

# Highly selective liquid product of CuFeO<sub>2</sub> treated by microwave in CO<sub>2</sub> hydrogenation

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A problem of environment has been considered as greenhouse effect and global warming. Especially a growth of CO<sub>2</sub> in atmosphere has changed future-plans for carbon capture and storage (CCS) to carbon capture and utilization (CCU) recently. Previously our group reported high liquid product selectivity in CO<sub>2</sub> hydrogenation through two reaction: reverse water gas shift (RWGS) and Fischer Tropsch. [1] By using CuFeO<sub>2</sub>, improved higher hydrocarbon selectivity and suppressing methane was collected. But carbon dioxide conversion was low compared to other reference. [2-3] In this work, we synthesized CuFeO<sub>2</sub> as simple microwave – hydrothermal method and treated different ratio of hydrogen and carbon monoxide to select increasing carbon dioxide with liquid fuel.

CuFeO<sub>2</sub> was synthesized by microwave - hydrothermal method with different times: 1 or 2 hr. Figure 1 present rhombohedral shape of CuFeO<sub>2</sub>. Increasing times makes catalyst well developed. That 2hr times is similar with previous 24hr hydrothermal CuFeO<sub>2</sub>. [1]

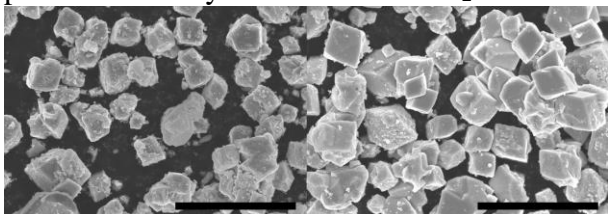


Fig.1 (a-b) SEM images of rhombohedral CuFeO<sub>2</sub>, synthesized by different times of 1, 2hr. (scale bar, 2.5um).

All of catalyst gets increasing CO<sub>2</sub> conversion in early reaction time, reaches a steady-state in

ca. 2hr. Interestingly, CuFeO<sub>2</sub> treated by CO shows increasing carbon dioxide conversion until 28%. But suppressing liquid product and increasing methane selectivity are exhibited. On the other hands, catalyst with CO/H<sub>2</sub> indicates that conversion of carbon dioxide increased and liquid fuel selectivity keeps with decreasing CO selectivity. Total yield of higher hydrocarbon selectivity was improved by using pretreatment of proper ratio of CO and H<sub>2</sub>.

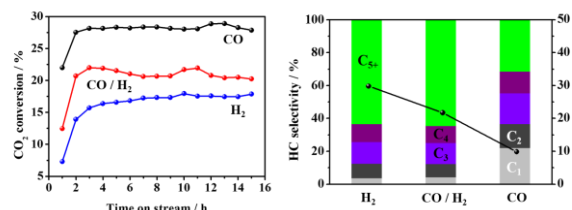


Fig. 2 (a) Time on stream for CuFeO<sub>2</sub> (2hr) with different pretreatment gas (reaction condition: 300°C, 10 bar, H<sub>2</sub>/CO<sub>2</sub>=3) (b) selectivity of CuFeO<sub>2</sub> on CO-free basis with bar graph. CO selectivity with broken line graph.

## REFERENCES

- [1] Y.H. Choi et al, *Appl. Catal B*, 202 (2017) 605-610.
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