Materials & Chemicals

Nanofluid Suspension Electrodes for the Rapid Capture and Conversion of CO2 to Fuels

WiSys: T230009US02

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WiSys is seeking strategic partners in the chemical manufacturing industry for commercialization of this innovative technology.

Overview

The accumulation of carbon dioxide (CO_2) in the atmosphere is a major contributor to climate change, prompting the development of technologies aimed at reducing emissions. While carbon capture and storage has been the primary focus, CO_2 is also a non-toxic and abundant compound that can serve as a low-cost or even negative-cost feedstock for industrial processes. With the expansion of renewable energy sources like solar and wind, there is growing potential to use clean electricity to convert captured CO_2 into valuable chemicals and fuels. This approach supports a circular carbon economy and aligns with the increasing market demand for sustainable products in sectors such as energy, agriculture, and chemical manufacturing. Despite this opportunity, current CO_2 conversion technologies face significant limitations. Most rely on solid-state or gas-diffusion electrodes, which suffer from low catalytic surface area, poor mass transport, and operational issues like fouling and degradation. These constraints lead to a trade-off between efficiency and production rate, making it difficult to scale these systems economically.

The Invention

Researchers at the University of Wisconsin–La Crosse have developed a novel nanofluidic system that captures and electrochemically converts CO_2 into fuels using suspended catalytic nanoparticles, offering higher efficiency and scalability than traditional solid-state electrodes. This approach suspends catalytic nanoparticles—such as tin, copper, or nickel compounds—in a flowing liquid medium, forming a nanofluid that acts as both the CO_2 capture agent and the electrochemical catalyst. When CO_2 is introduced into the system, it binds to the functionalized nanoparticles and is subsequently converted into valuable chemical products through electrolysis. This fluid-based design significantly increases the available catalytic surface area, enhances mass transport, and allows continuous catalytic operation with high efficiency and scalability. The nanofluid can be easily regenerated and reused, offering a cost-effective and modular solution for transforming CO_2 into commercially valuable products.

Key Benefits

- Faster rate of conversion of CO2 compared to state-of-the-art electrochemical methods.
- Increased catalytic surface area.
- Reduced maintenance compared to solid electrodes, which degrade or foul over time.
- Enhanced product separation, with easy recovery of gases and liquids from the nanofluid.
- Reusability of the catalyst
- Customizable composition, allowing tailored performance for different products and operating conditions.

Stage of Development

- Materials & Chemicals : Catalysts

For current licensing status, please contact Allee Marti at amarti@wisys.org or 608-316-4037