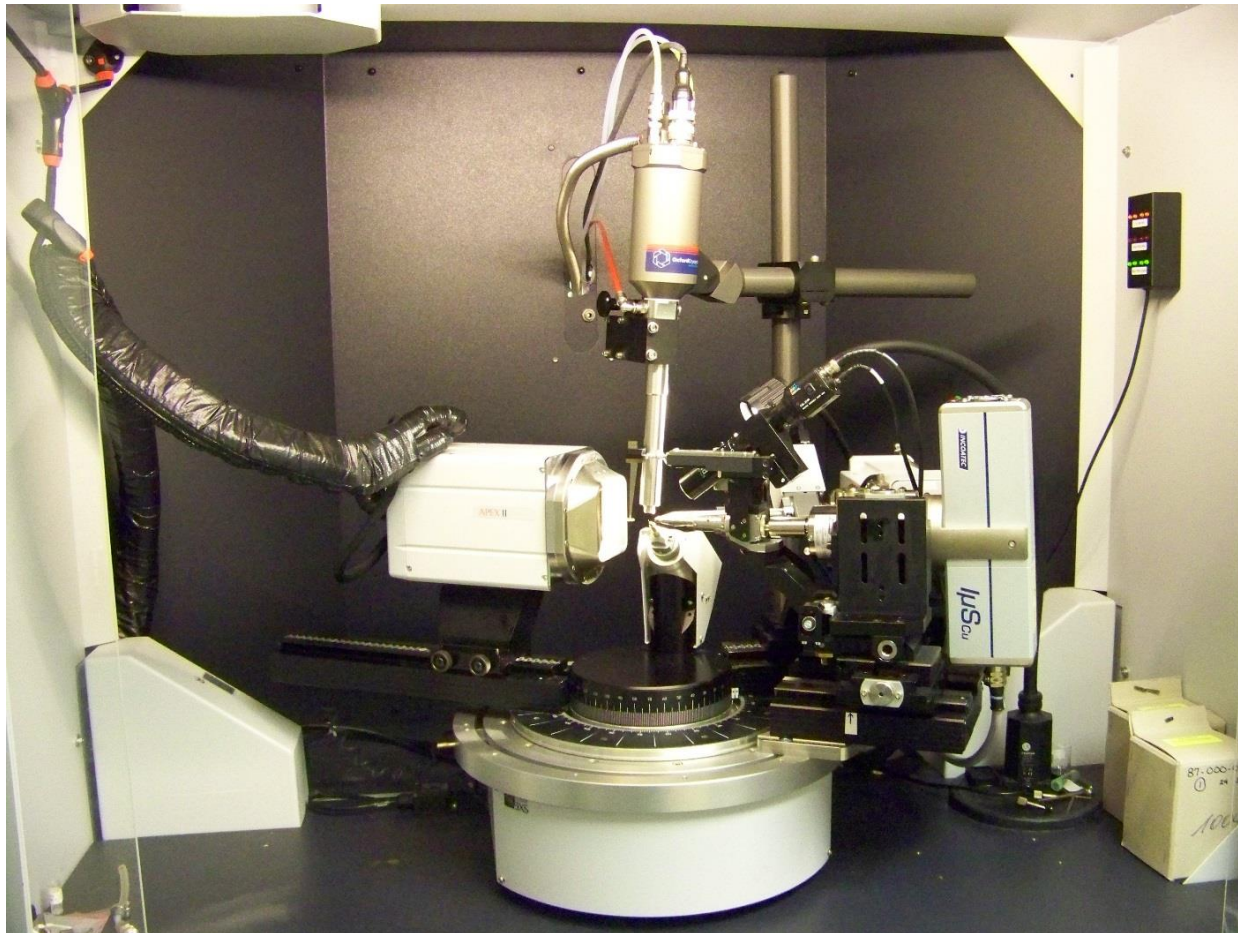


X-Ray Crystallography

Structure determination technique in which atom locations are determined through diffraction of X-rays from repeating atom layers in a crystal

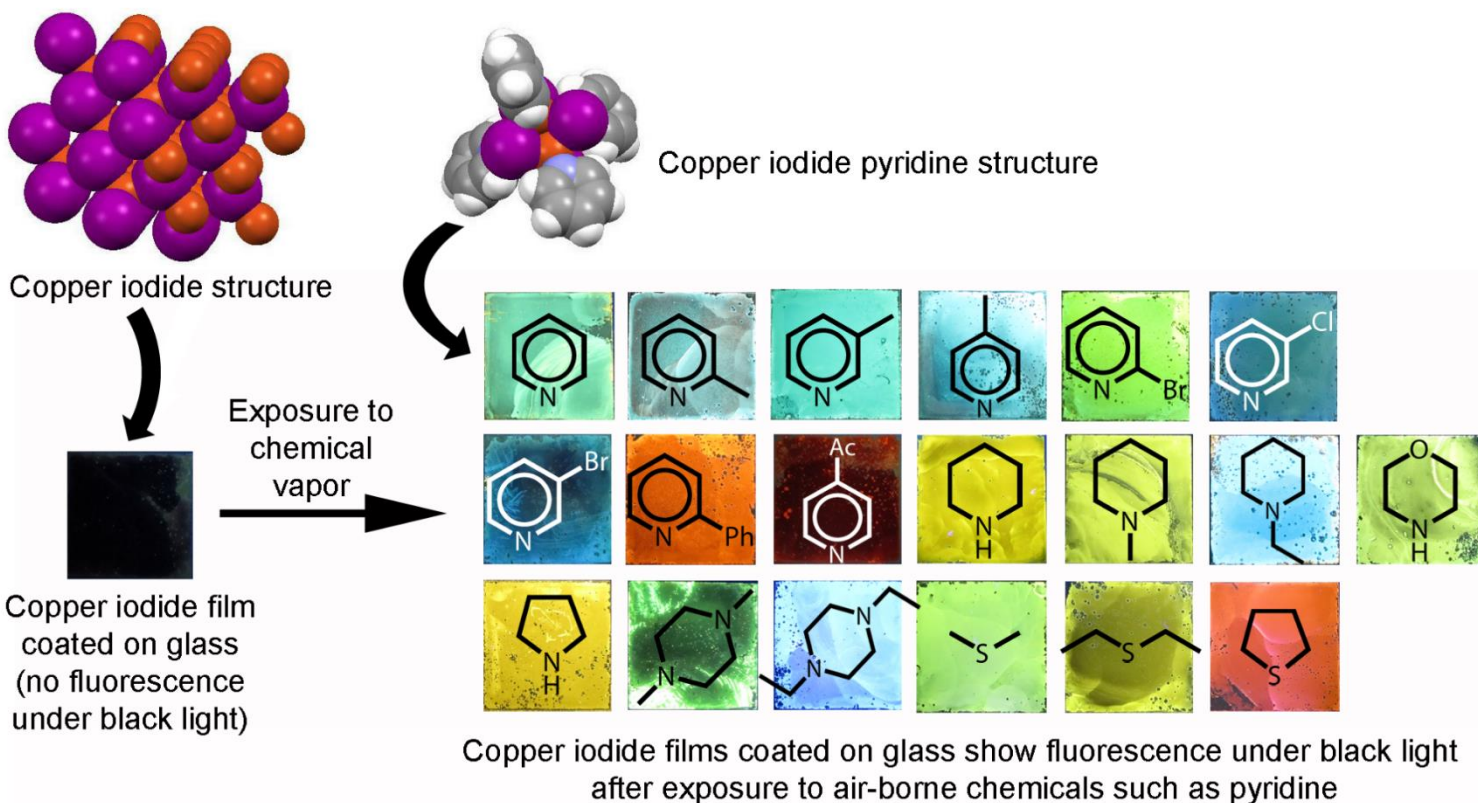


Our X-Ray Equipment: Bruker Apex DUO



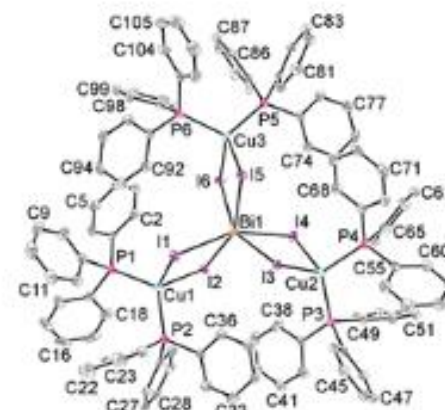
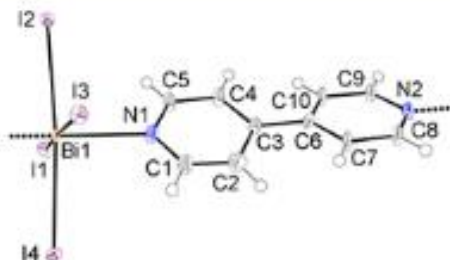
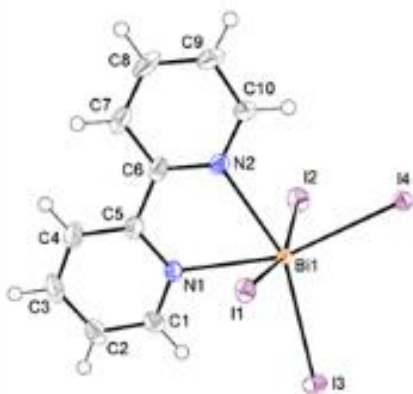
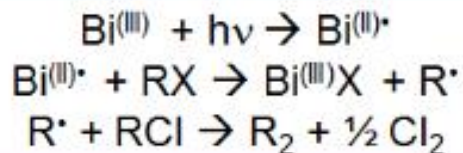
Network Materials as Environmental Sensors

Copper(I) iodide produces a photoluminescence emission response with sulfur and nitrogen compounds

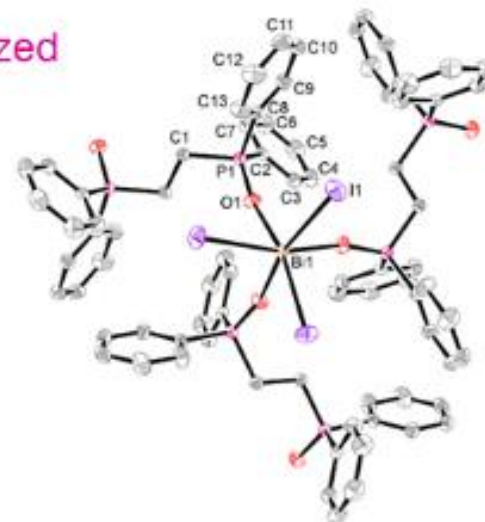
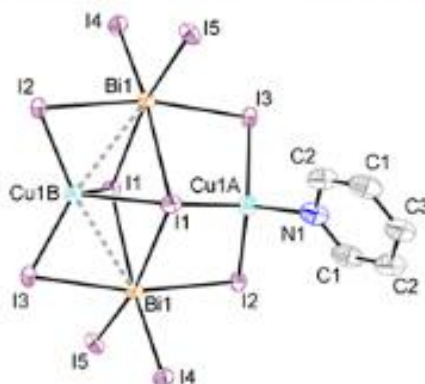
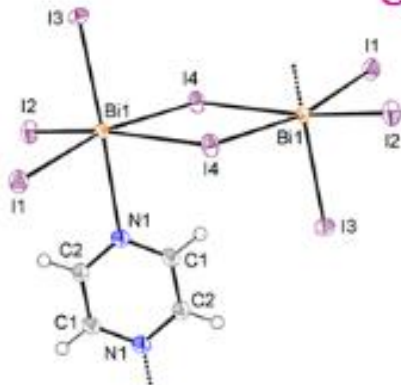


Bi(III) Compounds in Pollution Control

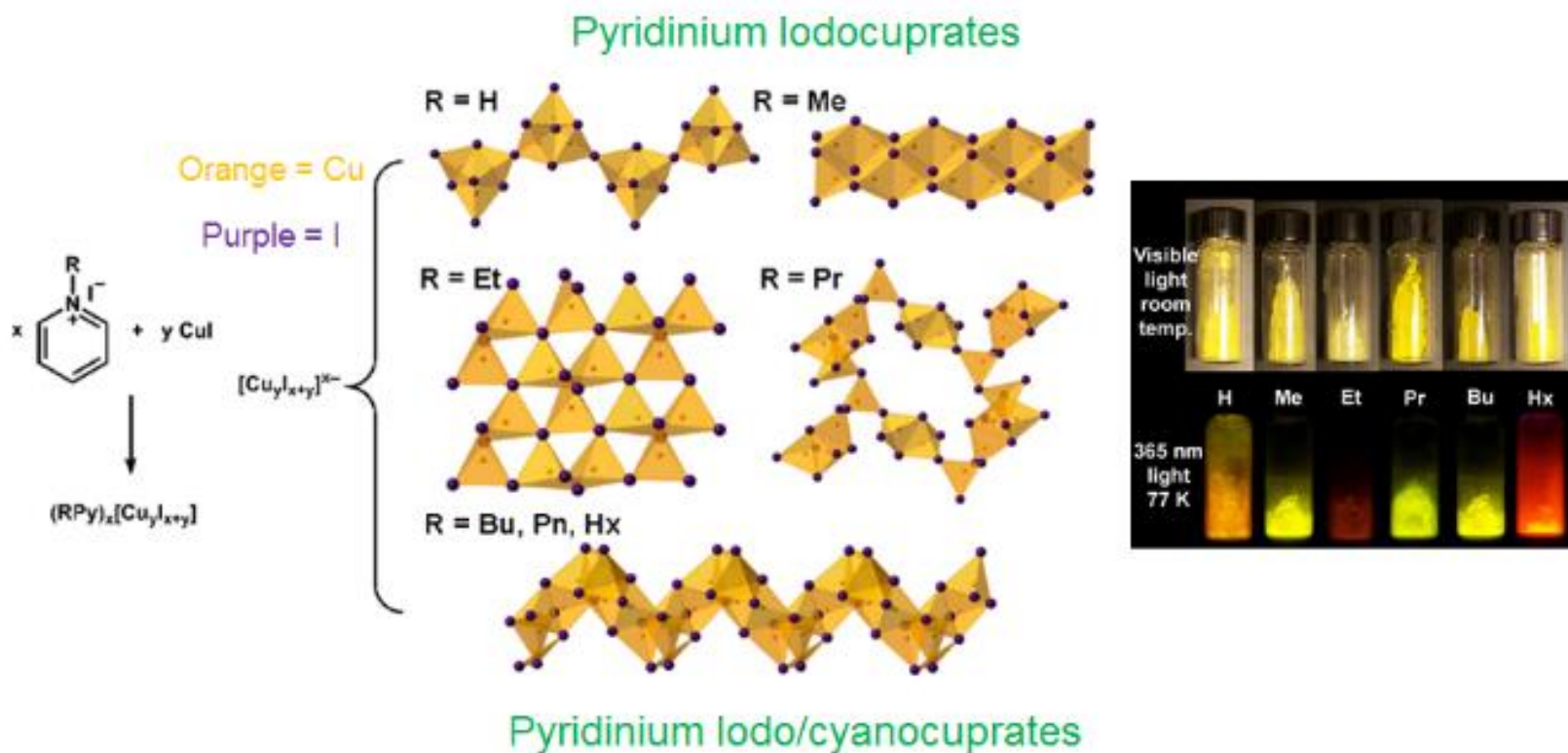
Photoreduction of Bismuth produces radicals that can destroy organic molecules



Some bismuth complexes synthesized

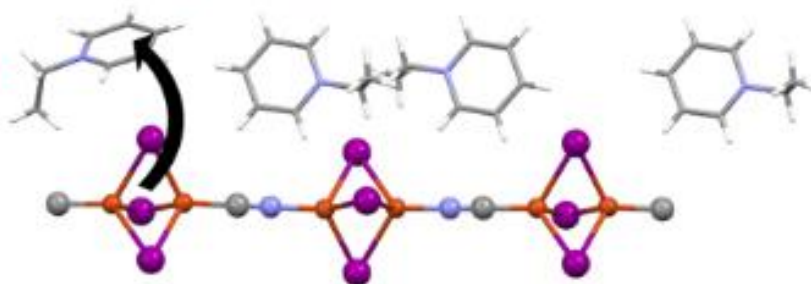


Charge Transfer in Cuprate Salts



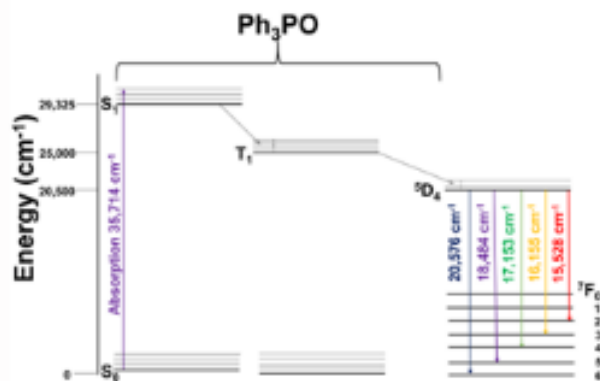
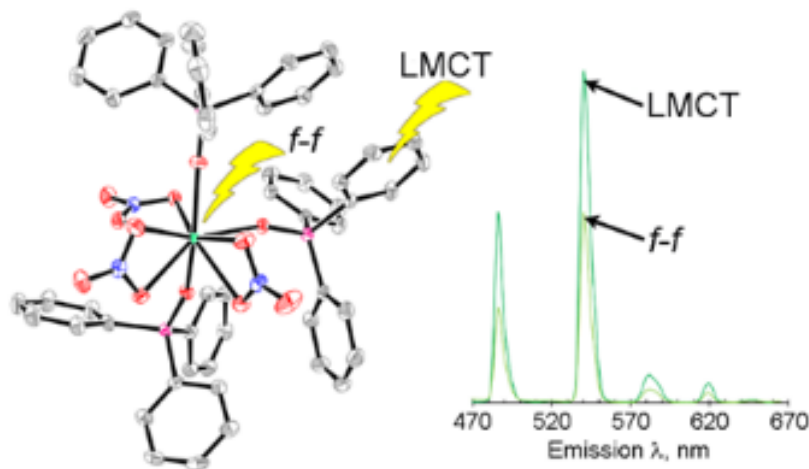
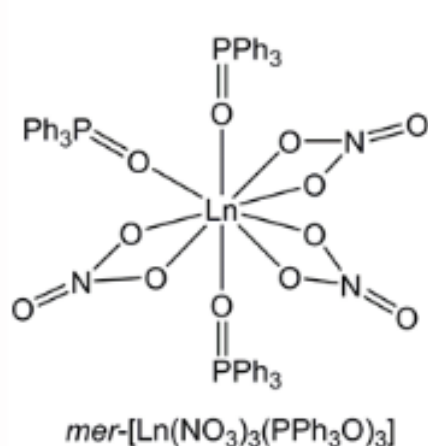
Electron-deficient pyridinium cation

Electron-rich iodocuprate(I) anion



Lanthanide “Antenna” Complexes

Lanthanide ions are used as phosphors in LEDs
Enhancing their energy conversion would improve LED performance



Aromatic rings in triphenylphosphine oxide (PPh₃O) ligand act as an “antenna” absorbing photon energy and transferring it to emissive f-orbitals in lanthanide ions via ligand-to-metal charge transfer (LMCT)

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