Int. J. Electrochem. Sci., 16 **(2021)** 150951

International Journal of
ELECTROCHEMICAL
SCIENCE
www.electrochemsci.org

High-performance Photoelectrocatalytic Reduction of CO_2 by the hydrophilic–hydrophobic composite Cu-SnO_2/ZIF-8

Dingding Zhang, Huimin Yang [*], Yupeng Li, Zhifang Li, Nan Gao, Wenjing Zhou, Zhenhai Liang [*]

College of Chemistry & Chemical Engineering, Taiyuan University of Technology, Taiyuan 030024, PR China
[*]E-mail: yanghuimin@tyut.edu.cn (Huimin Yang), liangzhenh@sina.com (Zhenhai Liang)

doi: 10.20964/2021.01.08

Received: 2 September 2020 / *Accepted:* 28 October 2020 / *Published:* 30 November 2020

Photoelectrocatalytic reduction CO_2 can solve energy shortages and environmental problems. However, the poor solubility and intense competition of the hydrogen evolution reaction (HER) seriously restrict CO_2 activation. Here, a hydrophilic–hydrophobic Cu-SnO_2/ZIF-8 composite catalyst was constructed by compounding hydrophobic ZIF-8 with hydrophilic Cu-SnO_2. Gas-phase CO_2 was directly used to improve the activation efficiency of CO_2 molecules, and hydrogen evolution was inhibited. Results showed that when the overpotential was as low as ~364 mV, the Faraday efficiency of formic acid reached 68.96%. The maximum current density approached 12.8 $mA \cdot cm^{-2}$ at -1.4V versus the Ag/AgCl electrode. The ZIF-8 unique structure promoted electron transfer and Cu-SnO_2 dispersion to provide additional active sites. The excellent photocatalytic performance of Cu-SnO_2/ZIF-8 may be attributed to the special hydrophilic–hydrophobic structure and the small band gap that can absorb much visible light.

Keywords: Hydrophilic-hydrophobic structure, CO_2 reduction, Photoelectrocatalysis, ZIF-8, Sn-based nanoparticles

FULL TEXT