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High efficiency graphene/Cu₂O electrode for the electrochemical reduction of carbon dioxide to ethanol

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Abstract

Fabrication of an efficient catalyst for the electrochemical reduction of CO₂ to valuable products at low overpotential remains a severe challenge. Herein, graphene (GN)/Cu₂O catalyst, with an average particle size of 20-50 nm has been synthesized and coated on copper foil. The linear sweep voltammetry studies showed that the 0.1 mg of GN/Cu₂O loaded catalyst exhibited the highest current density in CO₂ saturated 0.5 M NaHCO₃ electrolyte. The GN/Cu₂O electrode was significantly more active toward CO₂ reduction showing a current density of approximately 12.2 mA/cm² at -1.7 V versus Ag/AgCl, which is higher than Cu₂O electrode (8.4 mA/cm²). Gas chromatography-mass spectrometry analysis of the liquid products revealed that ethanol (~ 0.34 ppm) was found to be the predominant product at -0.9 V with high reasonably Faradaic efficiency up to 9.93%. These results suggest that graphene may be used as a promising non-metallic support for the electrochemical reduction of CO₂.

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