

TECHBRIEF

SELECTIVE CO₂ CONVERSION WITH NOVEL COPPER CATALYST

OPPORTUNITY:

This invention describes the synthesis and application of nanostructured copper (Cu) catalysts that selectively convert carbon dioxide (CO₂) into carbon monoxide (CO). This technology is available for licensing and/or further collaborative research from the U.S. Department of Energy's National Energy Technology Laboratory.

CHALLENGE:

The electrochemical CO₂ reduction reaction (CO₂RR) is an appealing strategy for addressing man-made CO₂ emissions because it can leverage excess renewable energy to produce carbon-neutral chemicals and fuels. However, the economic viability of large-scale CO₂RR systems will depend on the ability to selectively and efficiently form desirable products. Because it is earth-abundant and can produce a variety of products, Cu is a popular CO₂RR catalyst. Unfortunately, the wide product distribution of Cu introduces inefficiencies in the form of chemical separation steps.

OVERVIEW:

NETL researchers have developed synthesis and application of nanostructured Cu catalysts that selectively convert CO₂ into CO, which is a major component of synthesis gas. Synthesis gas is important because it is a versatile chemical building block that can be processed into a wide range of commodity chemicals and products, including methanol, hydrocarbons, fuel additives and plastics.

Unlike most other Cu catalysts, which are very unselective, the NETL catalyst selectively produces CO, without the need for expensive metals like gold and silver. In fact, the NETL catalyst structure has shown a 10-60-fold enhancement in product selectivity with improved CO₂ conversion rates and reaction efficiency compared to currently commercially available materials and similar materials in the open scientific literature. The improvement in catalytic rates, efficiencies, selectivity and overpotential biases address core technical issues that have prevented the development of effective electrocatalytic technologies for CO₂ utilization.

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ADVANTAGES:

The NETL technology is a significant breakthrough that drastically improves selectivity and performance of inexpensive material. Other advantages include:

- Eliminates the need for expensive metals like gold and silver.
- 10-60 times more selectivity than other commercially available copper-oxide catalysts.
- Product formation within 100mV of the thermodynamic limit for barrier-less reaction.
- High Faradaic efficiencies.

APPLICATIONS:

- Conversion of CO₂ to CO for CO₂ utilization applications.
- Production of industrial CO from CO₂ captured from power plants.
- Production of CO to generate revenue to offset costs associated with implementation of CO₂ capture technologies.

PATENT STATUS:

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