Technology from Kyoto University

Efficient CO_2 Conversion Catalyst with High CO Selectivity at Low Temperatures

We are looking to out-license the technology for its commercialization.

Enabling efficient production of e-fuels and chemicals from green hydrogen and CO_2

◆Background

CO_2 utilization technologies that convert CO_2 and renewable hydrogen (green H_2) into synthetic fuels and chemicals are attracting growing interest. A key reaction in these processes is the Reverse Water-Gas Shift (RWGS) reaction, which converts CO_2 and H_2 into carbon monoxide (CO) and water (H_2O). For efficient CO production, both high CO_2 conversion and high CO selectivity are essential. Suppressing methane (CH_4) formation is also important, as it reduces CO yield and affects downstream gas separation and purification. Catalysts that achieve high CO_2 conversion and CO selectivity at relatively low temperatures (around 400°C) are therefore highly desirable.

◆Description

This invention is a composite metal oxide catalyst designed to achieve both high CO_2 conversion and high CO selectivity in the RWGS reaction at relatively low temperatures (around 400°C). In laboratory tests (Fig. 1), the catalyst was evaluated against conventional RWGS catalysts, including reference catalysts provided by the Catalysis Society of Japan, under the following conditions: Temperature 673 K (400°C),Gas flow rate 50 mL/min. The catalyst demonstrated the following performance under the same experimental conditions(Fig. 2):

- **High CO_2 Conversion:**
  Approx. 35–40%, compared with 20–30% for conventional catalysts.
- **High CO selectivity:**
  Approx. 98–99%, compared with 20–70% for conventional catalysts.
  (CH_4 formation suppressed to approx. 1–2%.)

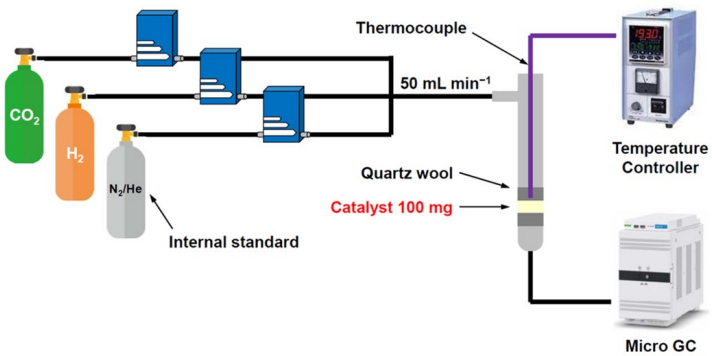


Figure 1. Experimental setup for the reverse water-gas shift (RWGS) reaction

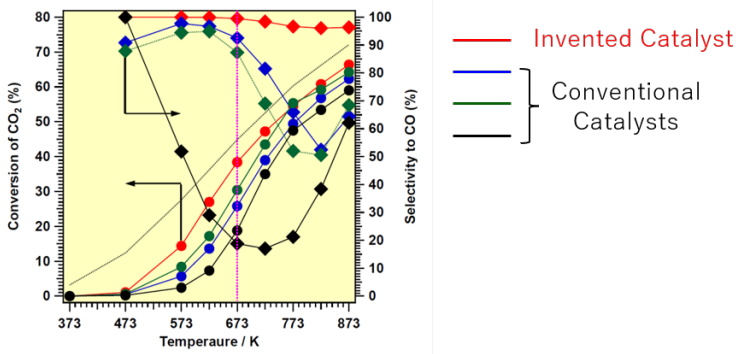


Figure 2. CO_2 Conversion and CO Selectivity vs. Temperature

◆Development Status

- TRL 3 – Laboratory validation completed
- Performance confirmed in laboratory tests. Long-term durability, scale-up, and validation under actual process conditions remain to be investigated.

◆Applications

- CO_2 utilization
- Synthetic fuels (e-fuels)
- Fischer–Tropsch (FT) synthesis
- Sustainable aviation fuel (SAF) production
- Methanol synthesis

◆Publications

- Manuscript on this invention in preparation
- ChemCatChem 2024
- J.Phys.Chem.C 2023,127,8946−8952

◆Intellectual Properties

- Applicant: Kyoto University

◆Offer

- Joint research
- License agreement (non-exclusive)
- Option agreement

◆Contact

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IAC Institutional Advancement and Communications

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