SELECTIVE CARBON MONOXIDE UPTAKE VIA METAL CARBANION FUNCTIONALIZED METAL-ORGANIC FRAMEWORKS

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PATENT STATUS

Country	Type	Number	Dated	Case
Patent Cooperation Treaty	Published Application	WO 2025/029669	02/06/2025	2023-160

Additional Patent Pending

BRIEF DESCRIPTION

The challenge of selectively capturing carbon monoxide from complex industrial gas streams has been addressed through the development of a new class of highly porous materials. By engineering specific metal carbanions into the MOFs, UC Berkeley researchers have created binding sites that mimic the sophisticated coordination chemistry found in biological systems. This framework, which utilizes a divalent metal and a carbon-based substituent such as alkanes or alkenes, allows for the precise and selective adsorption of CO2 even in the presence of competing molecules such as nitrogen or carbon dioxide. This molecular-level customization enables the material to function as a "chemical sponge" that can be tuned for various industrial separation and purification environments.

SUGGESTED USES

- Syngas Purification: Removing CO2 from synthesis gas streams to produce high-purity hydrogen for fuel cells or chemical synthesis.
- Industrial Gas Separation: Concentrating CO2 from industrial off-gases (like steel mill exhaust) for use as a chemical feedstock in the production of polymers and acetic acid.
- Air Quality Monitoring: Integration into high-sensitivity sensors for detecting CO2 in industrial or residential environments where high selectivity is required to avoid false positives.
- Life Support Systems: Use in specialized breathing apparatuses or enclosed environments (like submarines or spacecraft) to scrub toxic CO2 levels.
- Petrochemical Refining: High-purity separation of CO2 from hydrocarbon streams where traditional cryogenic distillation is energy-intensive.

ADVANTAGES

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Exceptional Binding Affinity: The metal carbanion sites provide a significantly stronger and more selective interaction with CO than standard physical adsorbents.

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OTHER INFORMATION

CATEGORIZED AS

» **Energy**
» Other
» **Materials & Chemicals**
» Chemicals
» Other
» **Research Tools**
» Other
» **Sensors & Instrumentation**
» Environmental Sensors
» Scientific/Research

RELATED CASES

2023-160-0

Molecular Tunability: Adjusting the carbon substituent (R) allows for the optimization of binding strength based on specific operating temperatures and pressures.

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High Chemical Stability: The $MFU-4l$ architecture is robust, ensuring the material maintains its structural integrity over repeated adsorption-desorption cycles.

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Reduced Energy Footprint: Selective capture at near-ambient temperatures eliminates the high energy costs associated with traditional cryogenic separation methods.

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High Active Site Density: The porous nature of the MOF provides a massive surface area, maximizing the CO uptake capacity per gram of material.

RELATED MATERIALS

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Next-Generation Metal-Organic Frameworks With High Deliverable Capacities For Gas Storage Applications
- Porous Polymer Networks For Per- And Poly-Fluoroalkyl Substance Separations
- Structures and Apparatus using Three-Dimensional Linked Networks
- Gas Separations With Redox-Active Metal-Organic Frameworks
- Metal-Organic Frameworks For Aromatic Hydrocarbon Separations
- Novel Porous Organic Polymers for Ammonia Adsorption
- Isothermal Carbon Capture And Release Of Carbon Dioxide With Molecular Polyamines
- Selective Nitrogen Adsorption Using a Vanadium Metal-Organic Framework
- Metal-Organic Frameworks for H2 Adsorption and Drug Delivery
- Redox-Active Metal-Organic Frameworks for the Catalytic Oxidation of Hydrocarbons
- Phase Change Adsorbents For Storage And Separation Applications

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