Dithienylethene Based Crystalline Solids

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Metal-Organic Frameworks (MOFs) have become prevalent throughout the scientific community as solid-state materials comprising a metal center or a secondary-building unit (SBU) and multi-topic organic linkers creating an extended network in one-, two-, or three-dimensions. MOFs, as synthesized, are intrinsically porous materials and frequently participate in guest-host exchange. This property has made MOFs excellent candidates for separation chemistry, heterogeneous catalysis, and gas sequestration. Recently, much focus has been directed towards transforming MOFs from passive to active materials through incorporation of small molecules that respond to external stimuli. Light is the most attractive external stimulus as it can be fine-tuned and provides both excellent spatial and temporal resolution. Dithienylethenes (DTEs) are a robust class of photochromic molecules that are well known for their reversible light-induced photoisomerization and intrinsic thermal stability. By functionalizing DTEs with coordinating groups such as pyridines or carboxylic acids, they can be directly integrated into the lattice of MOFs providing a way to control the local-chemical environment around the pores with light. With this in mind, our group is interested in the design, synthesis, and characterization of a series of DTEs containing both cyclic and acyclic backbones with 4-pyridyl functionality at the thiophene to aid in providing crystallographic resolution for the linkers after integration into the frameworks using Single-Crystal X-ray Diffraction. In addition to producing these photo-active MOFs, our group is also interested in producing co-crystals containing DTEs. While many successful attempts at growing crystals containing DTEs have been made, none containing an acyclic DTE have been photo-active. Our group is now determined to understand what role the nature of the DTE backbone plays into formation of photo-active crystalline solids.