Dual-purpose hybrid nanomaterial captures and converts carbon dioxide into industrial chemicals and fuel

Technology #cu12036

Carbon capture technologies are attractive solutions for combatting greenhouse gas emissions. This technology is a hybrid nanomaterial composed of polymer chains (canopies) grafted onto inorganic or organic nanoparticle cores. Amine and ether groups on the polymer chains provide carbon dioxide capture capacity, while the catalytic cores provide the electrical conductivity necessary to facilitate electrolysis. To perform carbon capture and conversion, gas laden with carbon dioxide is first passed through a reactor vessel containing the nanomaterial. Carbon dioxide captured by the functional groups on the polymer chains is then liberated by an elevation in temperature and reduced within the same vessel to produce industrial chemicals and fuel such as methanol via photoelectrochemical reactions.

Carbon capture and conversion can be performed in a single reactor without corrosive solvents or high pressure

Carbon dioxide captured by the nanomaterial is released via a temperature switch and converted within the same reactor vessel to the desired reaction products by the catalytic core. Since the core and polymer chain materials can be engineered for various reactions, carbon dioxide capture media do not need to be pumped to a second vessel between each capture/conversion cycle. In addition, the solvating properties of the polymer chains eliminate the need for corrosive solvents such as monoethanolamine (MEA). Finally, the negligible vapor pressure of the nanomaterial allow it to be used at high temperatures without a high-pressure reactor.

Lead Inventor:

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Applications:

- Capture and conversion of carbon dioxide into industrial chemicals and fuel such as methane and methanol.
- Other chemical reactions that would benefit from low vapor pressure, such as biomass conversion.

Advantages:

- Can simultaneously reduce atmospheric carbon dioxide and produce industrial chemicals.
- Multi-purpose core and polymer chain materials allow CO2 capture and conversion to be performed in a single reactor, thereby reducing operating costs.
- Can be used at high temperatures without a high-pressure reactor due to the low vapor pressure of the nanomaterial.
- Less corrosive than aqueous amine solutions such as monoethanolamine (MEA) and can be produced using readily available and environmentally friendly compounds such as silica and common polymers.

Patent information:

Patent Pending ([WO/2013/022894](http://example.com/wo2013022894))

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Related Publications:


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