CO_2 electrochemical reduction on Sn cathode: effect of the nature and concentration of the supporting electrolyte

Andrea Di Franco, Federica Proietto, Paola Meli, Alessandro Galia and Onofrio Scialdone

Dipartimento di Ingegneria, Università degli Studi di Palermo, Viale delle Scienze, Palermo 90128, Italy

E-mail: andrea.difranco04@unipa.it

The electrochemical reduction of CO_2 ($ERCO_2$) to formic acid using a tin electrode was widely studied as a sustainable and green route to convert a greenhouse gas into value-added products.[1] It was shown that the electrolyte solution plays an important role on the $ERCO_2$. Some authors found that an increase of the supporting electrolyte (SE) concentration improves the faradaic efficiency in formic acid (FE_{HCOOH}) [2], while other studies have shown a negative effect of high SE concentrations on FE_{HCOOH} [3].

In this framework, the effect of Na_2SO_4, K_2SO_4 and Cs_2SO_4 as SEs at different concentrations (0.03, 0.1 and 0.2 M) was investigated using Sn cathode by Linear Sweep Voltammetries (LSVs) and electrolyses.

LSVs demonstrated that both the CO_2 cathodic reduction and the hydrogen evolution strongly depend on the nature and the concentration of the SE. In particular, it was found that the effect of the concentration of SE depends on the applied working potential.

Electrolyses performed in conventional batch lab cells confirmed that the performances of the process strongly depend on the nature and the concentration of the SE. A series of electrolyses was performed in microfluidic cells equipped with very small inter-electrode distances to minimize the ohmic drops in the presence of low concentrations of SE. These experiments have shown that the SE can have both a positive or negative effect on the process depending on its concentration.

Keywords: *Supporting electrolyte, CO2 reduction, Formic acid, Microfluidic reactor, Sn cathode*

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