

On the electrocatalytic reduction of CO₂ using Cu-nanoparticles decorating Au electrode

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ABSTRACT

CO₂ is electrocatalytically reduced in aqueous solutions (NaHCO₃ and Na₂SO₄) at polycrystalline gold (Au) both bare and modified with copper nanoparticles (nano-Cu) (nano-Cu/Au). Copper nanoparticles were deposited by the cycling of potential in the range (–0.2–0.7 V) for various potential cycles. The effect of the electrolyte, as well as the nano-Cu loading on the electroreduction of CO₂, has been investigated. Nano-Cu/Au electrode has been voltammetrically and morphologically characterized. It has been found that the type of electrolyte, that is, NaHCO₃ and Na₂SO₄, is critical in the electrochemical reduction of CO₂; for instance, the CO₂ reduction is obscured by hydrogen evolution in NaHCO₃ solutions (pH 9.2) at both electrodes, that is, bare Au and nano-Cu/Au electrodes, the well-defined redox peak is obtained at both electrodes in Na₂SO₄ solution (pH 7), even though the pH of Na₂SO₄ is smaller. The extent of catalysis is based on the copper loading at the nano-Cu/Au electrode as well.

Keywords: CO₂ electroreduction; Electrocatalysis; Copper nanoparticles; pH

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