

## Reduction of CO<sub>2</sub> Using Metal Oxides

Efficient reduction of CO<sub>2</sub> is of utmost importance for improving the management of greenhouse-gas emissions, but it is also of significant relevance for many technological processes utilising CO.

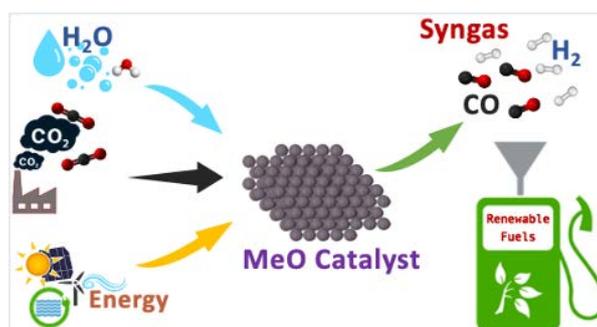
In this novel, catalytic process CO<sub>2</sub> is reduced to CO using a specially treated transition metal oxide in the presence of water vapour. Depending on combinations with other gases (e.g. reduction of CO<sub>2</sub> in the presence of H<sub>2</sub>), this provides an attractive, energy efficient way to produce e.g. synthesis gas, a mixture of H<sub>2</sub> and CO, which is extensively used in the chemical industry.

### BACKGROUND

By chemically reducing CO<sub>2</sub> appropriately, it can be used as CO in industrial processes, thus transforming it from a greenhouse culprit to an attractive source, e.g. for synthesis gas. Synthesis gas is a crucial intermediate resource for the production of hydrogen, ammonia, methanol, synthetic hydrocarbon fuels, and also essential in numerous petrochemical processes.

To date, on an industrial level, CO is usually obtained by oxidation of hydrocarbons or elemental carbon. Therefore, an efficient and cost effective way to reduce CO<sub>2</sub> resulting in high-grade CO would be highly desirable for environmentally benign CO production.

The proposed process uses low cost, abundant materials, operates in a broad temperature window and is also tolerant towards elevated CO<sub>2</sub> pressure, or impurities. The metal oxides used in the operation can be regenerated in parallel, enabling a real catalytic process.



### TECHNOLOGY

In the novel process CO<sub>2</sub> is reduced to CO by reaction with a specially treated transition metal oxide in the presence of water vapour. This can now be achieved at much lower temperatures than previously assumed. At the presence of moisture, CO<sub>2</sub> reacts with MnO and CoO to form CO and oxidise the metal oxide.

The inventive reaction of MnO and CoO with CO<sub>2</sub> to form CO was not known until now.

### BENEFITS

- Non-precious, earth-abundant metals
- Low temperatures
- High turnover numbers
- Tested long-term stability
- Low material costs
- High tolerance towards impurities

### APPLICATIONS

- Environmentally benign CO production (eg. for synthesis gas production)
- Industrial syntheses
- Refineries, petrochemical processes
- Environmental technology
- Further research

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REFERENCE:  
2019-006

DEVELOPMENT STATUS:  
Prototype development, TRL 4

KEYWORDS:

- CO<sub>2</sub> reduction
- Transition metal oxides
- Carbon monoxide formation
- Non-precious metals
- Syngas, oxogas
- Catalytic process

IPR:

Austrian patent and PCT filed

OPTIONS:

- R&D collaboration
- License agreement
- Sale

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