Synchrotron based of copper atomically dispersed on ZIF-8 structure for high ethanol selectivity in CO_2 reduction reaction

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ABSTRACT

Since the industrial revolution, the use of fossil fuels is increasing and the reserves are getting depleted, as science and technology advance. The gradual increase in atmospheric carbon dioxide concentration has led to a series of environmental problems such as global warming; therefore, the large-scale conversion of carbon dioxide is urgent. Electrochemical reduction of CO_2 is a promising route for sustainable production of fuels. A grand challenge is developing low-cost and efficient electrocatalysts that can enable rapid conversion with high product selectivity.

It is to note that different loading of copper precursors had effects on the synthesis results, such as the dispersion of copper atoms and electrochemical activity. It is interesting to note that the single-atom copper could be affected on its Cu-N_4 site and become agglomerated when higher potentials were applied.

This also gave rise to the formation of N_4 site vacancies. X-ray absorption spectroscopy (XAS) and high- resolution transmission electron microscopy were employed to study the fine structure among the physical properties of Cu-C-N. Three-electrode electrochemical reactor hyphenated with gas chromatography (GC) and nuclear magnetic resonance (NMR) were followed to analyze the electrocatalytic activity and products towards CO_2 reduction.

Keywords- Metal organic framework (MOF), Single atom catalysts (SAC), Carbon dioxide reduction, Electrocatalysis, In situ/operando X-ray absorption spectroscopy.