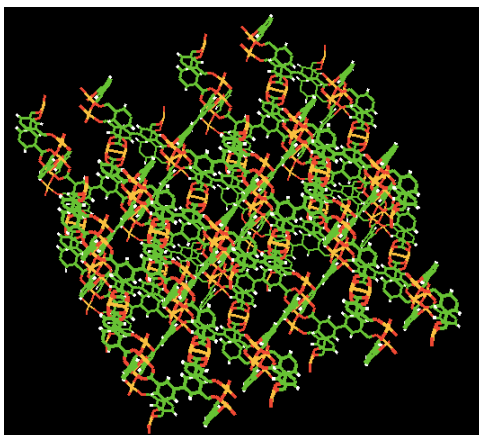


MOF 505

Composition and Creation:

Metal-organic framework 505, also known as MOF 505, is a porous material that is capable of absorbing significant amounts of gas. It is composed of copper, hydrogen, oxygen and carbon. The copper, carbon, and oxygen bond together to form $\text{Cu}_2(\text{CO}_2)_4$, which are “paddle wheel” shaped units. These further bond with benzene rings, which are carbon rings capped off with hydrogen at their ends. The MOF is not orthorhombic, which means that one of the angles is not 90 degrees. It is actually 120 degrees, which means that the MOF-505 bonds to other unit cells at an angle, instead of in the typical lattice structure seen in other MOFs. These components combined with its porous structure make the MOF a primary candidate for hydrogen and acetylene adsorption. This MOF is a man-made material created through synthesis. It is constructed by bridging its organic ligands that remain intact through synthesis. MOF-505 has a template that influences its structure. This is called the secondary building unit. It allows the MOF to have exposed metal sites, which encourages hydrogen binding to these sites.



This is a 2 by 2 by 2 supercell of MOF-505 simulated in Molden. The green represents carbon, white represents hydrogen, orange represents copper, and the red represents oxygen.

Uses:

MOF-505 is very useful for gas storage due to the exposed metal sites mentioned above. It is particularly useful for hydrogen and acetylene storage. It can have tremendous impact in industry and transportation. Acetylene is often difficult to store due to its volatility. MOF-505 offers a safer alternative to traditional methods of acetylene storage that are expensive and time-consuming. Acetylene is widely used in industry, mainly for welding and cutting due to the high temperature flame it produces. Therefore, MOF-505 would be a very useful material for storage. Experiments are currently being conducted to accomplish this now.

Recently, there has been a push towards using cleaner, renewable sources of energy. One such source is hydrogen. Hydrogen, when used in fuel cells to power vehicles, produces no pollutants. However, when ignited and combined with oxygen, it is extremely explosive and dangerous. MOF-505, due to its exposed metal sites and tremendously high surface area, is capable of storing hydrogen safely. This makes it quite useful as a

material for hydrogen fuel cells. MOF-505 is a useful material for gas storage, particularly acetylene and hydrogen, and could potentially revolutionize transportation and industry.

Works Cited

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