Researchers propose novel method to enhance electrocatalytic conversion of carbon dioxide

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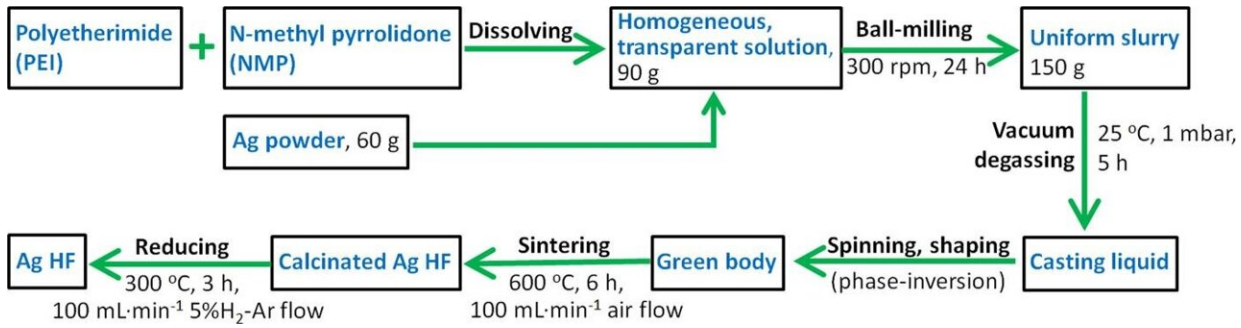

Diagram of the detailed fabrication procedures of Ag HF. Credit: *Angewandte Chemie International Edition* (2022). DOI: 10.1002/anie.202210432

A research team led by Profs. Chen Wei and Wei Wei from the Shanghai Advanced Research Institute (SARI) of the Chinese Academy of Sciences reported a novel method that enables efficient CO_2 electroreduction to CO by virtue of low-coordination chloride ion adsorption on a silver hollow fiber electrode.

The results were published in *Angewandte Chemie International Edition*.

The electrochemical conversion of CO_2 into carbon-based fuels and valuable feedstocks by renewable electricity is an attractive strategy for

carbon neutrality. CO is the key component of syngas, a mixture of CO and H_2 that can be directly converted into various value-added chemicals via well-developed industrial processes. Therefore, CO_2 electroreduction to CO is one of the most promising routes to obtain cost-competitive products.

However, due to the low solubility and diffusion coefficient of CO_2 in aqueous electrolytes, it remains a challenge to possess large current density, high faradaic efficiency and excellent stability for practical applications of CO_2 utilization.

In this study, on the basis of the highly efficient electroreduction CO_2 to CO over silver hollow fiber electrode, the research team further introduced chloride ions into the electrode solution. By means of specific adsorption of chloride ions, the electronic structure of the electrode surface was functionally regulated to inhibit the side reaction of hydrogen evolution.

The low-coordination chloride ion adsorption on a silver hollow fiber electrode reduced CO_2 to CO at a stable (>150 h) ampere-level current density (1 $A \cdot cm^{-2}$) and with a high CO faradaic efficiency (>92%).

Electrochemical experiments demonstrated that the high concentration Cl- in the electrolyte could be low-coordination adsorbed onto the surface of silver hollow fibers. This not only hinders the occurrence of the hydrogen evolution reaction, but also optimizes the kinetics of CO_2 reduction to CO, leading to a better eCO_2RR performance, even at the ampere-level current density.

This work provides a new strategy for further developing electrocatalytic CO_2 systems with high current density, high selectivity and high stability in CO_2 utilization and chlor-alkali industry.

More information: Shoujie Li et al, Chloride Ion Adsorption Enables Ampere-Level CO_2 Electroreduction over Silver Hollow Fiber, *Angewandte Chemie International Edition* (2022). DOI: 10.1002/anie.202210432

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