

## Cu フェライト触媒による光アシスト CO<sub>2</sub> 電解酢酸生成の選択性と安定性の向上

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Enhanced selectivity and stability of acetate production by photo-assisted CO<sub>2</sub> electrolysis using Cu ferrite catalyst (<sup>1</sup> Toyota Central R&D Labs., Inc.) ○Naohiko Kato\*, Shu Saeki, Yusaku F. Nishimura, Yasuhiko Takeda and Shinya Moribe.

High solar-to-chemical conversion efficiencies have been demonstrated for artificial photosynthetic reactions producing C1 compounds such as formate<sup>1)</sup>. However, highly selective production of specific C2 compounds including ethylene, ethanol, and acetate remains challenging. We found that Cu ferrite (CuFe<sub>2</sub>O<sub>4</sub>) catalyst produced acetate with a high faradaic efficiency (FE) over 90% through photo-assisted CO<sub>2</sub> electrolysis, in which light illumination notably enhances the acetate FE compared with that in the dark<sup>2)</sup> (Fig. 1). One of the drawbacks of a conventional CuFeO<sub>2</sub> catalyst is instability, leading to precipitation of metal Cu particles and leaching of Fe ions into the electrolyte, that lowers the FE during the operation, along with a low initial FE. By contrast, the CuFe<sub>2</sub>O<sub>4</sub> catalyst was stable; no precipitation of metal Cu or leaching of Fe ions was observed. Introduction of CuO into CuFe<sub>2</sub>O<sub>4</sub> doubled the current density while retaining the high FE, because the CuO functioned as a conductive additive.

*Keywords:* Artificial photosynthesis; Solar fuels; photo-assisted CO<sub>2</sub> electrolysis; Acetate; Cu ferrite.

人工光合成的にギ酸などの C1 化合物を生成する反応については、高い太陽光-化学エネルギー変換効率が実証されてきた<sup>1)</sup>。一方、エチレン、エタノール、酢酸などの特定の C2 化合物を高選択的に生成するのは容易ではない。我々は、Cu フェライト (CuFe<sub>2</sub>O<sub>4</sub>) 触媒を用いると、酢酸生成のファラデー効率 (FE) が暗所に比べて光照射により向上する光アシスト CO<sub>2</sub> 電解により 90% 以上の高い FE で酢酸を生成することを見出した<sup>2)</sup> (図 1)。従来の触媒である CuFeO<sub>2</sub> では、初期の FE が低い上に、反応中に金属 Cu 粒子が析出、Fe イオンが電解液に溶出し、酢酸 FE が低下した。これに対し、CuFe<sub>2</sub>O<sub>4</sub> は安定であり、Cu 析出や Fe 溶出は観察されなかった。更に、CuO を混合すると、これが導電助剤として機能し、その結果高い FE を維持しながら電流密度が約 2 倍にまで増加した。

1) N. Kato, et al., *ACS Sustain. Chem. Eng.*, **2021**, 9,16031.

2) N. Kato, et al., *J. Mater. Chem. A*, **2025**, <https://doi.org/10.1039/D5TA06122A>.

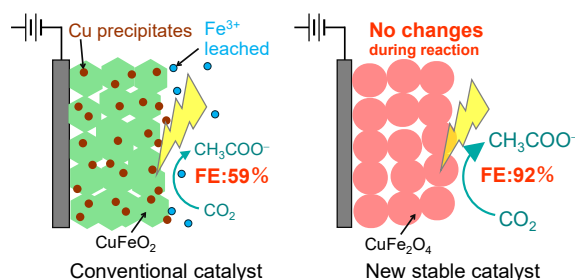


Fig.1 Newly developed CuFe<sub>2</sub>O<sub>4</sub> catalyst demonstrating stable photo-assisted CO<sub>2</sub> electrolysis to produce acetate with a high Faradaic efficiency exceeding 90%, compared with a conventional CuFeO<sub>2</sub> catalyst.